COBEC

1st Brazilian Congress in Electromyography and Kinesiology

1st National Meeting of Myotherapy Procedures

Piracicaba, São Paulo, Brazil
April 15th – 18th, 2010

All abstracts appear as submitted by the authors without editing

EDITORIAL

We have pleasure to publish in this important journal the papers presented at COBEC2010 - 1st Brazilian Congress of Electromyography and Kinesiology and 1st National Meeting of Myotherapy Procedures, promoted by the Piracicaba Dental School (FOP/UNICAMP) and the Brazilian Society of Electromyography and Kinesiology (SOBEC) with the theme "*Electromyography Applied to Health Sciences*".

Caused us great joy to note the significant number of participants, the quality of the presented papers and the great diversity of institutions involved with Kinesiologic Electromyography in our country.

A total of 438 professionals from different areas of health attended the event, representing 90 national and international institutions. From the 189 accepted and presented papers, the vast majority (73%) have the support of our funding agencies for research as CAPES, CNPq, FAPESP, FAEP and others.

This whole scenario leads us to believe that modern brazilian electromyography is consolidating in our country. Has reached a level of maturity and is now highly respected and internationally influent.

Therefore, we consider absolutely necessary every effort in improving the education of our electromyography. It is essential that its application is technically correct and standardized. After all, as well warns Prof. Carlo de Lucca: "*The Electromyography is a seductive muse, easy to use and too easy to abuse*"

The abstracts presented below were classified into the following areas: Muscular Pain, Kinesiology, Temporomandibular Dysfunction, Neurophysiology, Motor Analysis, Electrodes, Human Performance, Electromyographic Signal Processing, Physical Medicine and Rehabilitation, Sporting Medicine, Muscular Fatigue, Musculoskeletal Alterations and Postural Analysis

Our thanks to the authors for their valuable scientific contribution.
Hopefully next COBEC2012, can count again with their important participation.

Prof. Dr. Fausto Bérzin
President of COBEC2010 and SOBEC

1 ELECTROMYOGRAPHY STUDY OF MASTICATORY MUSCLES IN PATIENTS WHIT BRUXIMS BEFORE AND AFTER ACUPUNCTURE TREATMENT. PILOT STUDY

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INTRODUCTION

The bruxism is defined as oral activity characterized by the press of the teeth. Complex and multifactorial, frequently associate to the emotional stress and problems with occlusion or combination of both. Acupuncture is a therapeutic practice of the Chinese Traditional Medicine, that it seeks the preventions or treatment of countless diseases. The objective of this work is to evaluate the effect of the acupuncture in the electric sign of the muscular fiber in rest and to the self perception of the pain in patients with bruxism.

METHODS

Eight volunteers (women) from Dental Clinic of Acupuncture (State University of Campinas, Dental College of Piracicaba, SP – Brazil) aged between 18 and 36 years old (23.3 ± 8.2) and presenting class I of the Angle were divided in two groups:

1. Control group with four volunteers asymptomatic not bruxism.
2. Experimental group with four volunteers bruxism with the night press of the teeth accompanied of headache and muscular pain.

The experimental group were submitted to acupuncture treatment; a single session. They were evaluated before and after acupuncture treatment to verify and compare the electromyography activity of temporal, masseter and cervical muscles bilaterally in the rest moment. The activity muscles were evaluated with electromyography equipment (Myosystem 3.0).

The signs and symptoms of pain were evaluated considering the answer of patient (the self perception of the pain), measured through the analogical visual scale of pain (EVA). The control group was also evaluated in the same way. The evaluations were in two periods: before acupuncture treatment (T0) and after acupuncture treatment, immediately after treatment (T1), twenty four hour (T2), thirty six hour (T3) and seventy two (T4), in the three consecutive days post acupuncture treatment.

RESULTS

Fig 1: Evaluation of the pain (self perception) using EVA, in the different periods (TO, T1,T2,T3 and T4), of the 4 patients (P1, P2, P3 and P4).

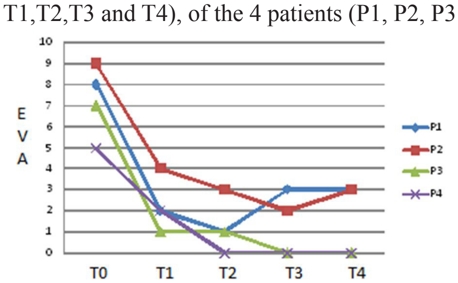

Table 1: Electromyographic evaluation in the rest moment comparing the RMS in the group controls (CG) with the experimental group (EG) in two periods: Period I is compared CG with EG in T0 and period II compared CG with EG in T1, T2 e T3 (after treatment with acupuncture).

Right Temporal RMS(μV)		Left Temporal RMS(μV)		Right Masseter RMS(μV)		Left Masseter RMS(μV)		Right Cervical RMS(μV)		Left Cervical RMS(μV)	
Mean	P	Mean	P	Mean	P	Mean	P	Mean	P	Mean	P
2.67		1.03		0.96		2.08		1.19		2.35	
18	0.03*	4.7	0.1	2.3	0.07	20.7	0.05*	3.2	0.04*	2.3	0.4
2.67	0.006*	1.03		0.96	0.05*	2.08	0.2	1.19	0.2	2.35	0.9
9.6		3.5	0.2	1.8		10.7		1.6		2.3	
2.67	0.1	1.03		0.96	0.01*	2.08	0.1	1.19	0.2	2.35	0.9
7.12		3	0.3	2.27		4.21		1.7		2.2	
2.67	0.1	1.03		0.96	0.07	2.08	0.6	1.19	0.8	2.35	0.5
5.52		2.1	0.1	1.54		2.66		1.24		1.9	

* Significant statistical

Comparing the experimental and control groups was observed that experimental group had most activity electromyography than control group with significant statistical in the different muscles in the different times.

Table 2: Evaluation electromyography in the rest moment, comparing the RMS before and after acupuncture treatment in the muscles and periods different: left temporalis (LT), right temporalis (RT), left cervical (LC), right cervical (RC), left masseter (LM) and right masseter (RM).

RMS Rest Muscles	Before Treatment (D0) RMS	After Treatment (D1) RMS	P D0/D1	Post 24h Treatment (D2) RMS	P D0/D2	Post 36h Treatment (D3) RMS	P D0/D3	Post 72h Treatment (D4) RMS	P D0/D4
TE	4.8	3.5	0.1	3.1	0.1	3.1	0.1	4.2	0.7
TD	18.0	9.6	0.8	7.1	0.02*	5.3	0.02*	5.5	0.02
ME	20.7	10.7	0.2	4.2	0.04*	2.7	0.05*	4.5	0.07
MD	2.3	1.8	0.4	2.3	0.9	1.5	0.3	2	0.6
CE	2.3	2.3	0.9	2.3	0.9	2.3	0.8	1.9	0.8
CD	3.2	1.7	0.07	1.7	0.07	1.7	0.06	1.2	0.2

* Significant statistical

The symptoms of painful was modified in the answer of the patients (self perception), however, our observed a positive effect and similar behavior in decrease painful symptoms. Before acupuncture treatment (T0) was presenting a middle of 7.5, it was decreases and stays in (T1=2.25), (T2 =1.25) e (T3, T4 = 2), showed significant statistical in all periods.

DISCUSSION

We observed the variations electromyography, when compared the controls and experimental groups where the averages of RMS in the rest of the experimental group before acupuncture treatment, find increased in all of the muscles can be justified why the bruxism, present muscles contraction in the moment rest for the muscular forces and neuronal disorders in patient submitted of stress situations and consequently cause screeching of the teeth (nocturne or of the days), that it is evidenced in the surface electromiographic.

After acupuncture treatment we can evidence the decrease of these measured, analyzed immediately (T0), where there was decrease in all muscles. In the evaluation 24h after treatment the parameters are maintained, the muscles are more relaxed. After 48 and 72 hours of the evaluation some parameters still maintained and others present variability for which we can affirm that the acupuncture cause alterations in the muscular fiber coinciding with discoveries of Dallanora LJ et al 1992, that it concludes that the acupuncture causes alterations in the electric activity of the muscle favoring the rest conditions and the patient's muscular activity. When the pain self perception was evaluated in the patient , we observed decrease for all of the muscles in the different periods, that interesting why can the acupuncture stimulate regeneration systems and regulation of the organism, producing answers mediated by superior centers of central control and for the endocrine and immunological systems (Macedo CR & Gubittosy ME 2008).

CONCLUSIONS

We concluded that the acupuncture reduced symptoms painfull and was reducing the eletromyographic activity of the muscles but, more studies are necessary in long periods to prove that the acupuncture is an effective therapy for the treatment bruxism.

REFERENCES

1. Macedo CR. (2008). Bruxismo do sono. Rev. Dent. Press Ortodon. Ortop. Facial, vol.13, n.2 pp. 18-22
2. James G. (2009). Orthodontics in a quantum world V: bruxis. Int J Orthod Miwaukee. Spring; 20(1):29-36
3. Dorland WA. (2000). Dorlands illustrated medical dictionary. 29th ed. Philadelphia: W.B. Saunder

2 SURFACE ELECTROMYOGRAPHIC STUDY OF RAMSAY HUNT SYNDROME: A CASE REPORT

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INTRODUCTION

The Ramsay Hunt Syndrome describe an uncommon acute infectious disease caused by herpes zoster and associated with facial palsy that affects the sensory and motor branches of the facial nerve, which may involve many cranial nerves, preferably the 8th (Hunt, 1907). Its prevalence is higher in individuals over 50 years old, and immunocompromised individuals with diabetes (Johnson et al., 1996).

Pain is the most common initial symptoms and is intense, lancinating and burning. After a period of approximately three days can occur a paralysis of the facial nerve homolateral (Ali, 1998; Grossmann, 2003).

The symptoms and signs are an inability to close the eye, to smile, wrinkle the forehead and whistle. A drooping of the face in the affected side, Speech may be mildly slurred. Damage to 8th cranial nerve generates loss to the hearing of the affected side and the patient can report nausea and loss of balance and tinnitus (Da Silva, 1998).

The surface EMG has been used by physicians and dentists as a measure of measuring the degree of commitment of some nerves associated with facial paralysis, as the Ramsay Hunt syndrome. Moreover, the literature about surface electromyography does not present clinical studies further on the subject (Bérzin, 2004).

The aim of this study was to describe
through surface electromyography, the electrical activity of Mm masseter and anterior temporalis in a patient with Ramsay Hunt Syndrome.

METHODS

The electromyographic (EMG) activity from anterior temporalis and masseter muscles of a 47 year-old woman with a Ramsay Hunt Syndrome was evaluated. Recordings were made on 12 channels of simultaneous EMG signal acquisition equipment (Myosystem I / Datahominis Tec. Co.). The analog EMG signal recorded were digitized using 12 bit A/D converter at a sampling rate of 4KHz. After digitalization, the signal was filtered by a digital pass-band of 10-500Hz. Myosystem I software version 2.12 was used to visualize and process the EMG signal.

The tasks were: (1) mandibular rest position for 30 seconds; (2) maximal voluntary contraction (MVC) for 5 seconds and; (3) masticatory activity for 10 seconds.

RESULTS and DISCUSSION

Although the literature considering to involvement of the 5 th cranial addition, the EMG examination of the patient shows that in habitual mastication, it was observed that the masticatory muscles evaluated acted in synchronism and satisfactory function with amplitudes within normal limits.

Moreover, masseter presented higher activity in relation to temporalis muscles, suggesting that the motor part of the 5 th par skull was not affected by the Ramsay Hunt Syndrome.

CONCLUSIONS

The surface EMG results of masseter and anterior temporalis muscles of patient with Ramsay Hunt syndrome shows that the motor part of the 5 th par skull is preserved.

REFERENCES

1. Ali RR. (1998). Ramsay Hunt syndrome. Geriatrics, 53, 93-102.
2. Da Silva WF. (1998). Craniofacial Pain. Lemos Editorial, São Paulo.
3. Hunt JR. (1907). J Nerv Ment Dis, 34, 73- 96.
4. Bérzin F. (2004). Braz J. Oral Sci, 3(10), 484-91.
5. Johnson KB, et al. (1996). Clinical Infections Diseases, 22, 1128-29.
6. Grossmann E. (2003). The clinic of pain, organization, operation and scientific bases. Editora Maio, Curitiba.

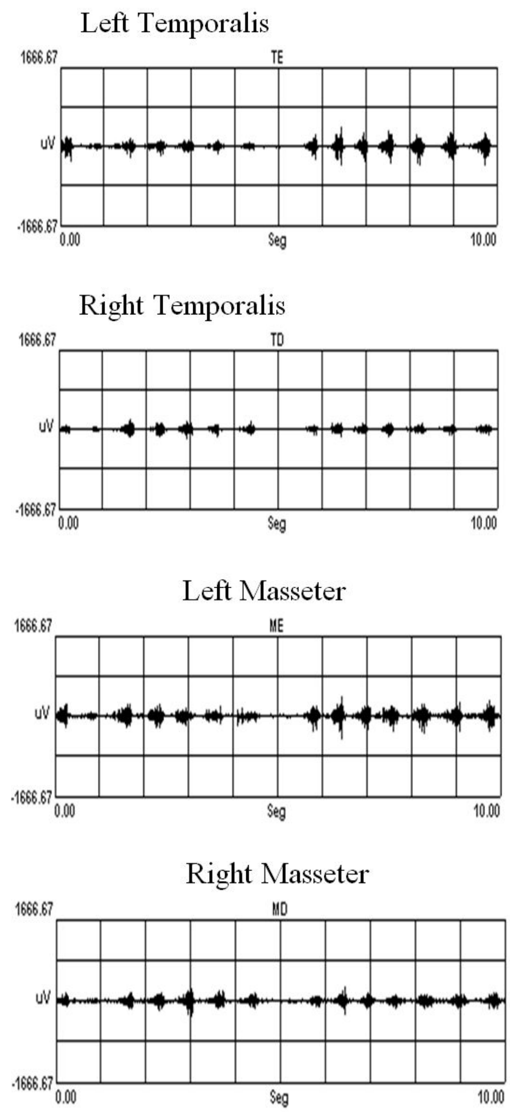

Figure 1: EMG activity during masticatory activity from anterior temporalis and masseter muscles in patient with Ramsay Hunt Syndrome.

3 FIBROMYALGIA AND TEMPOROMANDIBULAR DISORDERS: A REVIEW OF LITERATURE

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INTRODUCTION

Fibromyalgia, according to the American College of Rheumatology, is a disease primarily characterized by musculoskeletal and chronic diffuse pain for at least three months, and the presence of at least 11 of 18 specific tenderpoints (WOLFE *et al*., 1990). Several symptoms such as insomnia, depression and fatigue are associated with this pathology. Other symptoms found in fibromyalgia is pain related to temporomandibular joint (TMJ). According to the Americam Dental Association (ADA), temporomandibular disorders (TMD) are cases where you have pain in the preauricular region, the temporomandibular joint or masticatory muscles, limitation or deviation of mandibular movement, TMJ noise during the function mandibular and palpation and anormal relation of static and dynamic oclusal (DWORKIN *et al*., 1990). While syndrome, TMD have an important impact on quality of life of these patients, if associated with fibromyalgia, the clinical consequences require serious disabilities and relevant decrease in expected income of the individual. Thus the objective of this study was to present the relationship between fibromyalgia and the signs and symptoms of temporomandibular disorders.

METHODS

Bibliographic search was performed of the period of 1990-2009, in the Medline, Pubmed, Lilacs and Scielo databases, using the words: fibromyalgia, temporomandibular disorders, facial pain, RDC / TMD.

RESULTS and DISCUSSION

The literature points to a high prevalence of TMD in patients with fibromyalgia. Balasubramaniam et al (2007) investigated the prevalence of signs and symptoms of temporomandibular disorders in 51 subjects, 32 with fibromyalgia and 19 individuals with chronic pain. The results showed that 53% of fibromyalgia patients reported facial pain compared with 11% of other subjects. Of fibromyalgia who reported pain, 71% were classified as TMD according to the RDC / TMD. In the study by Salvetti et al (2007) ninety-three subjects with fibromyalgia were evaluated and the results showed that 79.6% of patients had at least one diagnosis of TMD according to the RDC / TMD. Other studies also reported prevalence of facial pain between 68% and 97% of patients with fibromyalgia. These results demonstrate greater involvement of the stomatognathic system in fibromyalgia, reinforcing the importance of a multidisciplinary approach in this pathology. In our preliminary study, conducted at the Piracicaba Dental School State University of Campinas, the six subjects with fibromyalgia female, aged 49.5 ± 7 evaluated, we classified according to RDC / TMD as in group I (myofascial pain) and electromyographic examination showed increased electrical activity of the masticatory muscles at rest, being higher in individuals with more pain reported by the EVA. This hyperactivity in the rest can lead to ischemia, fatigue and pain, aggravating the symptoms of fibromyalgia. Other studies have also shown that in patients with fibromyalgia syndrome and TMD symptoms such as chronic pain and stress can increase sympathetic activity, which alters the cardiovascular responses and makes the pain worse. Light et al (2009) evaluated 10 fibromyalgia, 10 TMD patients and 16 healthy controls and their results support the hypothesis that both fibromyalgia and those with TMD often develop a desregulation of beta-adrenergic activity contributes to altered cardiovascular responses and catecholamines and severity of clinical pain. In TMD, myofascial pain usually comes as a response to an acute trauma or chronic overload of the stomatognathic system, as in the case of bruxism, while in fibromyalgia has an insidious onset and etiology is not fully known, in which biochemical abnormalities neuroendocrine, and mechanisms of central sensitization may play an important etiological role (ADLER *et al*., 2002). According SALTARELI *et al.,* 2008) the complexity of factors involved in the frame of fibromyalgia, to the question of diagnosis and the proper approach by health professionals, shows the need for more studies that propose to expand the understanding of the issues experienced by these patients.

CONCLUSIONS

Temporomandibular disorders are often associated with fibromyalgia and myogenic disorders os masticatory system are the most commonly found in those patients.

REFERENCES

1. Wolfe F, Smythe HA, Yunus MB, Bennett AM, Bombardier CE, Goldenberg DL. Arthritis Rheum, 33: 160-172, 1990.
2. Dworkin SF, Leresche L, Derouen T, Korff MV. J. Prosthet. Dent. 36, (5): 574-579, 1990.
3. Balasubramaniam R, DE Leeuw R, zhu H, Nickerson RB, Okeson JP, Carlson CR. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. Aug;104(2):204-16, 2007.
4. Salvetti G, Manfredini D, Bazzichi L. Bosco M. Cranio: The Journal of Craniomandibular Practice. April (7): 127, 2007.
5. Light KC, Bragdon EE, Grewen KM, Brownley KA, Girdler SS, Maixner W. J Pain; 10(5): 542-52, 2009.
6. Adler GK, Manfredsdottir VF, Creskoff KW: Curr Pain Headache Rep; 6: 289-298, 2002.
7. Saltareli S, Pedrosa DFM, Hortense P, Sousa FAEF. Rev Bras Reumatol; 48(3): 151-156, mai/jun, 2008.

4 THE EFFECT OF THE ELECTROACUPUNCTURE ON THE PRESSURE PAIN THRESHOLD AND ON THE ELECTROMYOGRAPHYC ACTIVITIE OF THE UPPER TRAPEZIUS WITH MYOFACIAL PAIN

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INTRODUCTION

The myofascial pain syndrome is the most frequent cause of persistent muscle pain and is characterized by the presence of myofascial trigger points (MTrPs), which have been defined as hyperirritable spots located in taut bands of skeletal muscle that are painful on compression and can give rise to characteristic referred pain, motor dysfunction, and autonomic phenomena The MTrP is considered active if the referred pain pattern is present spontaneously and latent when this patter is reproduced due to the MTrP compression.

Acupuncture has been used as an alternative to conventional treatments to muscular pain as is defined as the stimulation of determinate points of the body, by the needle insertion, with the purpose of reaching desirable effects. The needle can be manually or electrically stimulated. In this case, through the needles, occurs the passage of an electric current with analgesic effects, with low frequency and high intensity. This electric current stimulates muscle nociceptors, which in turn activate the endogenous antinociceptive system. This explains why it is expected that EA is more effective on the pain relieving compared to manual acupuncture.

The aim of this study was to evaluate the effect of the EA on the treatment of the upper trapezius myofascial pain.

METHODS

Twenty females who were 18 to 40 years old (mean age: 27.3±1.09 years), with a body mass index from 19 to 25 kg/m2 (22.33±0.56 kg/m2), presenting with at least one myofascial trigger point in the upper trapezius, local or referred pain for more than 6 months and menstrual cycle regulated by the use of oral contraceptive participated in the study. Before all sessions the volunteers answered to an additional data formulary, which aimed to monitor the use of medicaments, the occurrence of influencing factors, headache and trapezius ache frequencies. Before and after sessions 1, 5 and 9 the measurement of the upper trapezius PPT by the digital algometer was performed at midway between the seventh cervical vertebra and the acromion bilaterally. At these same sessions, before and after each of them, the EMG exam was also performed. EMG electrodes were placed in the upper trapezius muscle midway between the seventh cervical vertebra (C7) and acromion (SENIAM, 1999). The exam was conducted with the subject seated in a chair at rest and in isometric contraction. The volunteer was asked to maintain the trapezius muscle at rest for six seconds and after that to undertake the raising of the shoulders, keeping this position in isometric contraction for six seconds, prompted by an adequate verbal command.

After the initial recording of data, the EA was applied. EA was performed in the same manner in all the nine sessions. The patient was positioned sitting in a chair. Needles were inserted bilaterally in the following points: VB21, GB20, IG4, F3 and directly in the region of the MTrPs "ashi points" (maximum of four needles). The equipment was programmed in accordance with the following parameters: alternating frequency F1 = 2Hz, T1 = 5 seconds, F2 = 100 Hz, T2 = 5 seconds; total time: 30 minutes; intensity: maximum supported by the patient without pain.

RESULTS and DISCUSSION

The PPT increased significantly on both sides after the end of the treatment ($P<0.0001$), and after EA in each measured sessions (1.5 and 9; $P<0.0001$). Other studies concerning the muscle pain treatment by EA found similar results after one (Nohama e Silvério-Lopes., 2009) and ten sessions (He et al., 2004). Despite that, it was not found studies that have evaluated the PPT before and after the end of treatment and at before and after the end of each or some session along this period.

A statistically significant increase in the EMG values of the right trapezius during isometric contraction was observed at the end of treatment ($P=0.032$) The left trapezius almost showed a significant increase in the EMG values, but the test failed to detect a significant difference at a level of 5% ($P=0.0506$). However, the left trapezius showed a significant increase in the respective rms values during isometric contraction before and after the EA in the ninth session ($P=0.0468$). This result indicates an improvement of muscle function and the effectiveness of EA for upper trapezius myofascial pain. It was not found studies evaluating the effect of EA on the muscular pain relief by the EMG analysis, but it has been already demonstrated that the upper trapezius EMG activity during contraction in subjects with pain presents lower rms values when compared to healthy subjects (Schulte et al., 2006; Kallenberg et al 2007).

There was no statistically significant difference in electromyographic activity of the right and left upper trapezius muscle at rest. However, the medium rms values during rest before treatment (3 μv) did not represent the sample dysfunctional conditions.

CONCLUSIONS

The improvement observed specially concerning PPT is enough to consider the EA effectiveness for the treatment of the upper trapezius myofascial. The EMG data obtained during contraction has also indicated it. Nevertheless, considering further studies, the monitoring of the force performed by volunteers during isometric contraction using a load cell could improve the EMG data collection, since it offers a way to perform reliable evaluations concerning their maximum effort, allowing more consistent data analysis.

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REFERENCES

1. Chou L, Hsieh Y, Kao M, et al.(2009). Remote influences of acupuncture on the pain intensity and the amplitude changes of endplate noise in the myofascial trigger point of the upper trapezius muscle. Arch Phys Med Rehabil. 90,905-912.
2. He D, Veiersted KB, Hostmark AT, et al. (2004). Effect of acupuncture treatment on chronic neck and shoulder pain in sedentary female workers: a 6 month and 3 year follow up study. Pain 109:299-307.
3. Kallenberg LAC, Schulte E, Disselhorst-Klug C, et al. (2007). Myoelectric manifestations of fatigue at low contraction levels in subjects with and without chronic pain. J Electromyogr Kinesiol. 17, 264–274.
4. Nohama P, Silvério-Lopes SM. (2009) Influence of the stimulating frequency involved in analgesic effects induced by electroacupuncture for neck pain due to muscular tension. Rev Bras Fisioter. 13,152-158.
5. Schulte E, Kallenberg LAC, Christensen H, et al. (2006). Comparison of the electromyographic activity in the upper trapezius and biceps brachii muscle in subjects with muscular disorders: a pilot study. Eur J Appl Physiol. 96,185–193.

5 ELECTROMYOGRAPHIC EVALUATION FROM MASSETER MUSCLE IN PACIENT USING FUNCTIONAL MAXILLARY ORTHOPEDICS APPLIANCE MADE BY DIFFERENT WAYS (PLANAS INDIRECT COMPOUND TRACKS)

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INTRODUCTION

Functional Maxillary Orthopedics (FMO) has closer relationship with mandibular kinesiology and this is the reason for it's proximity to Electromyography (EMG).
EMG is defined as muscle function study through the inquiry of the electrical signal the muscles emanate. (BASMAJIAN & DE LUCA, 1985).
MOYERS (1949) published that electromyographic data from patients with malocclusion were different than normal classified.
FMO under Neuro Oclusal Rehabilitation (NOR) has as deal the parallelism between Oclusal Plane (OP) and Camper Plane (CP). For this author announced an appliance named PLANAS INDIRECT COMPOUND TRACKS (PICT), where tracks is positioned in parallel to Camper Plane for neutrocclusions. (PLANAS, 1997) SIMÕES (2003) described that track must be parallel to OP and in the middle of interoclusal space gained after Posture Modification (PM).
In the UNIARARASs FMO Course, it's approved that the tracks position have to be parallel in relation to Camper Plane (CP).
In this work it was analyzed if there is difference between EMG data when the appliance PICT was made with tracks parallels to CP or OP.

METHODS

A patient with malocclusion was selected for this work age 4 to 16. Exclusion criteria: systemic disease historic that can falsify results. Appliance indications obey the suggested by Triple List for Diagnosis, Projecting and Treatment (SAKAI & CORSI 2004).
Method was divided in following stages:

- Stage 1: volunteer was clinically evaluated and directed to radiographic examinations.
- Stage 2: made gnatostatic casts and index card. (SIMÕES, 2003).
- Stage 3: photos and films registrations as supported by Protocol for Diagnosis in FMO. (SAKAI E CORSI, 2004).
- Stage 4: bilateral EMG registration from masseter muscle, following ISEK and SENIAM suggested protocol, in rest and isometric contraction verbally stimulated, three times pursued for each situation, as much as Diagnosis as with appliance. A 10 minutes interval was followed between registration in CP and OP.

EMG registration used:

- Signal acquiring System – Signal Conditioner Module with eight channels, 12 bites, low-pass filter and high-pass with 500 and 20 Hz respectively, and 50 times of gain;
- A/D converter plate, CAD 12/32 model with 12 bites and AqDados Software version 4.18, with 1000 Hz frequency of sampling. (equipments from Lynx Electronics Ltda.).

RESULTS and DISCUSSION

EMG data shows a frequency decrease from PC to PO, and this could be accepted as an indication of lower functional ask in isometrics for studied muscle, suggesting that muscles used to work with lower energy demand, against various articles showed EMG registration that suggests that patients with malocclusion present lower demand in comparison with normal.

CONCLUSIONS

PICT construction with tracks parallels to CP, do the mouth of volunteer with malocclusion while using appliance, simulate functioning in a understudied situation as ideal (OP parallel to CP), preparing by this way muscles to work under this condition but permitting to gain it by itself and not by technical imposition .

Figure 1: EMG registration, tracks parallels to CP.

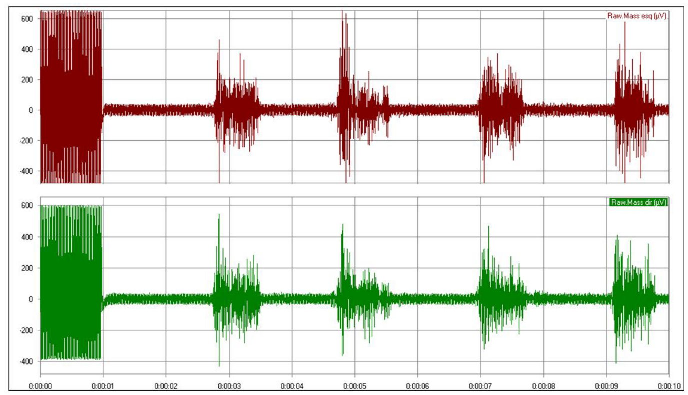
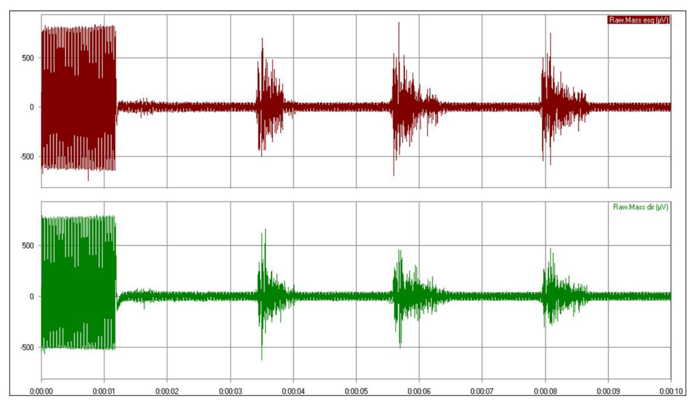


Figure 2: EMG registration, tracks parallels to OP.



REFERENCES

1. Basmajian JV, De Luca CJ. (1985) Muscles Alive: Their Function Revealed by Electromyography. 5. ed. Baltimore: Williams and Wilkins; p1.
2. Moyers R.E. (1991) Análise da musculatura mandibular. In Ortodontia, 4ª. edição. Rio de Janeiro: Guanabara Koogan; p167-86.
3. Planas P. (1994) Reabilitacão Neuroclusal. 2. ed. Barcelona; p165.
4. Sakai E, Corsi MB. (2004) Protocolo de Diagnóstico e Planejamento em Ortopedia Funcional dos Maxilares. Nova Visão em Ortodontia e Ortopedia Funcional dos Maxilares. São Paulo: Santos.
5. Simões WA. (2003) Ortopedia Funcional dos Maxilares vista através da Reabilitação Neuro Oclusal. São Paulo: Artes Médicas; p535-548,727.

6 EMG ACTIVITY OF TRUNK MUSCLES DURING EXERCISES PERFORMED WITH FLEXIBLE AND NON-FLEXIBLE POLE

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INTRODUCTION

Several studies indicate that abnormal activation of trunk muscle is present in patients with non-specific low back pain. Thus, the search for tools to interfere with muscle recruitment is the focus of research in physiotherapy, and among these instruments are flexible poles (ANDERS et al., 2007).
The oscillation of the pole causing kinematics perturbations, which requires a co-coordinated activation of trunk muscles and solicits different patterns of muscle recruitment (ANDERS et al., 2007).
The aim of this study was to identify the electromyographic activity of trunk muscles while performing different exercises with the use of flexible and non-flexible poles.

METHODS

Participated of this study 12 healthy individuals of feminine gender (20.4 ± 1.9 years), physically active.
All volunteers performed three different exercises (I – approximately 90º shoulder flexion and pole parallel to the floor; II – approximately 180º shoulder flexion and pole parallel to the floor; and III – approximately 90º right shoulder flexion and pole perpendicular to the floor) with a flexible pole (Flexibar®) and a non-flexible pole, which had the same length and mass (1.5m; and 800g). All exercises were performed in the standing and sitting positions. The pole movements were controlled by a metronome set at 300bpm.
The data kinematic collect was performed using the software Myoresearch 1.06 (Noraxon®) and a digital camera (Panasonic®) with a sample frequency of 30Hz. For the analysis was constructed a spatial model for calculating the frequency of movement of the poles in the Vicon Peak 9.0 software (Peak Motus®).
The electromyographic signal (EMG) was collected using the acquisition module of biological signals by telemetry (Noraxon®) and bipolar surface electrodes Ag/AgCl, circular, with conductive area of 1cm of diameter and intereletrode distance of 2cm (Meditrace®) positioned on the iliocostalis lumborum (IL), multifidus (MU), rectus abdominis (RA), external oblique (EO) and internal oblique (IO), on the right side (O'SULLIVAN et al., 2006; HERMENS et al, 2000). The electrode site had been shaved the skin, abraded and cleaned with alcohol.
The sampling frequency was 1000 Hz, low pass filter to 20Hz and high pass 500 Hz, and gain of 2000 times (20 times the pre-amplifier and 1000 on the module). The RMS values (Root Mean Square) of the EMG signals were obtained by a specific routine (Matlab), and normalized by the values of exercise I.
The data were statistically analyzed by Shapiro-Wilk test and ANOVA for repeated measures, and adopted a significance level of $p<0.05$.

RESULTS and DISCUSSION

In the comparison of the type of pole, was possible identified that the flexible pole generated higher EMG activity of the IO muscle than non-flexible pole (Figure 1). Since, higher activity of this muscle may be related to its function to stabilize the vertebrae (SÁNCHEZ-ZURIÁGA et al., 2009).
When comparing the EMG activity of trunk muscles in relation to the type of exercise was verified that the exercise III showed EMG activation of EO and IO muscle than the exercises I and II (Figure 2). This occurs because the configuration of exercise III, contributed to tend of these muscles to stabilize the rotation of the trunk (KENDALL et al., 1995).
Among the analyzed positions, only the IO showed greater muscle EMG activity in the standing position ($p<0.05$), a result that may be related to its function to stabilize the sacroiliac joint, which on standing is presented more unstable front pole oscillation (SÁNCHEZ-ZURIÁGA et al., 2009).

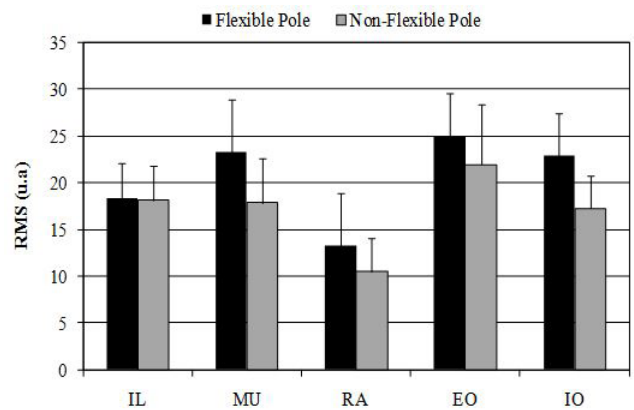

Figure 1: RMS values (u.a) of the analyzed muscles, non-flexible poles. *p<0.05. during the exercises performed with flexible and

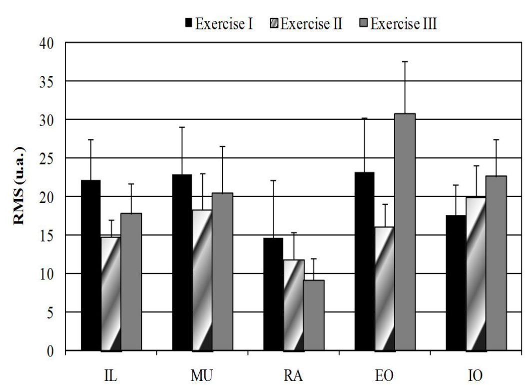

Figure 2: RMS values (u.a) of the analyzed muscles during the three exercises (I, II e III). *p<0.05.

CONCLUSIONS

The flexible pole can assist in automating patterns of muscle recruitment, especially for muscle IO. Although the type of exercise and posture do not alter the EMG activity of the analyzed muscles, suggests that for exercise prescription with a flexible pole, the biomechanical and kinesiological variables are considered to maximize the effect of the pole oscillation on the musculoskeletal system.

REFERENCES

1. Anders C, Wenzel B, Scholle HC. (2007) J Back Musculoskeletal Rehabil 20,167-175.
2. Hermens JH, Freriks B, Klug CD, Rau J. (2000) J Electromyog Kinesiol 14, 361-374.
3. Kendall FP, Kendall E, Provance PG. (1995) Músculos provas e funções. Manole.
4. O'Sullivan P, Dankaerts W, Burnett AF. (2006) Spine 31, E707-E712.
5. Sánchez-Zuriága D, Vera-Garcia FJ, Moreside JM. (2009) Arch Phys Med Rehabil 90, 1055-1060.
6. van Dieën JH, Cholewicki J, Radebold A. (2003) Spine 28, 834-841.

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7 CARDIORESPIRATORY AND NEUROMUSCULAR RESPONSES TO STATIONARY RUNNING AT DIFFERENT CADENCES IN AQUATIC AND DRY LAND ENVIRONMENTS

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INTRODUCTION

Some studies have analyzed the cardiorespiratory responses in aquatic environment for human gait or water aerobics exercises (Alberton et al., 2007; Masumoto et al., 2009). However, the neuromuscular responses, although well investigated for water walking (Miyoshi et al., 2004; Barela et al., 2006), are unknown for water aerobics exercises.
The aim of the present study was to analyze the cardiorespiratory and neuromuscular responses of young women performing stationary running exercise at different cadences in aquatic and dry land environments.

METHODS

Twelve healthy young women (22.33 ± 0.57 years) experienced in water aerobics exercises participated in this study. The study was approved by the Research Ethics Committee of the UFRGS (2006566).
Electrodes were placed on the belly of vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF) and semitendinosus (ST) muscles, with a 3-cm center-to-center spacing. Transparent dressings were used to insulate electrodes for the water condition trials. The electromyographic signals (EMG) were registered with a 4-channel EMG system (Miotool400 USB, Brazil), with a common mode rejection ratio >110 dB and a sampling rate of 2000 Hz by channel. The filtering of the raw EMG signal was performed with a 5th order Butterworth band-pass with cutoff frequencies of 25-500 Hz. The EMG data of each muscle were normalized by maximal voluntary isometric contraction (MVC).
The sample performed two test protocols, one land-based and the other water-based, with a two-hour interval between them. The stationary running exercise was executed in each of these environments during 4 min at 3 sub-maximum cadences (60, 80, and 100 bpm) and during 15 s at maximum effort, with a 5 min-interval between each situation. During the exercise, cardiorespiratory and neuromuscular data was acquired as from the third minute in the sub-maximum cadences. At maximum effort only neuromuscular data was acquired during 15 s.
We used blocked variance analysis, in which the effect of the subject was considered an additional source of variation for the statistical analysis. The data was processed using the SPSS (version 13.0) and R-project programs, with a $p < 0.05$.

RESULTS and DISCUSSION

The cardiorespiratory responses showed significantly differences between all sub-maximum cadences analyzed in this study. When comparing the environments, the dry land environment presented significantly greater heart rate (HR) and oxygen uptake (VO_2) values compared to aquatic environment (Figure 1).
The neuromuscular responses showed no significant increase on EMG signal from the VL, BF, RF and ST muscles with higher cadence of execution, except from the sub- maximum cadences to the maximum effort. When comparing the environments, the dry land environment presented significantly greater EMG signal responses from all the muscles at the sub-maximum cadences, except for the ST muscle which presented similar responses in both environments. However, at the maximum effort, all the analyzed muscle groups showed similar responses in both environments (Figure 2).

CONCLUSIONS

According to the results, we can conclude that performance of the stationary running exercise in aquatic environment at sub-maximum cadences presents lower cardiorespiratory and neuromuscular responses. At sub-maximum effort the cardiorespiratory responses can be maximized with the increase of the cadence; however, the neuromuscular responses are only maximized by the use of the maximum effort.

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REFERENCES

1. Alberton CL, Olkoski MM, Becker ME, Pinto SS, Kruel LFM. (2007). Cardiorespiratory responses of postmenopausal women to different water exercises. Int. J. Aquatic Res. Educ. 1:363-372.
2. Barela AMF, Stolf SF, Duarte M. (2006). Biomechanical characteristics of adults walking in shallow water and on land. J. Electromyogr. Kinesiol. 16:250-256.
3. Masumoto K, Hamada A, Tomonaga H, Kodama K, Amamoto Y, Nishizaki Y, Hotta N. (2009). Physiological and perceptual responses to backward and forward treadmill walking in water. Gait & Posture 29:199-203.
4. Miyoshi T, Shirota T, Yamamoto S, Nakazawa K, Akai M. (2004). Effect of the walking speed to the lower limb joint angular displacements, joint moments and ground reaction forces during walking in water. Disabil. Rehabil. 26(12):724-732.

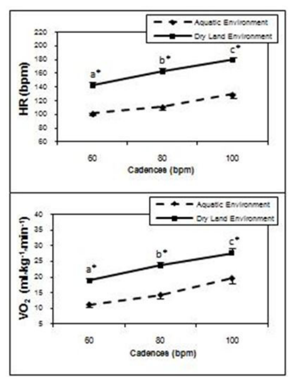

Figure 1 - Heart rate (HR) and oxygen uptake (VO_2) for different cadences performed in aquatic and dry land environments. * indicates significantly differences between environments. Different letters indicate significantly differences between cadences.

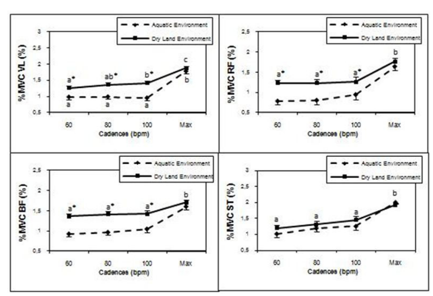

Figure 2 - The EMG signal normalized by maximal voluntary isometric contraction (MVC) of vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF) and semitendinosus (ST) muscles. Mean values expressed as log10. * indicates significantly differences between environments. Different letters indicate significantly differences between cadences.

8 COMPARISON OF PELVIC FLOOR MUSCLE FUNCTION IN PRIMIPAROUS AND MULTIPAROUS WOMEN

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INTRODUCTION

During gestation, a woman's body goes through several changes in order to adapt to pregnancy. The effects of a normal gestation on the physiology of the urinary tract are not completely understood (Abrams et al, 2002). The evaluation of pelvic floor (PF) function and the monitoring of the changes undergone by these muscles during gestation and delivery are of great clinic and scientific value (Morkved et al, 2004). The methods most commonly used to evaluate muscle contraction ability are clinical observation, digital palpation and PF functional assessment (AFA), perineometry and electromyography (Bo and Sherburn, 2005). The purpose of this study was to assess PF muscles using a subjective (AFA) and objective approach (perineometry) in primiparous and multiparous pregnant women who underwent Cesarean delivery.

METHODS

This study was conducted at the Obstetric Service of Botucatu Medical School Hospital, São Paulo State University (UNESP), as approved by the institution's Research Ethics Committee. Written informed consent was obtained from all study participants. PF assessment was carried out in primiparous and multiparous women (with up to two Cesarean deliveries) between 24 and 32 weeks of gestation. Multiparous women who underwent previous vaginal delivery were excluded. PF function was subjectively assessed by digital palpation or AFA. Later on, contraction was classified based on muscle response against examiner's fingers according to a newly proposed classification system used in the Gynecology, Obstetrics and Mastology Outpatient Clinic of Botucatu Medical School. The subject was asked to perform three strong and isolated fast contractions, and take a 120-s rest followed by three sustained contractions for as long as possible. If a contraction was kept for 6s, the subject was allowed to relax. The participant remained in the same position for the performance of perineometry. A probe covered with a nonlubricated condom using just hydrosoluble gel as a lubricant was introduced in the vaginal introitus, and inflated with air until the vaginal wall was reached as reported by the subject. Three strong and isolated fast contractions and three sustained contractions for the longest possible were requested. An interval of 30s was observed between contractions.

RESULTS

Seventeen pregnant women were allocated into two groups: G1 consisting of 8 primiparous participants, and G2 including 9 multiparous subjects. Median age was 26 and 29 years in G1 and G2, respectively. BMI was 28.06 Kg/m2 in G1 and 34.48 Kg/m2 in G2, respectively classified as overweight and obesity according to Atalah (1997). Median gestational age was 29 weeks in G1 and 26 weeks in G2. AFA results showed that, in G1, 50% of the subjects were classified as grade 3 (normal contraction of perineal fast and slow fibers), 25% as grade 2 (moderate contraction of perineal fast and slow fibers), and 25% as grade 1 (weak contraction of perineal fast and slow fibers), whereas in G2 44.5% were grade 3, 22.2% were grade 2 and 2d (strong contraction of fast fibers and moderate contraction of slow fibers), and 11.1% as grade 1. Comparison of AFA proportional distribution between groups revealed no statistically significant difference. Table 1 shows perineometric medians in mmHg for fast contractions (FC) and sustained contractions (SC).

Table 1: Median Fast and sustained contractions measured by perinometry

Perineometry	G1	G2	p*
FC	7.85	7.44	0.541
SC	8.25	7.43	0.673

* Test of Mann-Whitney

DISCUSSION

Baytur et al, assessing nulliparous and primiparous women, observed the PF muscle function was reduced in women who underwent vaginal delivery as compared with those who had a Cesarean delivery or were nulliparous. In this study, no comparison with vaginal delivery was possible as all multiparous participants had only had Cesarean deliveries. No statistically significant difference was observed between primiparous and multiparous subjects as assessed by perineometry and AFA. Vaginal digital palpation is the most commonly used method to evaluate PF muscles because it is inexpensive and easy to perform, requiring no equipment at all. However, this procedure depends on the skill and sensitivity of the examiner (Messelink, et al. 2005) and no validated system for the differentiation of muscle fiber type is available.

CONCLUSIONS

There was no significant difference in PF function measured by perineometry between primiparous and multiparous women undergoing Cesarean delivery.

REFERENCES

1. Abrams P, Cardozo L, Fall M, Griffths D, et al. Internacional Continence Society. Neurourol Urodyn. 2002; 21:167-78.
2. Atalah E. Rev Med Chile.1997;125:1429-36.
3. Baytur YB, Deveci A, Uyar Y, et al. (2005). Int J Gynecol Obstet, 88 276-80.
4. Bo K, Sherburn M. Phys Ther 2005;85:269-282.
5. Messelink B, Benson T, Berghmans B, Bo K, et al. Neurourol Urodyn. 2005;24:374-380.
6. Morkved S, Salvesen KA, Bo K, Eike-Nes S. Int Urogynecol J. 2004;15:384-390.

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9 ELECTROMYOGRAPHIC STUDY OF THE STERNOCLEIDOMASTOID AND PECTORALIS MAJOR MUSCLES DURING RESPIRATORY ACTIVITY IN HUMANS

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INTRODUCTION

The breathing muscles accessory considered have been widely studied aiming to obtain larger information of its actions, once that there are divergencies regarding its function, the period of the active respiratory cycle, the position of the body that would make the muscles act in more effective form and else, the way of breathing that would increase its activity (Kendall et al., 1995). The respiratory muscles electromyography (EMG) have been used for many years in order to investigate its actions during several forms of breathing; in different pulmonary volumes; in fatigue conditions in different postures; and after muscular training in patients with chronicle obstructive pulmonary diseases.

The purpose of this study was to accomplish, using surface EMG and by calculating the Root Mean Square (RMS) values of the SCM and PM muscles during the respiratory activity in humans and to verify which of these muscles could be an indicative to establish a valuation protocol for patients submitted to the mechanical ventilation.

METHODS

By the electromyographic study, eleven (11) healthy male volunteers were included, with ages varying from 18 to 25 years. The volunteers stayed in the supine posture using a breathing belt positioned at the level of their armpits, while they accomplished normal and forced breathing cycles. With this breathing belt, it was possible to control the phases of the breathing cycle (inspiration and expiration) for the displacements happened in the thoracic box. In the forced breathing test, the volunteers were requested to inspire for the nose and to expire for the mouth, while they maintained a standardized breathing rhythm being used a metronome.

The test was accomplished with 3 repetitions so much for the normal movement as for the forced. The electromyographic signs were captured through bipolar surface electrodes, positioned on the inferior third of the muscle ECM and inferior fibers of the muscle PM.

The electromyography signs were processed and the values of the root mean square (RMS) they were calculated by a period that would correspond to a breathing cycle that it was divided in inspiration and expiration. Significance tests were accomplished regarding the picked electric activities.

RESULTS and DISCUSSION

The results of this work are represented in a table (1) and a graph (1) and they indicate: 1) significant differences exist among the values of the electromyographic activity of the muscle ECM obtained during the forms normal and forced of breathing. The muscle ECM obtained the largest activity in the phase inspiratory and forced form of breathing, as confirmed by Legrand et al. (2003). some hypotheses are: a) in agreement with Cuello (1980) apud Costa et al. (1994), during the forced inspiration, to lung ventilation it is increased, doing with that the muscles considered main of the breathing they are in mechanical disadvantage, and consequently, need increase of the activity of the accessory muscles; b) the volunteers that presented larger value of RMS those that possessed a breathing pattern of the costal type were, because they have need of increase of the width of the thoracic box's movements, contributing to the elevation of the breastbone, and influencing, for synergic action the muscles of the neck (Jones et al., 1953); c) in the volunteers this muscle can still be more active in agreement with the pattern ventilatory, alert degree, forces muscular, resistance to the aerial flow and indulgence of the lungs and thoracic wall (Sheneerson apud Kendall et al., 1995); 2) significant differences exist among the values of the electromyographic activity in RMS of the muscles ECM and PM during the forced form of breathing. The activity of the muscle PM during the inspiration and expiration forced was smaller when compared to the activity of the muscle ECM in the same phases and breathing form, because the muscle ECM acts making the breathing movements properly said, and the muscle PM would act in the thoracic box's stabilization (Cala et al., 1992).

CONCLUSIONS

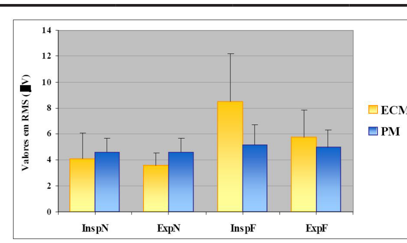
We ended that the muscles ECM and PM showed electromyography activity during the different phases and breathing forms; the phases and forms different from breathing can influence the activity of the muscles ECM and PM; and, the muscle ECM could be an indicator for elaboration of evaluation protocol to analyze the breathing pattern related with the activity of the muscles in patients with breathing problems.

REFERENCES

1. Calla, S.J.; Edyvean, J.; Engel, L.A. Chest wall and trunk muscle activity during inspiratory loading. J. *Appl. Physiol*., Austrália, **73(6)**:2373-2378, 1992.
2. Costa, D.; Vitti, M.; Tosello, D.O.; Costa, R.P. Participation of the sternocleidomastoid muscle on deep inspiration in man. An electromyographic study. *Electromyogr. Clin. Neurophysiol*., São Paulo, **34:**315-320, 1994.
3. Kendall, F.P.; McCreary, E.K.; Provance, P.G. *Músculos: provas e funções*. 4. ed., São Paulo, Manole, 1995. p.276-330.
4. Legrand, A.; Schneider, E.; Gevenois, P.A.; DE Troyer, A. Respiratory effects of the scalene and sternomastoid muscles in humans. J. *Appl. Physiol*., Bélgica, **94(4)**:1467-1472, 2003.
5. Jones, D.S.; Beargie, R.J.; Pauly, J.E. An electromyographic study of some muscles of costal respiration in man. *Anat. Rec*., Chicago, **117:**17-24, 1953.

Table 1 – Muscular activity (RMS) during respiratory movements.
Mean (X)), standard deviation (SD) and standard error (SE) of EMG root mean squared (RMS) values. Respiratory movements: inspiration (I) and expiration (E) in a normal (N) or forced (F) forms.

Músculos	Formas	Fases	Média	DP	EP
ECN	N	I	4.08	2.02	0.61
		E	3.59	0.98	0.30
	F	I	8.51	3.68	1.11
		E	5.74	2.15	0.65
PM	N	I	4.57	1.09	0.33
		E	4.59	1.11	0.34
	F	I	5.18	1.51	0.45
		E	4.97	1.33	0.40



Graph 1. Electromyographic values RMS (μV) of the SCM e PM muscles during breathing movements and forms.
The mean and standard error of the EMG RMS values from SCM and PM muscles. SCM and PM muscles in normal form of respiratory movement during inspiration (IN); SCM and PM muscles in normal form of respiratory movement during expiration (EN); SCM and PM muscles in forced form of respiratory movement during inspiration (IF); SCM and PM muscles in forced form of respiratory movement during expiration (EF).

10 ELECTROMYOGRAPHIC ANALYSIS OF THE TEMPORAL, MASSETER AND SUPRA-HIOIDS MUSCLES IN PERSONS WHIT DOWN'S SYNDROME

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INTRODUCTION

The Down syndrome or trissomy 21 is the most common chromosomal disorder. It is estimated that it occurs in one in 700 live births. Individuals with Down syndrome present with many general alterations, particularly generalized hypotonia. Electromyographics studies in individuals with Down syndrome shows that there is no loss or diminution of the muscle force, but rather alteration in the muscle behaviour when they make certain movements. Thence, the purpose of this study was to use electromyography to compare the action of the chewing muscles between normal individuals and those with Down syndrome, to determine whether differences are related just to the quality of if there are quantitative differences between these individuals.

METHODS

The temporal (front part), masseter (superficial part) and right and left supra-hyoids muscles were electromyographically analysed in 10 volunteers with Down Syndrome, 4 males, 6 female, aged 15 to 39 years compared with 10 normal individuals, all females. Signals were recorded on the skin surface utilising 5 pairs of Beckman mini-electrodes (Sensormed number 650950), which were 11 mm in diameter and had an active surface of 2 mm2. The signal after picked up was transferred to a signal conditioning module, model MCSY2 (Lynx), so that the channels could be adjusted to permit a final gain of 600 times with a cut-off frequency of 20 Hz for the high pass filter and 500 Hz for the low pass filter. This signal was recorded and stored. Aqdados software was used to digitise the electromyographic recordings and determine RMS values. The signals were then normalized using Microsoft Origin. The volunteers perform chewing and forced centric occlusion.

RESULTS and DISCUSSION

Muscle hypotonia (hypoactivity) consists of the reduction or complete absence of muscle tone. It can occur for various reasons and can be a symptom of many afflictions, among them Down syndrome. Based on these alterations, some authors consider the electromyography as an important test to determine neuromuscular disturbance, however, the specificity of the test is controversial because of the many causes of hypotonia. No significant differences were found in the individuals with Down syndrome when the chewing muscles were studied electromyographically, nevertheless a lack of motor co-ordination in chewing was demonstrated. During chewing, the individuals with Down syndrome did not show any sign of decreased action potential and the values were proportional to the two groups. For forced centric occlusion, no quantitative differences were seen in electromyographic signal in any of the muscles studied, when the two groups were compared. We suggest that in these individuals instead of muscle hypoactivity, the problem is more delay and variability in carrying out jaw movements and a lack of adaptation. In forced centric occlusion, a small difference was observed between the temporal muscles (right and left) in the individuals with Down syndrome, showing a slightly higher activity on the left side. We suggest that this alteration is just a question of habit, and that it is because of bad occlusion conditions in individuals with Down syndrome and not some kind of neuromuscular disorder. The 1 and 2 graphics show the averages of electromyographic activity in the muscles studied.

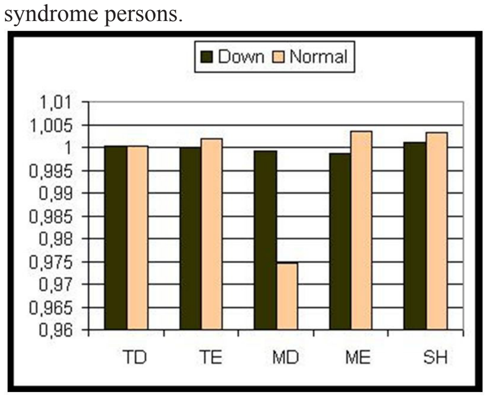
CONCLUSIONS

There were no differences in electromyographic pattern in the quantitative analysis of the two groups studied; however, qualitative differences were observed; during forced centric occlusion, there were differences between the right and left sides in the individuals with Down syndrome, showing an imbalance among the muscles that are motors to TMJ (temporomandibular joint); EMG was not satisfactory for detecting hypotonia. Based on the results, the muscles studied in the individuals with Down syndrome did not appear to show hypotonia, but rather a process of muscles discoordination, which could be treated with long-term physiotherapy.

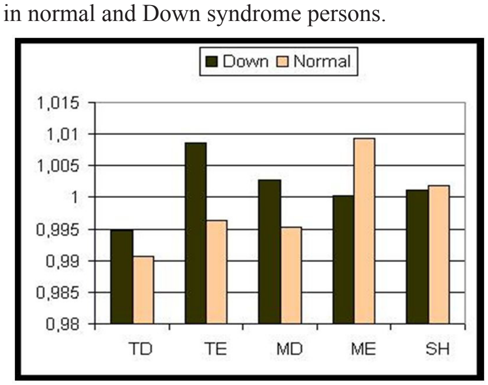
REFERENCES

1. Basmajian JV, De Luca CJ. (1985) Muscles alive: their functions revealed by electromyography. Baltimore. Willians & Wilkins, 1985.
2. Mazille MN, Woda A, Nicolas E, Peyron MA, Hennequin M. (2008) Effect of occlusal appliance wear on chewing in persons with Down syndrome. Physiol Behav, 93 (4-5): 919-29.
3. Niccoli Filho WD, Vitti M, Moraes FMD. (1989) Electromyographic analysis of the Masseter Muscle in Persons With Down's Syndrome. Rev Odont UNESP, 18: 293-304.
4. Latash ML, Corcos DM. (1991) Kinematic and Electromyographic Characteristics of Single-Joint Movements of Individuals With Down Syndrome. American Journal of Mental Retardation, 96(2): 189-201, 1991.

Graphic 1 - Variation of the average values during chewing, in normal and Down syndrome persons.



Graphic 2 - Variation of the average values during forced centric occlusion, in normal and Down syndrome persons.



11 ELECTROMIOGRAPHY OF THE THORACIC LIMBS OF BOXER DOGS DURING THE GAIT

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INTRODUCTION

The Surface Electromyography (SurEMG) has been introduced in veterinary medicine only in the 60's. Although its application has grown rapidly in recent years, only in 1998 such method has been used in veterinary medicine in Brazil (FEITOSA, USHJKOSHI, 2001). The knowledge about the behavior of muscle action in dogs helps veterinarian neurologists, orthopedists and physical therapists in a better understanding of the musculoskeletal system of animals. So, it is allows determine if this system is affected by a disease and evaluate the repercussion of possible sequels. Besides, treatment planning based in information obtained in SurEMG showed more effective results as observed in humans (VIANA, 2009).
Thus, this experiment aimed to analysis muscular action of the thoracic limb in Boxer dogs using SurEMG.

METHODS

This study was approved by the Committee of Ethics in Animal Experimentation of the Federal University of Goiás (Nº 006/2010) and performed at the Laboratory of Biomechanics and Bioengineering of the Faculty of Physical Education. Seven Boxer dogs, five females and two males, mean age 58 months ± 18 months, mean weight 32.1 kg ± 3.8 kg and average height of 55.71 cm ± 1.11 cm were used.
The animals were shaved in the skin surrounding the belly of following muscles: biceps, triceps and brachiocephalic. On shaved skin was applied 70% alcohol with cotton wool. For adaptation to the treadmill (Proaction, BHfitness®), the dogs were put to walk, without electrodes, at constant speed of 2m/s. Then, pre-geld, silver chloride disposable monopolar circular electrodes (3M®) with diameter of 30 mm, were placed on the shaved areas. For surface electromyography was used apparatus (Signal Conditioner Systems EMG, Brazil) with 16 channels. Ten channels were reserved for electro-myography and the other six for analog transducers. Electromyographic signals were processed in time domain by calculating the Root Mean Square (RMS), with sampling frequency of 2kHz, 5 Hz fourth-order Butterworth type low-pass filter and Matlab® software. Data acquisition occurred during the walking on the treadmill in constant speed of 2m/s in three successive series of 20 seconds each. For convention, just the right side was considered for evaluation. Data collection has been 10 seconds-cuts that showed the maximum and minimum mean values of the electromyography signal for each muscle. The relative amplitude (%RA) was calculated by the difference between maximum and minimum value divided by the maximum value according to LICK et al. (2008). Determination of the number of recruited motor units was done by calculation of the signal area for each muscle in each collection and then the average of the collection and the average among the animals.

RESULTS and DISCUSSION

The brachiocephalic muscle obtained a larger area because the highest peaks with values closer to 2mV, while the other muscles evaluated remained closer to zero. Probably, the function of maintenance the head position and the assistance in flexion of the shoulder during gait will require more fiber recruitment as describe by BADOUX (1986).
The biceps brachial muscle showed a similar behavior to brachiocephalic muscle. The graph shows the presence of constant activity, but the difference was the lower strength of the signal (Figure 1).
The triceps brachial muscle has a large area and important function, however its values did not report a greater recruitment of muscle fibers. Probably, it happened due to the movement of the skin that is an inherent problem of SurEMG, especially in areas where the skin is more loose or mobile, as observed in triceps muscle that is located in a flaccid region in many animal species (LICK, 2008).
SurEMG data of the biceps brachii, triceps brachii and brachiocephalic during the march are presented in detail in Table 1.

Table 1 - Average and Standard Deviation (SD) of maximum and minimum peak (mV) values, %RA - (max-min)/max and area (mVs) of the electromyographic signal of the biceps, triceps and brachiocephalis muscles in seven Boxer dogs.

		Biceps	Triceps	Brachio cephalic
Values of max peak (mV)	Aver	0,2852	0,3024	0,6157
	SD	0,1899	0,1422	0,6572
Values of min. peak (mV)	Aver	-0,4327	-0,3562	-0,4893
	SD	0,6007	0,3780	0,3763
%RA		25	22	18
Area (mVs)	Aver	857,9489	941,417	1294,627
	SD	455,1364	255,7081	990,6709

Carrier and Fishibein (2008) analyzed the action of six intrinsic muscles of the shoulder to check the functionality of the forelimbs as reversed support. The authors analyzed the moment in this joint and how these muscles work in order to maintain this structure and found out that little or no moment is observed in this joint in stance phase of gait.

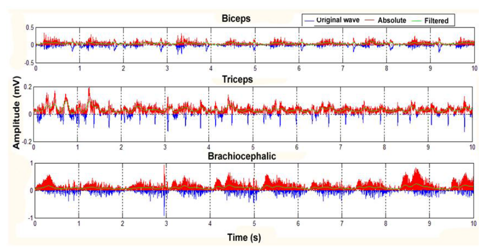

Figure 1: Graphics of the electromyographic signals of the biceps brachial, triceps brachial and brachiocephalic.

CONCLUSIONS

The results and methods presented here aimed to serve as reference to future evaluation of dogs with orthopedic or neurological injury, justifying the SurEMG in diagnostic of neurologic and orthopedic diseases and physiotherapy in dogs.

REFERENCES

1. Badoux DM. Biomecânica (1986) In: GETTY, R. s Anatomy of domestic animals. 5th . ed. Rio de Janeiro: Guanabara-Koogan. Cap. 5, p. 47-79.
2. Carrier DR, Deban SM. Fischbein T. (2008) Locomotor function of forelimb protractor and retractor muscles of dogs: evidence of strut-like behavior at the shoulder. The Journal of Experimental Biology, n. 211, p.150-162.
3. Feitosa MM, Ushjkoshi WS. (2001). Utilização da eletroneuromiografia in Medicine Veterinary Medicin. Continuous Education Joumal., SP, 4, 48-62.
4. Licka TF, Peham C, Frey A. Electromyographic activity of the longissimus dorsi muscles in horses when walking on a treadmill. The Veterinary Journal.2007 Oct [cited 2008 Nov 2] Availabe from: http://www.sciencedirect.com/science.
5. Viana M F. (2008). Dissertation: Surface Eletromyography in traumatic peripheral facial paralysis ande its correlation with the axonal degeneration – an experimental study in rabbits. FCMSC.

12 PELVIC LIMBS ELECTROMIOGRAPHY IN BOXER DOGS DURING THE GAIT

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INTRODUCTION

In veterinary medicine, muscle activity is evaluated only by inspection and palpation of the muscle or muscle groups during the gait. This procedure allows determine if the muscles are active or not during a specific movement, but in a limited and inaccurate way. With the development of surface electromyography (SurEMG), it is possible to check precisely the muscle activity in many situations, once the muscle contraction is immediately analyzed with the advantages of sensitivity, objectivity and quantitative nature of their signs (BASMAJIAN, DE LUCA, 1985).
Thus, the aim of this study was to evaluate the muscular action of the forelimb of Boxer dogs by means SurEMG in order to serve as reference for clinical applications.

METHODS

This study was approved by the Committee of Ethics in Animal Experimentation of the Federal University of Goiás (Nº 006/2010) and performed at the Laboratory of Biomechanics and Bioengineering of the Faculty of Physical Education. Seven Boxer dogs, five females and two males, mean age 58 months ± 18 months, mean weight 32.1 kg ± 3.8 kg and average height of 55.71 cm ± 1.11 cm were used.
The animals were shaved in the skin surrounding the belly of following muscles: superficial gluteal; semi-membranosus and semitendinosus; and rectus femoris. On shaved skin was applied 70% alcohol with cotton wool. For adaptation to the treadmill (Proaction, BHfitness®), the dogs were put to walk, without electrodes, at constant speed of 2m/s. Then, pre-geld, silver chloride disposable bipolar circular electrodes (3M®) with diameter of 30 mm, were placed on the shaved areas. For surface electromyography was used apparatus (Signal Conditioner Systems EMG, Brazil) with 16 channels. Ten channels were reserved for electromyography and the other six for analog transducers. Electromyographic signals were processed in time domain by calculating the Root Mean Square (RMS), with sampling frequency of 2kHz, 5 Hz fourth-order Butterworth type low-pass filter and Matlab® software. Data acquisition occurred during the walking on the treadmill in constant speed of 2m/s in three successive series of 20 seconds each. For convention, just the right side was considered for evaluation. Data collection has been 10 seconds-cuts that showed the maximum and minimum mean values of the electromyography signal for each muscle. The relative amplitude (%RA) was calculated by the difference between maximum and minimum value divided by the maximum value according to LICK et al. (2008). Determination of the number of recruited motor units was done by calculation of the signal area for each muscle in each collection and then the average of the collection and the average among the animals.

RESULTS and DISCUSSION

The SurEMG was chosen because it is painless, noninvasive and allows the functional assessment of the animal gait. Also, the main authors (BASMAJIAN, DE LUCA, 1985; CRAM, KASMAN, 1998; MERLETTI, 2004) and international societies dedicated to study of SurEMG are unanimous to relate that this method is an important and reliable resource to measure the number of activated muscle fibers during the evaluation in humans, justifying the proposal of this study in applying it in animals.
The lowest mean value of peak was found in the rectus femoris, while the highest average monthly peak was found in the muscle group semitendinosus and semimembranosus as presented in Table 1. This muscle group showed an irregular muscle activity of greater intensity, while the rectus femoris maintained a constant activity. The superficial gluteal muscle worked in a similar way to the muscle group evaluated, probably because it is a large muscle according to EVANS & DE LAHUNTA (1994), which is equivalent to the activity of two muscles (Figure 1).

Table 1: Average and Standard Deviation (SD) of maximum and minimum peak (mV) values, %RA - (max-min)/max and area (mVs) of the electromyographic signal of the rectus femoris, semitendinosus/semimembranosus and superficial gluteal muscles in seven Boxer dogs.

		Biceps	Triceps	Brachio cephalic
Values of max peak (mV)	Aver	0.0283	0.3283	0.1525
	SD	0.0413	0.4361	0.0847
Values of min peak (mV)	Aver	-0.094	-0.2867	-0.1728
	SD	0.3599	0.4331	0.2519
%RA		43	18	21
Area (mVs)	Aver	92.412	816.88	557.955
	SD	31.564	756.383	135.920

The %RA value was used to minimize the individual influences in comparison of the muscle activity between the dogs. In this study, the area that represents the estimated number of fibers recruited was higher in the muscle semitendinosus /semimembranosus since their peak values were higher and the area of the EMG signal is a trapezoid shape representation. This was expected since the electrodes picked up the signal from two muscles simultaneously, beyond the possibility of increase of crosstalk between the muscles, that is a serious problem in SurEMG of closely related small muscles (LICK et al., 2008).

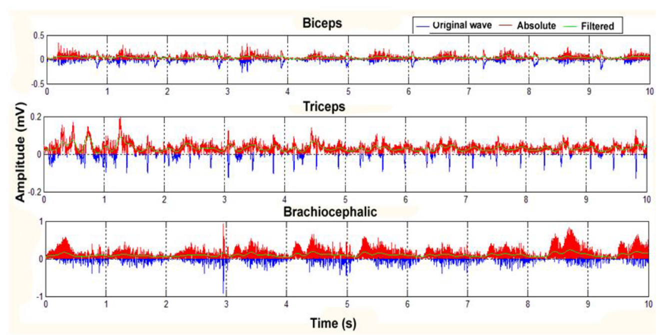

Figure 1: Graphics of the electromyographic signals of the rectus femoris; semitendinous and semimembranosus; and superficial gluteal.

CONCLUSIONS

This study showed that the SurEMG is an important functional study method of the rectus femoris, semimembranosus and semitendinosus muscle in Boxer dogs, essential to characterize orthopedic and neurological disorders affecting these muscles.

REFERENCES

1. Basmajian JV, De Luca CJ. (1985) Muscles alive: their functions revealed by electromyography. 5th ed. London: Williams & Wilkins.
2. Cram JR, kasman GS. (1998) Introduction to Surface Eletromyography. Gaithersburg: Aspen Publication.
3. Evans HE, Lahunta A. (2001) Guia para a dissecação do cão. 5th Rio de Janeiro: Guanabara Koogan. 250 p.
4. Licka TF, Peham C, Frey A. Electromyographic activity of the longissimus dorsi muscles in horses when walking on a treadmill. The Veterinary Journal.2007 Oct [cited 2008 Nov 2] Availabe from: http://www.sciencedirect.com/science
5. Merletti R. (2004) Electromyography: Physiology, Engineering, and Non-Invasive Applications. 1st .ed. New Jersey: John Wiley & Sons.

13 MOTOR CONTROL OF THE EXERCISE OF EXTENSION AND FLEXION OF THE KNEE CARRIED THROUGH IN THE REFORMER ACCORDING TO METHOD PILATES

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INTRODUCTION

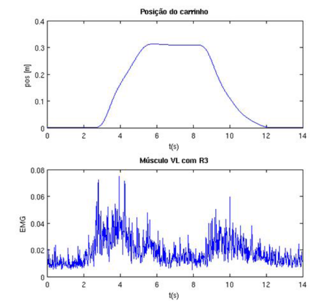
The Pilates method was developed by Joseph Pilates and consists of a set of exercises that aim at the profit of muscular force and flexibility. The exercises can be carried through in the ground (mat) or specific devices. The Reformer device was the first one to be constructed by Joseph and basically it consists of a set of springs (elastic load) and a sliding platform (stand). The movements of the method are generally of reversion, being that in the phase of gone the muscle it works in concentric contraction, stretching the springs and speeding up the member to the target. The accumulated potential energy in the springs during the stretching of the same ones is set free in the phase of return of the movement. Thus, the spring drags the member for its initial position, forcing the patient to carry through an eccentric contraction of form to decelerate the movement softly. Although the increasing popularity of the method, its principles are based on empirical observations, without scientific endorsement. Of this form, a biomechanics description and of motor control of the exercises used in the method would be the starting point for the kinesiology agreement of the exercises and its lapsing for therapeutic ends.

METHODS

Eight volunteers with age band between 20 and 40 years, sedentary, without previous experience with the Pilates method and without description of injury skeletal muscle or neuromuscular had participated of this study. The volunteers had been instructed to carry through a task of extension (gone) and flexion (return) of the knee in the equipment Reformer (*D&DPilates*) according to Pilates Method with three levels (R1, R2, and R3) distinct of resistance imposed for the springs (five repetitions in each condition). In the initial position, the volunteers had remained in dorsal decubitus, with the feet supported in the fixed bar of the device. In this position, the knees had been located in 120º of flexion and ankles and hip in 90º of flexion, the supported superior members in the stand. The gone movement of (of the initial position until the target) was characterized by the extension of the knee (phase 1). This phase was followed by a period where the volunteer remained in the target (phase 2). The return movement (of the target to the initial position) was characterized by the movement of flexion of the knee (phase 3). Coordinates X and Y of the mark (LED) placed in the stand of the Reformer had been registered using Optotrak 3020 esteem the linear displacement and activity EMG of the vast lateral and semitendinous was registered with surface electrodes (*Delsys, Incorporation*). Data EMG had been processed in accordance with the protocol established for the ISEK. Kinematic data and EMG had been filtered and quantified using Matlab software.

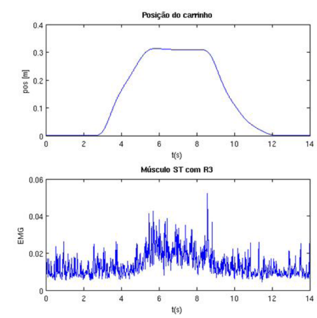
RESULTS and DISCUSSION

The linear displacement of the mark placed in the stand of the *Reformer* is presented in function of the time (figure 1A). It notices that the movement of the initial position until the target is characterized initially by an ascending slope and is represented by a linear displacement of approximately 35 centimeters. The second phase of the movement is characterized by the time that the segment remains in the target (plateau). Finally, the third phase represents the movement of return to the initial position. The figure 1B more illustrates agonist activity EMG (vast lateral - VL) during the movement executed with the weighed load (R3). This activity is characterized by two well defined envelopes of activity. In the first phase, the VL is activated of concentric form to assist in the extension of the knee and during the third phase it is activated eccentric to help to slowly decelerate the segment in the initial position.



A
B
Figure 1

The figure 2B more illustrates antagonistic standard EMG (semitendinous - ST) during the movement executed with the weighed load (R3). In contrast of what it was observed in the VL, the ST has an envelope of clear-cut activity EMG during the second phase of the movement.



A
B
Figure 2

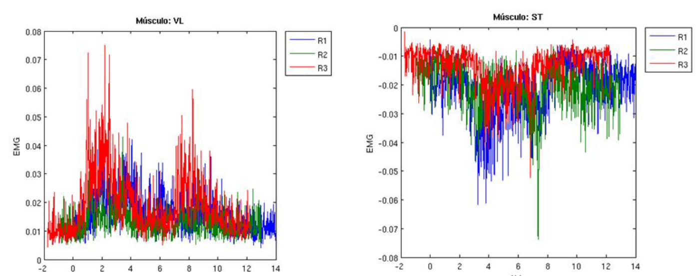


Figure 3

The figure 3 illustrates the effect of the increase of the load in the standard of agonist modulation (VL) and antagonist (ST). The activity of the VL was bigger for bigger loads, whereas the amount of the ST diminished with the increment of the load. The presented secular series in this study are representative of the behavior observed in all the volunteers. The increase of agonist activity EMG with increment of the elastic load already was demonstrated previously. The reduction of the activity of the ST with the increase of the load would be related with the nature of the elastic load.

CONCLUSIONS

The increase in the amount of the activity of the VL was necessary to move an additional elastic load. The elastic load generates a force in the opposing direction reducing, therefore, the necessity of antagonist activation.

REFERENCES

1. Gottlieb GL. (1996). J Neurophysiol. 76, 3207-29.
2. Gottlieb GL. (1998). J Neurophysiol. 80,1860-1867.
3. Queiroz BC, et al. (2010). Arch Phys Med Rehabil.91.

14 IMPACT OF PREGNANCY AND DELIVERY TO THE SYNERGY AMONG TRANSVERSUS ABDOMINUS/OBLIQUOUS INTERNUS AND PELVIC FLOOR-ELECTROMYOGRAPHIC EVALUATION

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INTRODUCTION

Exercises for the pelvic floor muscle and abdomen must be thoroughly evaluated and coached so that through synergy, a better understanding regarding the reactions to exercise and exercises quality can be achieved. It is of great importance to understand the synergy of the abdominal pelvic area in different phases of women's life such as pregnancy and puerperium. In these phases it is possible to notice great changes in abdominal and pelvic floor muscles which lead to a greater attention of the physiotherapist so the exercises can be really efficient.
For this reason, this observational study had as objective to simultaneously evaluate through electromyography, the transversus abdominis and pelvic floor muscles during common exercises made by pregnant and/or puerperal women.

METHODS

This study was approved by the PUC MINAS Research Ethics Committee under the registration: CAAE - 0307.0.213.213-07.
The sample was composed of 81 women, with a mean age of 23.5 years old (DP=4.8), selected from Programa de Saúde Materno Infantil in Poços de Caldas (MG, Brazil), all of which were divided into four groups: Group (A): 20 nulliparous; Group (B): 25 primiparous, with a gestational age greater or equal to 24 weeks; Group (C): 19 puerperals in late phase (40 to 60 days), after vaginal delivery; Group (D): 17 puerperals in late phase (40 to 60 days), after cesarean section.
The electrical activity of the abdominal and pelvic floor muscles was simultaneously recorded by surface electromyography. The volunteers were positioned in dorsal decubitus and coached to perform three successive maximum, voluntary contractions of the pelvic floor; in the same way an isometric contraction of the abdomen was requested. The data were simultaneously recorded by the electromyograph software. The results went through variance analysis (ANOVA) with Orthoganal Contrast Test, using the statistic program "R", from R Development Core Team (2008). The adopted significance level was under 1% .

RESULTS and DISCUSSION

During pelvic floor muscles exercises, there was a significance level regarding abdominal synergy of the nulliparous women (p=0.0007) when compared to the other groups. No significance level was found among the other groups data, as shown in table 1.

Tabel 1: Abdominal synergy - Maximum voluntary contraction of the pelvic floor.

Groups	P-Value
Nulliparous compared to Pregnant, Post vaginal delivery and Post c-section	0.0007***
Pregnant women compared to Post vaginal delivery and Post c-section	0.4509
Post vagial delivery compared to Post c-section	0.2786

* Orthogonal Contrast test; *** Significant value considering p≤0.001

Our result corroborates that of Neumann e Gill (2002), whose study found the transversus abdominus and obliquous internus recruitment during pelvic floor muscles contractions. However, in this study there is no reference to pregnant and puerperal women.
During isometric abdominal exercise, the nulliparous showed significant values when compared to the other studied groups. (Table 2)

Table 2 – Synergy of the pelvic floor muscles – Isometric abdominal exercise.

Groups	P-Value
Nulliparous compared to Pregnant, Post vaginal delivery and Post c-section	0.00001***
Pregnant women compared to Post vaginal delivery and Post c-section	0.7949
Post vagial delivery compared to Post c-section	0.9633

* Orthogonal Contrast test; *** Significant value considering p≤0.001

This finding is in accordance to the studies of Bo (2004), Neumann e Gill (2002) and Sapsford (2001), which affirmed that the co-activation of the transversus abdominus normally occurs during the pelvic floor contraction in women who were not in specific phases.

CONCLUSIONS

There is synergy among transverses abdominus /obliquous internus and pelvic floor muscles in young, nulliparous and healthy women. Pregnant and late puerperal women do not present co-activation of those muscles independently of the mode of delivery.

REFERENCES

1. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and Intra-abdominal pressure 2002; International Urogynecology Journal 13: 125-132.
2. Bo K. Pelvic floor muscle training is effective in treatment of female stress urinary incontinence, but how does it work? Int Urogynecol J 2004, 15: 76-84
3. Sapsford R. The pelvic floor. A clinical model for function and rehabilitation. Physioter 2001; 87: 620-630.
4. Sapsford RR, Hodges PW, Richardson CA, Cooper DH, Markwell SJ, & Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. Neurourol Urodyn. 2001; 20, 31-42.

15 CARDIORESPIRATORY AND NEUROMUSCULAR RESPONSES TO A WATER AEROBIC EXERCISE PERFORMED AT DIFFERENT CADENCES WITH AND WITHOUT WATER-RESISTANCE AND WATER-FLOATING EQUIPMENTS

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INTRODUCTION

Water aerobics have received considerable attention and the acute cardiorespiratory responses in this type of exercise have been investigated (Alberton et al., 2009). However, the neuromuscular responses to water aerobics exercises are limited (Pöyhönen et al., 2001a; 2001b).
The purpose of this study was to compare the cardiorespiratory and neuromuscular responses in women performing the stationary running with the elbow flexion/extension at different cadences with and without water-resistance and water-floating equipments.

METHODS

Fifteen healthy young women familiar with the aquatic environment agreed to participate in this study (age: 23.33 ± 0.51 years). The study was approved by the Research Ethics Committee of the UFRGS (2007905).
The bipolar electrodes were placed on the belly of biceps brachii (BB), triceps brachii (TB), rectus femoris (RF) and biceps femoris (BF) muscles. Transparent dressing was used to insulate electrodes. The maximal voluntary isometric contraction (MVC) was collected and was used to calculate the percentage of MVC (%MVC) of the collected EMG signal. The EMG signal was filtered using a 5th order Butterworth band-pass filter with cutoff frequencies of 20-500 Hz and was collected by a 4-channel EMG system (Miotool400, Brazil), with a common mode rejection ratio >110 dB and a sampling rate of 2000 Hz.
The subjects performed the exercise in three situations: without equipment (NO-E), with water-floating equipment in upper and lower limbs (FLO-LLs/ULs) and with water-resistance equipment in upper and lower limbs (RES-LLs/ULs) and each one was executed at three cadences (80, 100 bpm and maximal effort). For submaximal cadences the exercise was performed during 4 min and during 15 s at maximal effort. During the exercise, cardiorespiratory and neuromuscular data was acquired as from the third minute in the submaximal cadences. At maximal effort only neuromuscular data was acquired during 15 s.
Cardiorespiratory and neuromuscular comparisons were analyzed by repeated measures ANOVA two-way and three-way, respectively. An alpha level of 0.05 was adopted for all statistical tests (SPSS vs. 15.0).

RESULTS and DISCUSSION

The cardiorespiratory responses showed significantly greater values for 100 bpm when compared with 80 bpm. Furthermore, the situations FLO-LLs/ULs and RES-LLs/ULs showed statistically significant greater values compared with NO-E (Figure 1).
The neuromuscular responses demonstrated statistically significant greater values for %MVC BB and %MVC RF at maximal effort compared with 80 and 100 bpm and the same occurred for %MVC TB, however 100 bpm was also similar with 80 bpm. For %MVC BF was found statistically significant differences between the three cadences analyzed.
Between the situations for %MVC TB was showed statistically significant greater values in the situation FLO-LLs/ULs compared with RES-LLs/ULs and NO-E (Figure 2). For %MVC BF the main factor situation was tested again, because the interaction between situation*phase was significant. The main factor situation showed significant differences just in hip extension between NO-E and FLO-LLs/ULs compared with RES-LLs/ULs.
The main factor phase of movement exerted influence only on the variable %MVC RF, with significantly greater values for hip extension compared with hip flexion.

CONCLUSIONS

Based on the results of the present study, we can conclude that the cardiorespiratory responses can be maximized in this specific water aerobic exercise by increasing the performance cadence or by the use of water-resistance and water-floating equipments.
However, the neuromuscular responses are mainly maximized by the increment in the velocity of movement in the water.

REFERENCES

1. Alberton CL, Tartaruga MP, Pinto SS, Cadore EL, Silva EM, Kruel LFM. (2009). Cardiorespiratory responses to stationary running at different cadences in water and on land J. Sports Med. Phys. Fitness 49(2):142-151.
2. Pöyhönen T, Kyrolainen H, Keskinen KL, Hautala A, Savolainen J, Mälkiä E. (2001a). Neuromuscular function during therapeutic knee exercise under water and on dry land. Arch. Phys. Med. Rehabil. 82:1446-52.
3. Pöyhönen T, Kyrolainen H, Keskinen KL, Hautala A, Savolainen J, Mälkiä E. (2001b). Electromyographic and kinematic analysis of therapeutic knee exercises under water. Clin. Biomech. 16:496-504.

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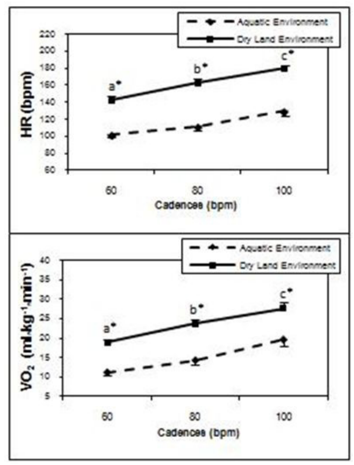

Figure 1 – (A) Heart rate (HR), (B) percentage of the maximal HR (%HRmax), (C) oxygen uptake (VO2) and (D) percentage of the maximal VO2 (%VO2max) for different situations performed at 80 and 100 bpm. * Indicates significantly difference between cadences. Different letters indicate significantly differences between situations.

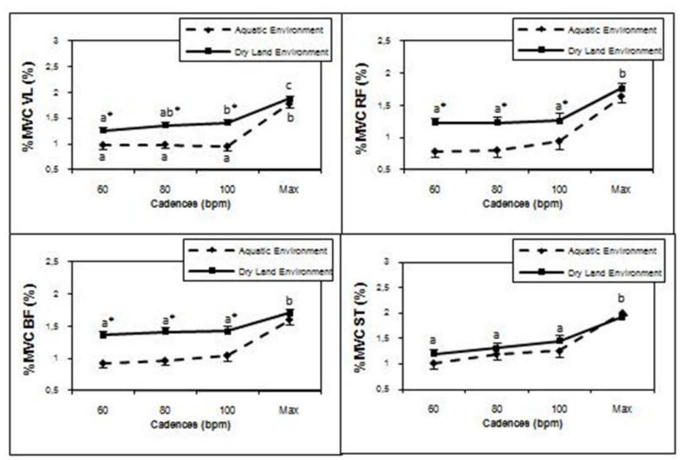

Figure 2 – (A) Percentage of the maximal voluntary isometric contraction for biceps brachii (%MVC BB) during elbow flexion and (B) extension, (C) percentage of the maximal voluntary isometric contraction for triceps brachii (%MVC TB) during elbow flexion and (D) extension, (E) percentage of the maximal voluntary isometric contraction for rectus femoris (%MVC RF) during hip flexion and (F) extension for different situations performed at 80, 100 bpm and maximal effort. Different letters indicate significantly differences between situations. Different capital letters indicate significantly differences between cadences.

16 VALITADION OF THE MIOFUNCTIONAL ASSESSEMENT INSTRUMENT WHIT SCORES (OMES) IN YONG AND ADULT SUBJECT

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INTRODUCTION

Temporomandibular disorders (TMD) is often associated with disturbances of stomatognathic functions, but no assessment myofunctional protocol that has been tested in order to measure myofunctional degree in TMD patients, according to scientific criteria.

The literature reveals that there is a validated instrument for clinical assessment of structures and functions of the stomatognathic system in young people and adults, with the exception of the screening protocol of orofacial dysfunction "The Nordic Orofacial Test-Screening - NOT-S", applicable from childhood to adulthood (Bakke et al, 2007).

The evaluation of myofunctional protocol with numerical scales (OMES) was validated for children (Felicio and Ferreira, 2008) and aims to characterize the condition of muscles and the functions of the stomatognathic system, allowing, based on the expected scores, pre-established set not only the presence or absence of any myofunctional disturbance, but also on its degree.

The aim of this study is to analyze the criterion and construct validity of the protocol for the evaluation OMES myofunctional in adults with TMD and reliability intra and inter examiners.

METHODS

The project was approved by the Ethics in Human Research. The subjects were selected from clinical examination and according to the Research Diagnostic Criteria for TMD (Dworkin, Leresche, 1992). Participated 50 subjects with TMD (TMD group) and 30 healthy subjects without TMD (control group). All they were evaluated about their orofacial myofunctional conditions conditions malfunctioning abnormalities. The images were recorded on video. The criterion validity of the protocol OMES was analyzed by comparing with the protocol'S NOT (Bakke et al, 2007). The construct validity was examined by: (a) comparing the group with TMD to a control group to verify the capacity of OMES in differentiating differentiate subjects with and without miofunctional disturbance (b) comparing the group with TMD before and after myofunctional therapy to analyze the ability of OMES to measure the changes due to treatment.

Therefore, the myofunctional evaluation of ten subjects with TMD who received myofunctional treatment (T group) were compared in the diagnostic phase and final phase of treatment, following the protocol of 120 days of treatments, with weekly sessions of 45 minutes the first 30 days and biweekly thereafter. Two examiners performed the evaluation and reliability intra and inter examiners was analyzed.

Data analysis The test Pearson's correlation was used to analyze the correlation between OMES protocols and NOT-S and between assessments by two examiners using the OMES (100% of the sample) and test-retest conducted by E1 (20-26% the sample).

Interrater reliability and intrarater was calculated by the split-half. The Mann-Whitney test was used to compare the groups and Wilcoxon test for comparison of the TMD in the early diagnosis and in the end of therapy. The program used STATISCA and the level of significance was set at 5% ($P < 0.05$).

RESULTS and DISCUSSION

Considering that the scales of protocols OMES and NOT'S, are reversed, the criterion validity of OMES protocol for the evaluation of adults was confirmed by the significant negative correlation with the NOT'S ($r = -0.86$, $p < 0.01$). So you can say that the OMES is able to measure what is supposed to measure, which is a requirement for the validity of an instrument.

In phase D there was no significant difference between groups T and control the following items OMES: appearance / jaw posture, cheeks, face and tongue; tongue mobility, jaw and cheeks, and the chewing and swallowing functions ($p < 0.05$).

In group T there was no significant difference between diagnostic and final phases in the following items: appearance / jaw posture and tongue, tongue mobility, and the swallowing and chewing functions ($P < 0.05$). There was a tendency to significant difference in the lips and jaw mobility ($P = 0.059$).

The construct validity of OMES was confirmed both by the protocol's ability to differentiate subjects with and without orofacial myofunctional disorders (OMD) as the ability to reflect the changes in the T group, from the treatment. The intrarater reliability was 0.91 and the correlation 0.84. The interrater reliability was 0.89 and the correlation 0.80 ($p < 0.01$).

Subjects with TMD were selected to compose the experimental group, whereas the association of TMD with myofunctional disorders has been reported (Ferreira et al, 2009) and myofunctional therapy is part of the treatment of these patients. Thus, the construct validity of OMES for youth and adults has been confirmed, according to both pre-requisites, that are, the instrument's ability to differentiate symptomatic from asymptomatic subjects and the ability to measure changes in symptomatic patients after treatment (Pehling, 2002). The high interrater reliability and intrarater to suggest that, since the examiners are trained, the data obtained with the OMES are reliable and can be played.

CONCLUSIONS

The protocol OMES proved to be valid for measuring myofunctional disorders in young people and adults was able to construct validity, since allowing the differentiation between control subjects and myofunctional disorders and reflected changes resulting from myofunctional therapy. There was good reliability ratings in test-retest and interrater.Thus, the instrument appeared to be valid and useful for the myofunctional diagnosis in adults.

REFERENCES

1. Bakke M, Bergendal B, Macalister A, Sjögreen L, Asten P. Development and evaluation of comprehensive screening for orofacial dysfunction. *Swed Dent J*. 2007;**31(2)**:75-84.
2. Dworkin SF, LeResche L: Research diagnostic criteria for temporomandibular disorders: Review, criteria, examinations and specifications, critique. *J Craniomandib Disord Facial Oral Pain*. 1992;**6**:301-355.
3. Felício CM, Ferreira CLP. Protocol of orofacial myofunctional evaluation with scores. *Int J Pediatr Otorhinolaryngol*. 2008;**72(3)**:367-375.
4. Ferreira CLP, Silva MAMR, Felício CM. Orofacial myofunctional disorder in subjects with temporomandibular disorder. Cranio. 2009;**27**:268-274.
5. Pehling J., et al. Interexaminer reliability and clinical validity of the temporomandibular index: a new outcome measure for temporomandibular disorders. *J Orofac Pain*. 2002;**16(4)**:296-304.

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17 ELECTROMYOGRAPHY OF TEMPORAL AND MASSETER MUSCLES IN PATIENTS WITH TEMPOROMANDIBULAR DISORDER TREATED WITH INTEROCCLUSAL SPLINT

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INTRODUCTION

In the treatment of Temporomandibular Disorder (TMD), the most used therapy has been the occlusal splint. Therefore, checking the real effectiveness of using the Michigan-type oclusal splint in the treatment of TMD is extremely important, since these disorders have been treated by using various methods whose effectiveness is not always measured or whose results are still questionable. Electromyographic analysis has been used to evaluate the effect of the treatment of TMD patients treated with occlusal splints. However, although the electromyographic (EMG) indices proposed by Ferrario et al. (2006) have been used in the dental field, there's no report of studies investigating the effects of the Michigan splint employing these indices. The aim of this study was to analyze the effects of the treatment of patients with articular TMD, with or without muscular disorders, with the Michigan occlusal splint, by analyzing the standard electromyographic indices and self perception of the signs and symptoms of TMD.

METHODS

The participants consisted of 20 women, 10 with mixed TMD, myogenous and arthrogenous, (TMD group), at the average age of 37, who were treated with the Michigan occlusal splint and 10 subjects without signs and symptoms of TMD (control group), at the average age of 22. The RDC/TMD, Axis I, was used for classification. The subjects were evaluated in two stages, pre-treatment and after 120 days of treatment with the splint, respectively called diagnosis (D) and finals (F). The procedures are described below.
The EMG surface was recorded in masseter and temporalis right and left muscles was recorded using a computerized instrument (Freely, De Götzen srl; Legnano, Milano, Italy). The conditions investigated were: (a) maximum voluntary dental clench (MCVA) with cotton rolls interposed between the first molars/ second premolars (10 mm thick cotton rolls - Roeko Luna); (b) maximum voluntary teeth clench (MCV). The protocol described by Ferrario et al. (2006) was used to obtain a set of standardized electromyographic indices.
The ProTMDmulti-part II questionnaire (Felício et al, 2009) was used to determine the severity of the perception of TMD signs and symptoms by the subjects.
The Michigan occlusal splint model was made and installed in accordance with the steps described by Leandro and Nunes (2000). The adjustment of the splint in each patient was carried out with carbon paper and the EMG records with the splint, in order to achieve a perfect distribution of occlusal contacts and, consequently, a greater distribution of power. And for this, 3 adjustments were made in each patient, 4 the first in the act of delivery of the splint, the second after a week using the splint, and the last after 30 days of use. Continuous use was recommended in the first 15 days and only during the night after this period. Categorical data were analyzed by Wilcoxon test (intragroup) and Mann-Whitney test (between groups). The EMG data were analyzed by Student t test (parametric statistics), for paired data (intra-group) and unpaired (among groups). It was considered significant $P < 0.05$.

RESULTS and DISCUSSION

In the TMD group there was significant reduction from FD to FF for the average pain on palpation of the temporalis and lateral pterygoid, for the right and left sides ($p < 0.05$). In the FD, the CG and the GTMD showed significant differences in pain sensitivity at all sites palpated, except in the suprahyoid muscles. In FF the differences were maintained in muscles masseter, pterygoid, esternocleidomatoideo, trapeze, temporomandibular joint (TMJ) and the tendon of the right temporal left.
In GC the frequency of signs and symptoms ranged from 0 to 20%. In GTMD it ranged from 0 to 80%. There was a significant reduction in the severity scores of GTMD between the FD and FF for the following signs and symptoms: muscle pain, TMJ pain, neck pain and noises in the ATMs. In FD there were significant differences between the CG and GTMD for the severity of muscle pain, TMJ pain and neck pain, ear fullness and noise at ATMs. In the FF there were significant differences between groups regarding muscle pain and noises in the ATMs. The results are consistent with previous studies that showed reduced pain on palpation, and the TMD symptoms after treatment with occlusal splints. In GTMD between FD and FF, EMG indices evolved toward normal values and there was a significant difference in the rate of ASIM ($p < 0.05$). Among the groups C and DTM in FD there was a significant difference in indexes POC temporal, TORS, ASIM, and EMG activity (microvolts) and MCVA in the MVC. In FF there was a significant difference between groups in temporal POC, TORS, and EMG activity (microvolts) in MCVA.
As noted previously, patients with TMD show asymmetric activation of jae muscles (Ries, Alves, Bérzin, 2008).
The positive EMG indices can be explained by the inhibitory effect of the use of the splint - which simulates an ideal occlusal condition - on the muscle activity and can be considered as a prime factor in reducing pain.

CONCLUSIONS

The use of Michigan occlusal splints was found to be effective in promoting the improvement of the aspects investigated. However, as there was no remission of symptoms and no significant improvement in all EMG indexes, the occlusal splint should not be seen as a unique and definitive treatment for TMD. Thus, it can be suggested that in many cases the treatment should be combined with other therapies, such as those involving direct work with the muscles and functions of the stomatognathic system.

REFERENCES

1. Felício CM, et al. (2009). Cranio. 27(1), 62-67.
2. Ferrario VF, et al. (2006). J Oral Rehabil. 33, 341-348.
3. Leandro LFL, Nunes JN. (2000). ATM: diagnóstico e tratamento. Pancast.
4. Ries LG, Alves MC, Bérzin F. (2008). Cranio. 26(1):59-64.

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18 MAY THE LOSS OF ANTERIOR TEETH PROMOTE PAIN IN TEMPOROMANDIBULAR JOINT?

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INTRODUCTION

Loss of posterior teeth may alter masticatory function which leads to mechanical stress on mandibular bone1. However, there is no consensus that loss of posterior teeth accelerates enough degeneration within the temporomandibular joint (TMJ) to promote pain. Presently there are no consistent scientific data supporting that TMD pain or resistance of jaw opening are associated with loss of teeth, or whether it can be prevented by the teeth occlusion maintenance. Nevertheless, reduced number of teeth and pain from the TMJ were demonstrated to be significant risk factors for impaired chewing ability1. The problem faced is if that missing teeth can cause remodeling in the TMJ by itself or if it needs other risk factors (environmental factors, disc displacement) to induce a more severe arthritis, pain and dysfunction. It has also been demonstrated that chronic expression of Il-1β induces osteoarthritis, condylar deformity, alter proteoglycan metabolism, and a decreases resistance in jaw opening[2,3,4]. Patients presenting TMD often exhibit behavior associated with pain from the TMJ and/or masticatory muscles inflammation. This behavior is characterized by these clinical features: increased pain from jaw function and decreased chewing amplitude[1]. The main of this study was to examine the effect of missing anterior teeth on nociceptive behavior and resistance of jaw opening in adult mice, when associated with intraarticular induction of interleukin-1β (IL-1β) expression.

METHODS

It was studied utilizing five mice groups: 1- (n=4) Col1-IL1β^{XAT} transgenic mice (TG) which received FIV(Cre) infectious particles injections in both TMJs and having the maxillary and mandibular incisors shortened; 2 - (n=4) Wild type mice (WT) that received intraarticular FIV(Cre) and had incisors shortened; 3- (n=6) TG that received intraarticular FIV(Cre) and had no incisors shortened; 4- (n=5) TG that received intraarticular injection of FIV(gfp), a viral vector encoding for the reporter gene green fluorescent protein, and had no incisors shortened; and 5 - (n=4) a WT Control Group, that received intraarticular normal sterile saline injections, and had no incisors shortened. Nociceptive behavior and joint/muscle dysfunction was evaluated at one, four and eight weeks, through orofacial grooming and resistance to jaw opening respectively. Oral facial grooming evaluation was done three times: 1, 4 and 8 weeks from the beginning of the experiment. Resistance jaw opening test was done once, after 8 weeks from the beginning of experiment. The data were analyzed by the ANOVA one way test, and the posterior comparison among the groups were done through Dunnet test (p=.05).

RESULTS and DISCUSSION

The results demonstrated that groups 1, 2 and 3 had an improvement in grooming behavior after 8 weeks (146±116; 219 ±125; 173±95; 140±58, respectively) when compared with control group 5 (55±9) (*P*=.03); but they didn't differ when compared among themselves. The resistance of jaw opening showed a decrease when clipped teeth were associated with FIV(Cre) injection (1.9; 1.7 and 1.5, to groups 1, 2 and 3 respectively) when compared with SS and FIV(gfp) TMJ injection (2.9 and 3.2, to groups 5 and 4 respectively). The results are demonstrated in tables 1 and 2.

It was supposed that loss of anterior teeth would create an overloading in the TMJ. The data of groups 1 and 2 (missing teeth mice) showed an increase of grooming and a decrement of jaw opening resistance. However, the group 3 (no missing teeth) showed the same results of groups 1 and 2. In this point, is necessary to consider that the three groups received FIV(Cre) TMJ injection. It suggests that, independently of missing teeth, the induction of IL-1 β within the joint may improve the possibility of osteoathries. Osteoathrites has been correlated with the presence of various cytokines, neurotropins and products of tissue injury. In rats, TMJ injection of recombinant human IL-1β resulted in the development of arthritis (Balkhi et al, 1993). Studies identify IL-1β as a key mediator in the development of TMJ pathology and dysfunction (Hinton, 1993; Kawata et al, 1997). In the present study, it was used a mice model to TMD pain using somatic mosaic analysis in the Col1-IL-1 XAT-transgenic mouse described by Lai et al (Lai et al, 2006). Probably the results showed by groups 1, 2 and 3 are related with the inflammation promoted by FIV(Cre) injection within the TMJ. In the presence of nociceptive input, there is a decrease in muscle strength in concentric muscle work (chewing, clenching), a reduced range of motion, and a slowing of movement due to antagonistic co-contraction of extensors during eccentric muscle work (jaw opening). The decrease in the resistance to jaw opening observed the FIV(Cre) transgenic mice (groups 1, 2 and 3) suggests pain avoidance. It supports the pain-adaptation hypothesis and other pain models in which bite force is decreased.

Table 1. Grooming means (seconds) and standard deviation (SD) of mice groups during the periods of evaluation

	1 week		4 weeks		8 weeks	
group	mean	SD	mean	SD	mean	SD
1	113.9	32.2	198.1	62.0	146.0	116.6
2	158.1	19.2	187.2	104.3	219.9	125.9
3	141.2	18.3	167.2	90.5	173.0	95.7
4	116.8	49.5	138.4	60.6	140.2	58.6
5	64.8	7.1	67.4	16.5	55.5	9.17

Table 2. Means and standard deviations (SD) of the resistance to mouth opening presented by the mice groups (mm).

Group	1	2	3	4	5
Mean	1.9	1.74	1.57	3.2	2.9
SD	0.3	0.23	0.21	0.22	0.32

CONCLUSIONS

The data suggest the induction of IL-1β expression by FIV(Cre) TMJ injection, with or without missing teeth, lead to increase pain and to reduce bite force.

REFERENCES

1. Balkhi KM, Tallents RH, Katzberg RW, et al. (1993) J. Orofac Pain. 7(1):89-9
2. Hinton RJ. (1993) Acta Anat (Basel).147(2):97-104.
3. Kawata T, Niida S, Kawasoko S, et al. (1997) J Craniofac Genet Dev Biol 17(4):198-203.
4. Lai Y; Shaftel SS, Miller JH, et al. (2006) Arthritis Rheumat. 54:1184-97
5. Lindsten R, Magnusson T, Ogaard B, et al. (2004) J Orofac Pain. 18(1):56-61.

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19 DIAGNOSIS CONTRIBUITION OF SURFACE ELECTROMYOGRAPHY FOR TEMPOROMANDIBULAR DISORDERS

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INTRODUCTION

Surface electromyography (SEMG) has been consistently used by clinicians and researchers to assess muscular function. SEMG is considered an important instrument in the evaluation of muscular conditions in Temporomandibular Disorder (TMD) patients (Stohler, 1999; Svensson, 2007). However, it does not seem to be able to determine the presence of dysfunction because it is limited in terms of reliability, validity, sensibility and specificity (Klasser & Okeson, 2006).

The aim of this study was to compare the SEMG of the temporalis anterior and masseter muscles in subjects classified by the Research Criteria Diagnosis for Temporomandibular Disorders (RDC/TMD) Axis I (Dworkin & LeResche, 1992), and to find a measure that could better distinguish between TMD and non-TMD subjects. Once such a measure was found, the objective was to verify SEMG validity to diagnose TMD.

METHODS

Sixty-one female volunteers aged between 18 and 36 (23,3 ± 8,2) participated in this experiment. The volunteers were divided into two groups, namely TMD and control. The TMD group comprised 36 myogenic TMD patients and the control group consisted of 25 non-TMD subjects. The EMG records were obtained using the Myosystem BR-1 equipment with 12 channels, 12-bit resolution, and gain of 50 times. Differential surface electrodes (pure silver, gain 100) were used. The software Myosystem BR-1 3.0 version was used to visualize and process the SEMG signal, with a frequency sample rate of 2000 Hz and digital band-pass filter of 10-500 Hz. The signals were then analyzed according to measures of Root Mean Square (RMS), Integral of Envelope Linear and Median Frequency. Maximal biting and bilateral chewing were assessed.

The results were observed in relation to mean, standard deviation, coefficient of variation and angular coefficient of the linear regression, which were obtained from three windows in each signal during the recorded period. Analysis of Variance (ANOVA) was used to assess the difference between groups, and Discriminant Analysis to test the diagnostic validity of SEMG.

RESULTS and DISCUSSION

The mean of envelope linear values during dynamic contractions of the temporal muscle was different between groups ($p<0,03$), and the angular coefficient of the linear regression to RMS values was different during isometric ($p<0,04$) and isotonic ($p<0,05$) contractions in the same muscle.

The sensibility values ranged from 80,6% to 84,3%, the specificity values ranged from 66,6% to 76% and predictive positive values ranged from 72,2% to75%%.

According to Dworkin & LeReshe (1992), Chung & Nguyen (2005) and Kitara et al. (2006) temporomandibular disorders is a chronic pain condiction and envolves a multidisciplinary approach, and this characteristics require more than 95% of specificity and more than 70% of sensibility or predictive positive values.

CONCLUSIONS

Based on the findings, the SEMG of temporal anterior muscle is able to differentiate TMD and non-TMD subjects when the mean of envelope linear values during dynamic contractions is observed, and when the angular coefficient of linear regression for RMS values in static and dynamic contractions is examined. Nevertheless, the validity of SEMG as a diagnostic instrument for the TMD condition could not be corroborated in this study.

REFERENCES

1. Chung H, Nguyen PH. (2005) Changing unit culture: an interdisciplinary commitment to improve pain outcomes. J Healthc Qual. 27(2), 12-9.
2. Dworkin S, LeResche L. (1992) Research diagnostic criteria for temporomandibular disorders: rewiew, criteria, examinations, and specifications, critique. J Cranio Mandib Dis Fac Oral Pain. 6, 301-55.
3. Kitahara M, Kojima KK. (2006) Ohmura A. Efficacy of interdisciplinary treatment for chronic nonmalignant pain patients in Japan. Clin J Pain. 22(7), 647-55.
4. Klasser GD, Okeson JP. (2006). The clinical usefulness of surface electromyography in the diagnosis and treatment of temporomandibular disorders. JADA, 137, 763-71.
5. Stohler CS. (1999). Craniofacial pain and motor function: pathogenesis, clinical correlates, and implications. Crit Rev Oral Biol Med. 10, 504–18.
6. Svensson P. (2007). What can human experimental pain models teach us about clinical TMD? Arch Oral Biol. 52(4), 391-4.

20 TEMPORO MANDIBULAR DISFUNCTION AND OROFACIAL PAIN TREATED BY FUNCTIONAL MAXILLARY ORTHOPEDICS: SURFACE ELECTROMYOGRAPHY DIAGNOSIS AND ATTENDANCE

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INTRODUCTION

Functional Maxillary Orthopedics (FMO) and Temporo Mandibular Dysfunction (TMD) and Orofacial Pain are Dentistry specialties' recently recognized by Dentistry Federal Council in Brazil, and show inter-relationship specially about Neuromuscular System; because of this, Surface Electromyography (SEMG) present like a ideal tool to functional analysis states as in results attendance gained by individuals with TMD and submitted to treatment by FMO can reach (Sakai,2006). This work will present a clinical situation where patient has a mouth with relatively good health, but with difficulties on execution of masticatory function; after physic-functional examination with emphasis on mandibular dynamics, SEMGs study where asked (bilateral registration from masseter, anterior temporalis, sternocleidomastoideous and others) and radiographic examinations (teleradiography in NHP – Rocabado, 1983) and usual norma, panoramic, periapicals form all teeth, TMJ with mouth closed/rest and maximal open); after these, gnatostatic casts were obtained and respective gnatostatic and chalcographic index card from patient (Simões, 2003). Each examination complete another on giving diagnosis information as on after treatment attendance. Proposition of this work is present graphic evidences (gnatostatic index card), frequency and amplitude (SEMG) from diagnosis and post treatment attendance, that are supplementary suggesting that can and have be used together.

METHODS

SEMGs registration were made from masseter pars superficialis, anterior temporalis, sternocleidomastoideous and others muscles, bilaterally, with passive bipolar electrodes Ag-AgCl (NORAXON-USA), reference electrode Kendall Meditrace (Canada), on periods (rest, isometrics, isotonics, mandibular lateralization) as examinations for diagnosis; in parallel gnatostatic casts and gnatostatic and chalcographic index cards were gained, over and above x-ray examinations (NHP and usual norma teleradiographies, panoramic, TMJ, periapicals). These SEMG registrations were made under ISEK e SENIAM parameters. Data were registered on BioEMG II (Bioresearch Inc.), version 1.72, 12 bit analog digital conversion, sample frequency 1000Hz,CMRR> 120db.

RESULTS and DISCUSSION

Based on results gained (figures 1 and 2) it is permitted conclude that SEMGs registration amplitude on Diagnostic phase of this experiment suggest that If there are no conditions to do equilibrated profit muscular functions over and above non equilibrated mandibular positioning, by consistently similar way to gained on gnatostatic index card images. Gnatostatic triangle positional and spatial equilibrium (Santos in Simões,2003), additioned to after treatment SEMGs data (Results), suggests that the use of both examinations can permit to professional that choose follow this kind of treatment, use examination results that permit verification between both, amplifying in important way the possibility to adopt correct diagnosis direction and for treatment results gained.

CONCLUSIONS

Presented results permit conclude that:

1. SEMGs registration and gnatostatic index card images can be used in complimentary form on treatment of cases that present muscular pain on TMD and pain frame diagnosis and attendance.
2. Amplitude and frequency data showed in na unambiguous way the situations existing in studied musculature, as many on Diagnosis phase and Results.

Figure 1: SEMG data on rest during Diagnostic phase (1) e After treatment attendance (2).

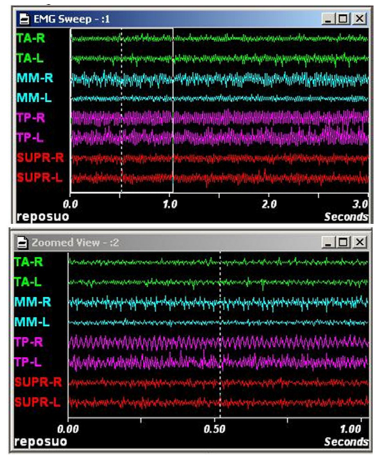
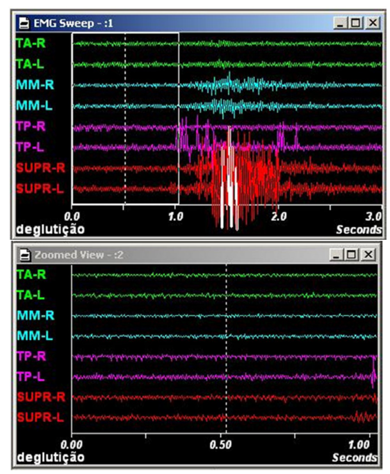


Figure 2. SEMG data of deglutition on Diagnostic phase (1) and After treatment attendance (2).



REFERENCES

1. Simões WA. Ortopedia Funcional dos Maxilares Artes Médicas Ed..,v.2,p549-606,2003
2. Rocabado M. Biomechanical relationship of the cranial, cervical and hyoid regions. J Craniomand Practice ,1(3):61-66,1983
3. Santos JLB. Ficha gnatostática Planas/Ficha gnatostática tridimensional Santos in Simões WA. Ortopedia Funcional dos Maxilares Artes Médicas Ed..,v.2,p598-606,2003
4. Sakai E. Avaliação eletromiográfica de músculos da mastigação em pacientes portadores de maloclusão tratados com Ortopedia Funcional dos Maxilares. [Tese Doutoramento]Piracicaba;UNICAMP/FOP; 2006

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21 IMMEDIATE EFFECT OF THE RESILIENT SPLINT EVALUATED BY SURFACE ELECTROMYOGRAPHY IN PATIENTS WITH TMD

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INTRODUCTION

This study aimed to analyze the immediate effect of resilient splints through surface electromyography test and compare the findings with the electromyographic profile of asymptomatic subjects.

METHODS

The participants were 30 subjects, 15 patients with TMD (TMD Group) and 15 healthy subjects (Control Group) classified according to Research Diagnostic Criteria (RDC/TMD) Axis I. It was made a resilient occlusal splint with coverage of all the dental elements of 2 mm thick, silicon, for each patient from TMD Group. The EMG examination was performed before and immediately after installing the splint, where 3 tests were performed: 1. Maximum Voluntary Contraction (MVC) with cotton rolls (standards test), 2. MVC in Position of Maximal Intercuspation; 3. MVC with the splint in position. The EMG signal was recorded for 5 seconds. EMG indices were calculated that assessed muscle symmetry, jaw torque and impact.

RESULTS and DISCUSSION

There was a statistically significant difference when compared these rates between the study groups. The symmetry index values in the Control Group were higher than the TMD Initial Group and similar to the TMD Group after the installation of the splint. The index values of torque were higher in TMD Initial Group when compared with the Control. Impact values were lower than normal values in TMD Initial Group and restored when the installation of the splint.

CONCLUSIONS

The resilient occlusal splints may be used as complementary or adjunctive in the treatment of temporomandibular disorders.

REFERENCES

1. Ferrario VF, Sforza C, Tartaglia GM, Dellavia C. Immediate effect of a stabilization splint on masticatory muscle activity in temporomandibular disorder patients. J Oral Rehabil, Oxford, v. 29, n.9, p.810-5, Sep. 2002.
2. Sforza C, Zanotti G, Mantovani E, Ferrario VF. Fatigue in the masseter and temporalis muscles at constant load. Cranio, Chattanooga, v. 25, n. 1, p. 30-36, 2007.
3. Botelho AL, Melchior MO, Silva AMBR, Silva MAMR. Electromyographic evaluation of neuromuscular coordination of subject after orthodontic intervention. Cranio. v.27, p.152 - 158, 2009.

Figure 1: a) Maximum voluntary contraction (MVC) with cotton rolls of 10mm thick positioned between the second premolar and first molar on each side; b) MVC without cotton rolls in the Position of Maximal Intercuspation; c) MVC with the resilient occlusal splint in position.

22 EFFECTS OF UPPER CERVICAL MANIPULATION ON THE ELECTROMYOGRAPHIC SIGNAL OF MASTICATORY MUSCLES IN WOMEN WITH TMD

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INTRODUCTION

Temporomandibular disorder (TMD) is characterized by pain and hyperactivity of the masticatory and cervical muscles (AAOP, 2009, ASTJS, 2003). There is neurological and biomechanical interrelations between the temporomandibular joint (TMJ) and the cervical column.

In the trigeminal caudal nucleus, convergences of afferences from cervical levels (C1, C2, and C3) and orofacial region (trigeminal nerve) occurs (Marfurt and Rajchert, 1991).

According to Alcântara et al. (2002), afferences originated from the TMJ can cause hyperactivity of upper cervical muscles, and consequently reduce mobility of C1.

In order to restore mobility and promote muscular relaxation, one may use vertebral manipulation (Vernon, Humphreys and Hagino, 2007; Herzog, Scheele and Conway, 1999).

The objective of this study was to evaluate the effects of upper cervical manipulation on isotonic activity of the masticatory muscles as observed by electromyography, in women with TMD.

METHODS

Five women were selected, ages between 20 and 37 (25.8±6.8) years, with TMD diagnosed by the RDC/TMD, and received two manipulations to the upper cervical column, as described by Ricard (1990), per week, during five consecutive weeks.

For the manipulation procedure, the volunteers remained in supine position while the therapist passively performed slight cranial traction of the head with rotation of the head, and then applied a high velocity and low amplitude thrust for rotation to the right side, followed by the same procedure with rotation to the left side.

The lasting effects of manipulation on electromyographic signal (EMGS) of the masseter and anterior portion of the temporal muscles were evaluated bilaterally.

For the electromyographic assessment, an electromyograph EMG1000 (Lynx®) was utilized, with 16 bits of resolution, interfaced with a microcomputer, as proposed by Guirro, Forti, and Rodrigues-Bigaton (2006), with simple differential electrodes (Lynx®). Amplifications of 1000 times, with filter of 20-1000 Hz and sampling frequency of 2000 Hz were also utilized.

The electrodes were positioned bilaterally on the belly of the masseter and anterior region of the temporal muscle, according to Cram, Kasman, and Holtz (1998), after skin cleansing with alcohol at 70%. The reference electrode was placed over the manubrium bone. The EMGS was collected during isotonic activity of the aforementioned muscles, for 15 seconds, during two separate times: pre and post-intervention.

The EMGS data was processed with Matlab® 6.5.1 software, utilizing a specific function for calculation the Root Mean Square (RMS). For standardization was used as reference value the peak RMS value obtained in the collection of baseline during the situation isotonia. In sequence, a comparison of RMS values from before and immediately after manipulation was realized by utilizing the Anova F statistical test.

RESULTS and DISCUSSION

There was significant increase in EMGS in the agonist phase for the left masseter (LM) and anterior portion of the right temporal muscles (RT), which concurs with Colloca and Keller (2001), where they evaluated the immediate effects of vertebral manipulation on the lumbar spine in volunteers with low back pain, and observed significant increase of the isometric EMGS of lumbar paravertebral muscles (Figure 1).

In the antagonist phase, there was reduction of EMGS for the left and right temporal muscles, and the right masseter, after intervention with manipulation (Figure 2).

Sato and Kawamura (2005) evaluated individuals with and without TMD and observed that those with TMD presented reduction in electromyographic activity of the masticatory muscles in the agonist phase and increase during the antagonist phase of mastication. In this context, it is observed that after the intervention period with manipulations, the electromyographic activity of masticatory muscles was altered during mastication, and resembled a more normal pattern.

CONCLUSIONS

Manipulation of the upper cervical spine alters electromyographic activity of the masticatory muscles during mastication, bringing them closer to a normal patter.

Figure 1 – Average of normalized RMS values for the left temporal (LT), left masseter (LM), right temporal (RT), and right masseter (RM) muscles, during the agonist phase of mastication, before and after the manipulation treatment period.

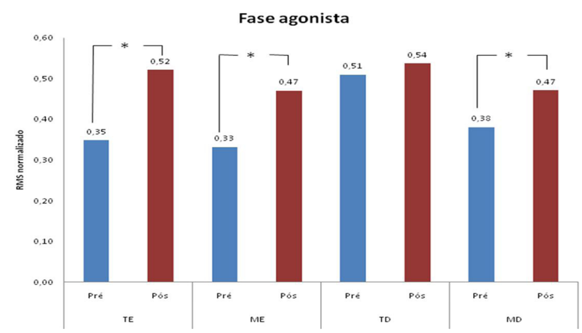
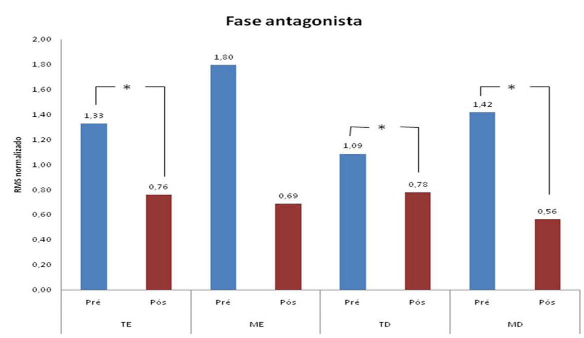


Figure 2 - Average of normalized RMS values for the left temporal (LT), left masseter (LM), right temporal (RT), and right masseter (RM) muscles, during the antagonist phase of mastication, before and after the manipulation treatment period.



REFERENCES

1. Guidelines. (2003). Cranio.21(1),68-76. ASTJS. (2003). J Craniomandib Pract. 21, 68-76.
2. Marfurt CF, Rajchert DM. (1991). J Comp Neurol. 303(3), 489-511.
3. Alcantara J, Plaugher G, Klemp DD. (2002) J Manipulative Physiol Ther. 25(1), 63-70.
4. Vernon H, Humphreys K, Hagino C (2007). J Manipulative Physiol Ther. 2007; 30(3), 215-27.
5. Herzog W, Scheele D, Conway PJ. (1999). Spine. 24(2), 146-52.
6. Ricard F. (1990). Deverlaque. 576p.
7. Cram JR, Kasman GS, Holtz J. (1998). Gaithersburg, Maryland: Aspen Publishers.
8. Colloca CJ, Keller TS. (2001). J Manipulative Physiol Ther. 24(8), 489-500.

23 MEDIAN FREQUENCY AND SIGNAL NORMALIZATION: ELECTROMYOGRAPHIC SIGNAL ANALYSIS OF MASSETER MUSCLE IN FEMALE

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INTRODUCTION

Chewing is influenced by the specific characteristics of each food (DEGUCHI, KUMAI e GARETTO, 1994). The mandible muscles participate in a series of motor tasks including bite and mastication food, deglutition and speech (KORFAGE et al., 2005).
This study aims to analyze the correlation between the EMG normalized signal (NS) and median frequency (Fmed) in masseter muscle of females.

METHODS

The study was characterized as: descriptive, observational, cross-sectional and individual, performed at the Laboratory of Orofacial Motricity and Clinic of Pediatric Dentistry, UFPE. Participated 25 volunteers through a convenience sample, exclusively female individuals, from 18 to 27 years old, mean 22.0 years (SD= +/- 1,8) according with the criteria for inclusion and exclusion pre-established. The Miotool 400 equipment connected to the notebook with Miograph 2.0 software set (sampling frequency of 1024 points, the cutoff frequency of 20Hz-500Hz; Nothi offline filter 59Hz-61Hz) was used. Initially, the muscle surface was cleaned. Volunteer held a sustained maximum voluntary contraction (MVC) and, then, was made the mastication of food (bread, apple, stuffed cookie and peanut, respectively). The mastication sign was standardized by the MVC. Were considered for analysis the median frequency of the signal (FFT - Fast Fourier Transformation) and the normalized signal with the Kolmogorov-Smirnov test for testing the normality assumption of variables and the correlation coefficient considering the 5% margin of error. This study was approved by the Ethics Committee of UFPE and registered with CEP/CCS/UFPE Nº 116/08, Of Nº218/2008; SISNEP 0114.0.172.000-08. Financial support from CNPq - Universal 15/2009. Notice PIBIC UFPE/CNPq. 2008/2009.

RESULTS and DISCUSSION

For individuals, during mastication of different foods, the normalized electromyographic signal to masseter muscle had more intense on the left side in most events (Table 1). In this population, the study of the correlation coefficient between the median frequency of signal with the normalized signal (Table 2) showed that peanut got a stronger correlation index (right masseter-R=0.280; left masseter-R=0.303). Individuals had lower correlation coefficients for apple (right masseter-R=0.052; left masseter-R=0.003). The statistical correlation between these parameters showed a positive correlation but in all cases the correlation value was less than 0.6, which features a weak correlation. It's believed that prolonged mastication may reduce the masticatory efficiency as a result of fatigue of mastication muscles (TZAKIS, KILIARIDIS and CARLSSON, 1989). The literature shows that masticatory performance was significantly influenced by dental state, but not by age or sex (FONTIJIN-TEKAMP et al., 2004) and the strength can be related to the proportions of muscle fiber types (UEDA et al., 2002). It's also possible that the type of food can influence the preferred mastication side.

CONCLUSIONS

Was evidenced a predominance of electrical activity of the left masseter during mastication of all foods. However, the results are showed dominant for the chewing of a single food, peanuts.

REFERENCES

1. Deguchi T, et al. (1994). Statistics of differential Lissajous EMG for normal occlusion and Class II malocclusion. Am J Orthod dentofac Orthop,105(1):42-8.
2. Korfage JAM, et al. (2005). Fiber type Composition of the Human Jaw Muscles (Part 1) Origin and Functional Significance of Fiber type Diversity. J Dent Res, 84(9):774-83.
3. Tzakis MG, et al. (1989). Effect of chewing training on masticatory efficiency. Acta Odontol. Scand, 47(6):335-60.
4. Fontijin-Tekamp FA, et al. (2004). Swallowing threshold and masticatory peformance dentate adults. Physiology & behavior, 83(3):431-36.
5. Ueda HM, et al. (2002).Differences in the fatigue of masticatory and neck muscles between male and female. Journal of Oral Rehabilitation, 29(6):575–82.

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Financing of CNPq.

Table 1: Data of EMG signal, median frequency (Fmed) and normalized signal (NS) for the masseter muscle during food mastication.

	Bread	Apple	Stuffed cookie	Peanut
		Right Masseter		
Fmed (Hz)	182.96	175.14	165.74	166.94
SN	178.22	131.03	143.70	162.98
		Left Masseter		
Fmed (Hz)	172.96	167.77	161.92	158.21
SN	198.29	163.55	189.90	208.42

Table 2: Data of the EMG signal correlationn, median frequency (Fmed) and normalized signal (NS) for the masseter muscle during food mastication.

	Bread	Apple	Stuffed cookie	Peanut
	Fmed	Fmed	Fmed	Fmed
	R	R	R	R
Masseter R				
SN	0.167	0.119	0.052	0.280
Masseter L				
SN	0.003	0.108	0.055	0.303

24 MEDIAN FREQUENCY AND SIGNAL NORMALIZATION: ELECTROMYOGRAPHIC SIGNAL ANALYSIS OF MASSETER MUSCLE IN MALES AND FEMALES

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INTRODUCTION

The mandible muscles participate in a series of motor tasks including bite and mastication food, deglutition and speech (KORFAGE et al., 2005). Chewing is influenced by the specific characteristics of each food (DEGUCHI, KUMAI e GARETTO, 1994).

This study aims to analyze the correlation between the EMG normalized signal (NS) and median frequency (Fmed) in masseter muscle of males and females.

METHODS

The study was characterized as: descriptive, observational, cross-sectional and individual, performed at the Laboratory of Orofacial Motricity and Clinic of Pediatric Dentistry, UFPE. Participated 18 males (42%) and 25 women (58%), with ages ranging from 18 to 27 years, mean 22.5 years (SD = + / - 2.2) according with the criteria for inclusion and exclusion pre-established. The Miotool 400 equipment connected to the notebook with Miograph 2.0 software set (sampling frequency of 1024 points, the cutoff frequency of 20Hz-500Hz; Nothi offline filter 59Hz-61Hz) was used. Initially, the muscle surface was cleaned. Volunteer held a sustained maximum voluntary contraction (MVC) and, then, was made the mastication of food (bread, apple, stuffed cookie and peanut, respectively). The mastication sign was standardized by the MVC. Were considered for analysis the median frequency of the signal (FFT - Fast Fourier Transformation) and the normalized signal with the Kolmogorov-Smirnov test for testing the normality assumption of variables and the correlation coefficient considering the 5% margin of error. This study was approved by the Ethics Committee of UFPE and registered with CEP/CCS/UFPE Nº 116/08, Of Nº218/2008; SISNEP 0114.0.172.000-08. Financial support from CNPq - Universal 15/2009. Notice PIBIC UFPE/CNPq. 2008/2009.

RESULTS and DISCUSSION

For individuals during mastication of different foods, the normalized electromyographic signal to masseter muscle in females was larger on the left (Table 1). And, for the chewing of males proved, predominantly, larger than the right (Table 2). And, for the chewing of males proved, predominantly, larger than the right. In this population, the study of the correlation coefficient between the median frequency of signal with the normalized signal for female subjects showed that peanut butter was the food that got a stronger correlation (masseter right - R = 0.280; left masseter muscle - R = 0.303). The same for males (masseter right - R = 0.431; left masseter muscle - R = 0.361). The statistical correlation between these parameters showed a positive correlation but in all cases the correlation value was less than 0.6, which features a weak correlation. It's believed that prolonged mastication may reduce the masticatory efficiency as a result of fatigue of mastication muscles (TZAKIS, KILIARIDIS and CARLSSON, 1989). The literature shows that masticatory performance was significantly influenced by dental state, but not by age or sex (FONTIJIN-TEKAMP et al., 2004) and the strength can be related to the proportions of muscle fiber types (UEDA et al., 2002). It's also possible that the type of food can influence the preferred mastication side.

CONCLUSIONS

The data showed the correlation is dominant for the chewing of a single food, peanuts. We demonstrated a predominance of the masseter different with respect to the side, between individuals.

REFERENCES

1. Deguchi T, et al. (1994). Statistics of differential Lissajous EMG for normal occlusion and Class II malocclusion. Am J Orthod dentofac Orthop,105(1):42-8.
2. Korfage JAM, et al. (2005). Fiber type Composition of the Human Jaw Muscles (Part 1) Origin and Functional Significance of Fiber type Diversity. J Dent Res, 84(9):774-83.
3. Tzakis MG, et al. (1989). Effect of chewing training on masticatory efficiency. Acta Odontol. Scand, 47(6):335-60.
4. Fontijin-Tekamp FA, et al. (2004). Swallowing threshold and masticatory peformance dentate adults. Physiology & behavior, 83(3):431-36.
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Table 1: Data of EMG signal, median frequency (Fmed) and normalized signal (NS) for the masseter muscle during food mastication of females subjects.

	Bread	Apple	Stuffed cookie	Peanut
		Right Masseter		
Fmed (Hz)	182.96	175.14	165.74	166.94
SN	178.22	131.03	143.70	162.98
		Left Masseter		
Fmed (Hz)	172.96	167.77	161.92	158.21
SN	198.29	163.55	189.90	208.42

Table 2: Data of EMG signal, median frequency (Fmed) and normalized signal (NS) for the masseter muscle during food mastication of males subjects.

	Bread	Apple	Stuffed cookie	Peanut
		Right Masseter		
Fmed (Hz)	166.70	153.16	147.27	149.07
SN	119.95	100.78	100.30	135.00
		Left Masseter		
Fmed (Hz)	164.66	152.28	145.02	142.15
SN	111.18	85.93	112.69	122.78

25 CORRELATION AMONG TEMPOROMANDIBULAR DISORDERS, STRESS AND POSTURAL CHANGES

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INTRODUCTION

Temporomandibular disorder (TMD) and orofacial pain are frequent problems that affect great part of the population. These conditions affect mainly the temporomandibular joint and the craniocervical segments, commonly presenting facial algiae of head and ear, cracking, among others.
The etiologic factors triggering the TMD can be attributed to the several neurological musculoskeletal changes, malocclusion, postural changes, traumatic and psychosomatic factors, either isolated or associated (ENDO *et al*., 2008).
Stress can be characterized as a set of organic reactions to aggressions from diverse origins, able to disturb the internal balance, influencing well-being and body health. However, if an emotional component is associated with a physical factor such as occlusal change, tension will be released via the stomatognathic system, which can cause symptoms of pain and dysfunction (MARTINS *et al*., 2007).
In this sense, it is observed that the etiologic factors of the TMDs are varied, with associations occurring mainly between psychosomatic factors and musculoskeletal changes. However, it is noticed that there is limited evidence of the etiologic factors involving the postural and emotional changes in the TMD.
Therefore, this research had as its goal to analyze whether there is a correlation among temporomandibular disorder, stress and postural changes.

METHODS

This investigation can be characterized as descriptive, with cross section and quantitative data analysis.
This research was appreciated and approved by the Ethics Committee in Research of UNIMONTES, under protocol no. 1249.
The population of this study was composed of individuals having TMD, residents of the municipality of Montes Claros - MG. The sample comprised 21 subjects of both sexes, age between 19 to 55 years, with a clinical odontological diagnosis of TMD, attended to at a clinic school of a higher education institution of Montes Claros - MG. The sampling collection was intentional and for convenience.
The tools used in this research were the perceived stress questionnaire, the TMD evaluation record (MARQUES, 2005), a postural evaluation card (static analysis) and a squared. All the participants of the sample signed a free and informed consent and underwent physical evaluation of the TMD, analysis of the level of stress perceived and assessment of postural changes.
For the data analysis, descriptive statistics, with means, standard deviations, frequencies and percentages was used. For the analysis of the correlation between TMD and the level of stress, *Sperman's* Non Parametric test was used, with significance level of 5%.

RESULTS and DISCUSSION

During the physical evaluation of these patients, the main complaints and parafunctional habits were assessed. Thus, it was found that an expressive portion of this sample (52.5%) reported as the main complaint the algic conditions, mainly in the cervical and facial segments, associated with other impairments. However, other changes found which should be highlighted were oral fatigue (33.4%) and crackings, being found in 38.1% of patients with TMD.
In this sense, findings similar to the literature were evidenced, once the signs and symptoms characteristics of the TMD are the algic manifestations and hypersensitivity of the masticatory muscles, of the TMJ and in the cervical region, in addition to joint sounds such as crackings and clicks (GOMES et. al., 2006).
Regarding the parafunctional habits, it was noticed that most of these patients present teeth grinding (80.9%) alone or associated with other factors, such as nail biting and supporting the mentum on the hand. However, only three patients (14.3%) reported having no parafunctional habits.
Based on the postural analysis results, it was found that there is a great prevalence of postural deviations in individuals having TMD. The most evident changes were the presence of head protrusion in 90% of the sample, shoulder protrusion (95%) and 66.7% presented an increase in lumbar lordosis. In the upper limbs, mainly raised shoulders (71.4%) and bended elbows (81%) were noticed.
An interesting characteristic that was evidenced in this investigation is the association of occlusal changes and postural deviations. Thus, it was found that a large part of the sample (81%) were in the occlusal class (Angle) type II – overbite, 14.3% in class I or normoocclusion and only one patient presents class III (underbite).
Thus, it was found that 94.1% of the patients with occlusal changes class II (overbite) had shoulder protrusion and 88.2% presented head protrusion. However, only one patient presented underbite, with head and shoulder protrusion as well.
Stress influences and provokes the appearance of parafunctional habits, which cause hyperactivity of the masticatory muscles, leading to muscular spasms, being considered the main factor triggering pain in the TMD (AMANTÉA *et al*.,2004).

Table 01 - Sperman's correlation coefficient between TMD (Mobility and algiae) and the level of stress.

	Level of Stress		
	N	Correlation coefficient	Sig
Joint Mobility	21	0.208	0.365
Algiae Upper Trapezium D	21	- 0.300	0.896
Algiae Upper Trapezium E	21	- 0.130	0.574
Algiae Scalenes E	21	0.015	0.948

**Significance P ≤ 0.05*

In the analysis of the perceived stress, it was found that these subjects presented a level of stress considered moderate, with mean index of 27.9 within 56 possible. However, diverging from literature, a significant correlation between the main clinical conditions of individuals having TMD with stress was not found (table 01).

CONCLUSIONS

In this context, the results suggest that there is an association between the clinical conditions of TMD with postural changes, mainly with the occlusal changes. On the other hand, a significant correlation between stress and the temporomandibular disorders was not evidenced.

REFERENCES

1. Amantéa, D.V. et. al. (2004). *Revista Brasileira de Ortopedia*. 12,3.
2. Endo C., *et al*. (2008). *Revista Online*. 12, 1-2.
3. Gomes, B.M. *et. al*. (2006) *Ciência Odontológica Brasileira*. 9, 4 -11.
4. Marques, A.P.L. (2005). *Cadeias musculares, Um programa para ensinar avaliação fisioterapêutica global*. São Paulo, Editora Manole.
5. Martins *et al*. (2007). *Revista Brasileira de Epidemiologia*. 10, 2.

26 PREVALENCE OF DISTURBANCES TO THE MUSCULAR CHAINS AND ALGIC DISORDERS IN PATIENTS WITH TEMPOROMANDIBULAR DISORDERS

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INTRODUCTION

Temporomandibular disorder (TMD) can be considered as a term used to define a series of clinical disorders involving the temporomandibular joint (TMJ), the masticatory system, the occlusal system and other craniocervical musculoskeletal structures leading to signs and symptoms of pain and dysfunction, which can restrict and incapacitate certain corporal physiological activities (PASINATO *et. al*.,2006).

In etiopathogenic terms, there is a consensus among several authors in that the etiology of TMD is multifactorial and could be related to structural factors such as malocclusion, musculoskeletal changes, postural changes, traumatic factors, psychological factors, among others (ENDO *et al*.2008).

To Marques (2005), the muscles organize themselves into muscular chains, being that the change in any corporal segment can interfere and change the positioning of other corporal segment.

A number of studies have shown that patients with TMD present body posture changes due to the complex, anatomic and biomechanical interactions between the stomatognathic system and the craniocervical segment. However, evidence showing the main changes in the muscular chains in individuals having temporomandibular disorder is limited.

In this sense, this investigation had as its purpose to verify the prevalence of muscular chains disturbances and algic disorders in patients with TMD.

METHODS

The present research has a descriptive character, with cross section and quantitative data analysis.

The population of this research was composed of patients with Temporomandibular Disorder (TMD) from the municipality of Montes Claros-MG. The sample comprised 21 patients of both sexes, with a clinical odontological diagnosis of Temporomandibular Disorder (TMD), referred by a private practice and a clinical school of a higher education institution of Montes Claros - MG. The sample selection was intentional and for convenience.

For tools, an authorization form and the TMD evaluation and muscular chains record were used (MARQUES, 2005). After authorization and referral of patients with TMD, all sample subjects signed a free and informed consent and underwent a physical evaluation (anamnesis and physical examination) of the TMD and assessment of the muscular chains (static and dynamic analysis).

The data was handled through descriptive statistics, with means, standard deviations, frequencies and percentages.

RESULTS and DISCUSSION

Based on the results presented in this study, it was found that the sample presented a mean age of 37.6 (+11.3) years, being most part (90.4%) female. This data corroborates the literature, once there is a much higher incidence of TMD in women than in men, mainly related to situations of stress (DI GRAZIA and FORTI, 2007).

During the physical evaluation of the patients with TMD, the palpation of facial and spine muscles becomes crucial in order to analyze the algic disorders and myofacial pains (MARQUES, 2005). With palpation, it was found that these patients presented a mild to intense algic condition. Several muscular segments were affected, once 38% of the sample presented facial algiae on the medial pterygoid D, 33% on the lateral pterygoid D, 47% on the medial pterygoid E. However, on the cervical spine, it was noticed that most patients reported algiae on the upper trapezius E (80.9%), upper trapezius D (76%), followed by the scalene E (52%) and scalene D (42%).

The algic disorders manifest themselves in the referred form through the activation of myofacial trigger points (TG). When ascertaining the main focuses of active TG in the patients with TMD, coherence to the literature described was observed, since there was predominance on the upper trapezius muscles D and E with 90.5% of the patients affected, medial trapezius (47.6%), scalenes (28.6%) and rhomboids (19%).

According to Veronesi (2008) the analysis of muscular chains is a method for reading posture and awareness, aiming at the correct and harmonious use of the body, preserving its mechanics. In this context, very relevant data was observed in this study, since most patients with TMD (95.2%) presented changes in their muscular chains, proving to be an important factor in the physiopathogeny of these disorders and for the therapeutic approach.

The majority of subjects in this sample (76.19%) presented changes in the anterior muscular chain and only 19.1% presented impairment in the posterior master chain. This data diverges from the literature, being stated with higher impairment in the posterior master chain, resulting in an important reduction in the expandability of the thorax and the cervical spine movements (VERONESI, 2008).

When analyzing the disturbances to the anterior master chain (dynamic evaluation), it was found that 90.4% of the patients have greater shortening of the respiratory chain muscles. These findings could be associated with the postural changes obtained through static postural examination, which found the presence of head protrusion in 90% of the sample, shoulder protrusion (95%) and 66.7% presented an increase in lumbar lordosis.

The analysis of the upper limbs found higher prevalence of changes in the anterior chain of the arm, with 66.2% affected and only 47.62% of the sample presented changes in the anteromedial chain of the shoulder.

CONCLUSIONS

From the data found, a high prevalence of craniofacial algic disorders and muscular chains disturbances in individuals having temporomandibular disorders can be evidenced. A higher prevalence of changes in the anterior master chain, mainly in the respiratory chain and the anterior chain of the arm, was also noticed

REFERENCES

1. Di Grazia, R.C., Forti, V.A.M. (2007). *Efeitos do programa de terapia manual na qualidade de vida de mulheres na meia idade com disfunção da articulação temporomandibular*. São Paulo.
2. Endo C., et al. (2008). *Revista Online*. 1-2.
3. Marques, A.P.L. (2005). *Cadeias musculares, Um programa para ensinar avaliação fisioterapêutica global*. São Paulo, Editora Manole.
4. Pasinato, F., et al. (2006). *Revista Brasileira de Fisioterapia*. 10, 3.
5. Veronesi Jr., JR. (2008). RPG / RFL: *O método da reeducação postural global pelo reequilíbrio funcional laboral*. São Paulo, Andreoli.

27 COMPLETE DENTURES WITH NÓBILO'S SLIDING PLATES: A sEMG ANALYSIS

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INTRODUCTION

Temporomandibular dysfunction (TMD) is characterized by facial and temporomandibular joint pain, masticatory muscles tenderness, limited mandibular movements, joint sounds and an altered occlusal relationship (Zuccolotto et al., 2007). The etiology of TMD is a controversial matter due the involvement of several features as occlusion, stress, muscular hyperactivity and asymmetric condyles position in the mandibular fosse (Hotta et al., 2000)

METHODS

The aim of this clinical research was to evaluate the surface electromyography activity (sEMG) of the masseter and anterior temporalis muscles, both sides, in nine TMD patients before and after use of the complete dentures with Nóbilo's sliding plates during rest position and postural movements, like protrusion and left and right laterality (10s). This modality of treatment was the selected due their neuromuscular deprogramming effect (Zuccolotto et al., 1999; Zuccolotto et al., 2007) and the improvement of the horizontal and vertical maxillomandibular relationships. The sEMG analysis was performed using a with differential active electrodes (silver bars 10 mm apart, 10 mm long, 2 mm wide, 20x gain, input impedance 10 GΩ and 130 dB common mode rejection ratio). Surface differential active electrodes were placed on the skin, bilaterally on both masseter muscles and on the anterior portion of the temporalis. A ground electrode was also used and fixed on the skin over the sternum region. The sEMG signals were analogically amplified with a gain of 1000x, filtered by a pass-band of 0.01-1.5KHz and sampled by a 12-bit A/D converter with a 2 KHz sampling rate. The data collected were normalized by maximum voluntary contraction (MVC – 4s), and the results were statistically analyzed using the t-test (SPSS- 17.0- Chicago).

RESULTS

The results showed statistically significant improvements ($p<0.05$) in electromyographic activities of masseter and temporalis muscles in rest and all postural positions after use of the complete dentures with Nóbilo's sliding plates. During the clinical conditions, it was observed that the patients showed a minor sEMG activity for the rest position and greater sEMG values for right and left lateral excursions, and protrusion after the use of the complete dentures with Nóbilo's sliding plates for all the analyzed muscles.

DISCUSSION

After use of the complete dentures with Nóbilo's sliding plates prostheses, the patients felt greater comfort and suitable esthetic appearance. They also related that they could chew better than they did with the old dentures.

CONCLUSIONS

The data allow us to conclude that the of the complete dentures with Nóbilo's sliding plates may be an effective treatment for the relief of painful symptoms associated with temporomandibular dysfunction in complete dentures wearing.

REFERENCES

1. Zuccolotto MCC, Vitti M, Nóbilo KA, Regalo SCH, Siéssere S, Bataglion C. Electromyographic evaluation of masseter and anterior temporalis muscles in rest position of edentulous patients with temporomandibular disorders, before and after using complete dentures with sliding plates Gerodontology 2007; 24; 105–110.
2. Hotta TH, Nunes LJ, Quatrini AH, Bataglion C, Nonaka T, Bezzon OL. Tooth wear and loss: symptomatological and rehabilitating treatments. Braz Dent J. 2000;11(2):147-52.
3. Zuccolotto MCC, Nóbilo KA, Nunes LJ, Hotta TH. Sliding plates on complete dentures as a treatment of temporomandibular disorder: a case report. J Craniomandibular Pract 1999; 17: 289–292.

28 ASSESSMENT OF STRESS IM BRUXISM

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INTRODUCTION

The parafunctional habits, among which bruxism (scrape and/or clutch the teeth) can be detached, can be the setting going to painful symptomatology which can generate pain-spasm-pain.

It is important to point out that bruxism can cause tension headache, dysfunction on the chewing muscle, cervical pain, temporomandibular jaw pain, clicks, restriction to the mandibular movements and the detritions of the teeth.

Psychosocial and stress variations play important role at this parafunctional generation (Salute et al, 2005), made by unvoluntary and longing contraction, frequent at those having temporomandibular dysfunction.

So, this study has the aim of assessment the existence of stress at women with or without bruxism.

METHODS

20 volunteers, aged 18 to 40, were selected and slit in two groups:

- Group I: 10 women without bruxism;
- Group II: 10 women who were with bruxism.

The selected volunteers passed by the following tests: Visual analogic measure of stress, Verbal stress perception measure and salivary cortisol dosage, a trustworthy index of free concentration of plasma cortisol obtained by simple procedure, uninvasive, free of stress, wich can be easily handled by people without training (Antonini et al, 2000).

In order to verify the numbers obtained between the groups, a test t was used, considering the significant values with $p<0.05$.

RESULTS and DISCUSSION

Figure 01 presents values obtained by the stress perception measures. In both assessment the values obtained were higher at women with bruxism ($p<0.05$).

Figure 01 – Stress perception measures.

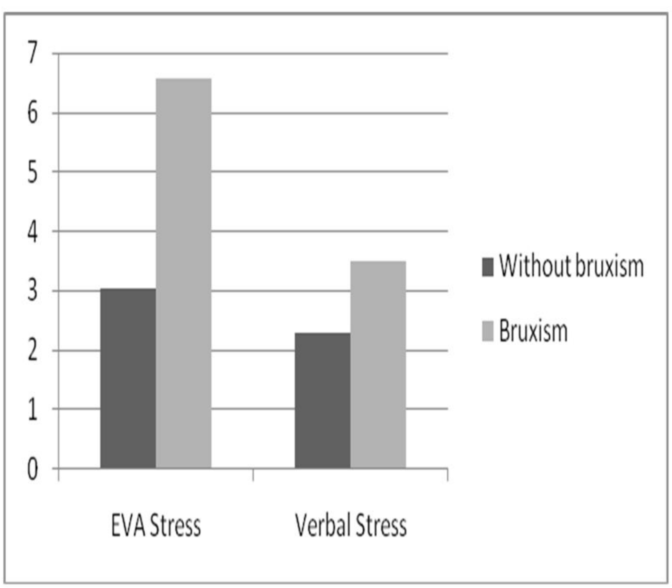
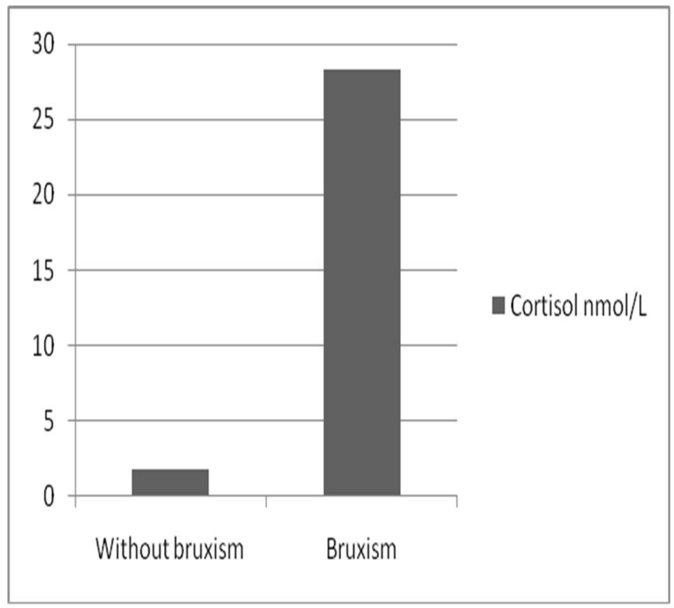


Figure 02 shows the salivary cortisol values, pointing that at the group with bruxism the concentration of this hormone is mainly higher ($p<0.05$), suggesting the existence of stress, and it over places the feeding feedback mechanism and the circadian rhythm, resulting the raise of the adrenocorticotrofic hormone and cortisol itself.

Figure 02 – Salivary cortisol values



CONCLUSIONS

It was possible to verify higher stress existence at those at the bruxism group, as much observed at the self avaliation, as at the cortisol dosage. So can be suggest that stress is a stimulus that can be related to this para-function pathogeneses.

REFERENCES

1. Saletu A, et al. (2005). On the pharmacotherapy of sleep bruxism: placebo-controlled polysomnographic and psychometric studies with clonazepam. Neuropsychobiology, 51, 214-25.
2. Antonini SR, Jorge SM, Moreira AC. (2000). The emergence of salivary cortisol circadian rhythm and its relationship to sleep activity in preterm infants. Clin Endocrinol. 52, 423-6.

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29 IS IT POSSIBLE TO TREAT CLINICALLY A RUPTURE OF TMJ DISC?

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INTRODUCTION

The osteoarthrosis is one of the pathologies that affect the Temporomandibular joint (TMJ) ranging from low to high intensity. The objective of this study is to demonstrate a report case having a pathologic condition associated with fracture of articular disc.

METHODS

A patient, male, 23 years old, sought the Orofacial and Deformity Center complaining of some noises in the left TMJ and deviation of mandible plane caused by intrusion of mandibular head in the mandibularis fossa on the same side.

On the case history, the patient reported that extraction of his third molars and bilateral tonsillectomy were done few months before started having pain which was measured by Visual Analogic Scale (VAS) reaching 7(seven) on it. In addition, it was observed the presence of bruxism and articular hypermobility leading a maximal mouth opening of 51,02mm.

On the Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), it was possible to observe a degenerative process on the left side of TMJ. Evaluating the MRI, there was a rupture in the articular disc having a piece placed more anterior and another one more posterior to the head of mandible.

RESULTS AND DISCUSSION

The treatment applied was based on Interocclusal appliance (IOA) and some exercises for coordination. Glicosamine Sulphate and Condroitin Sulphate also were prescribed simultaneously, 3 times a day.

Trauma associated with other etiologic factors may have a significant importance on the degenerative disorders of TMJ in approximately half of patients (PULLINGER; SELIGMAN, 1987). On the other hand, there is no scientific evidence for any etiologic factors of these disorders (TOLLER, 1972).

The use of IOA helps to reduce the mechanic load on the articular surfaces modifying the mandible position, reducing the symptoms and signs of TMD (FU et al., 2003). The Glicosamine sulphate combined with the Condroitin one was used to try to restore the wearing caused. Patients who took these medicines had a significant improvement of pain, diminished the sensitivity to palpation and reduced the internal noises in the TMJ (NGUYEN et al., 2001).

CONCLUSIONS

The applied treatment showed to be effective on the articular tissues re-generation, to reduce the clinical signs and pain (VAS = 0) confirming the effectiveness of the clinical therapy used.

REFERENCES

1. Fu AS, et al. (2003). Cranio. 21, 172-175.
2. Nguyen P, et al. (2001). Cranio. 19, 130-135.
3. Pullinger AG, Seligman DA. (1987) J Craniomand Disord. 1, 251-256.
4. Toller PA. (1972). Br Dent J.134, 223.

30 PRELIMINARY STUDY OF SLEEP, PAIN, QUALITY OF LIFE AND ELECTROMYOGRAPHY ACTIVITY OF MASTICATORY MUSCLES IN PATIENTS WITH TEMPOROMANDIBULAR DISORDER AND FIBROMYALGIA.

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INTRODUCTION

Pain and musculoskeletal disorders are among the main causes of absenteeism disability in developed and developing countries. Among them, fibromyalgia and temporomandibular disorders are highlighted by the high impact that determine the quality of life of patients (MOLDOFSKY, 2001). Furthermore, insomnia is particularly prevalent in individuals suffering pain. According to Teixeira et al (2001), about 1/3 of patients with chronic pain presents alpha rhythm during non-REM sleep suggests that the magnitude of pain that patients experience can become more pronounced due to the disruption or lack of sleep . Thus the objective of this study was to evaluate the presence of temporomandibular disorders, sleep quality and life, pain, and electrical activity of masticatory muscles of women with fibromyalgia.

METHODS

The research was conducted at the Piracicaba Dental School State University of Campinas. For this preliminary project were selected 6 female subjects, aged 49.5 ± 7, with fibromyalgia. Exclusion criteria were considered as systemic diseases, exposure to macro trauma on the face, dislocated joints, use of braces, dental pain, presence of sinusitis, ear infections, cancer, lupus erythematosus and hormonal disorders. The evaluation of all study subjects was performed by a single operator, properly calibrated and the application of instruments of selection and classification of patients. Facial pain was assessed by Visual Analogic Scale (VAS) and later the subjects were assessed by the RDC / TMD for the diagnosis of temporomandibular disorders. Next the subjects respond to the Fibromyalgic Impact Questionnaire (FIQ) and the Pittsburgh Sleep Quality Index (PSQI), which evaluates the quality of sleep in the last month. For interpretation of the FIQ was used Average (M1) of the seven items of the questions 4 to 10 who have continuous measurements of 0 to 10. Later the subjects were referred for electromyographic evaluation. Surface EMG was recorded from the anterior temporalis, masseter and suprahyoid muscles using surface differential electrodes of silver bars 10 mm apart, 10 mm long, 2 mm wide, gain of 20 times, input impedance of 10 GΩ and common mode of rejection ratio (CMRR) of 130 dB (Lynx Tecnologia Eletrônica Ltda., São Paulo, SP, Brazil). The EMG signals were analogically amplified with gain of 50 times, sampled by 12 bits A/D covert board (model CAD 12/46, Lynx Tec¬nologia Eletrônica Ltda., São Paulo, SP, Brazil) with 2 kHz frequency. The bandpass Butterworth filter was 20-1000Hz. The differential electrodes were placed over both the masseter, the anterior temporal and the suprahyoid muscles. Three five-second recordings of the surface electromyography signals were performed with mandible at rest. The softaware Matlab 6.5.1 was used to analyze EMG amplitudes by root mean square (RMS) values.

RESULTS and DISCUSSION

The six subjects were classified, according to the RDC / TMD, with temporomandibular disorder of type I (myofascial pain) and that subjects 1, 2, 4, 5 and 6 in group IA (myofascial pain) and only the subject 3 in group IB (myofascial pain with limited opening), as shown in Table 1. According to the literature the prevalence of facial pain is between 68% and 97% of patients with fibromyalgia, and the most commonly found in myofascial pain (BALASUBRAMANIAM et al, 2007; SALVETTI et al, 2007). In the analysis of quality of sleep all subjects were classified as poor sleepers by the PSQI, in other words, obtained PSQI>5 (Table 1). Despite all the subjects present themselves poor sleepers in this preliminary study, no direct relation to increase of facial pain with an increased rate of sleep quality in PSQI was founded. Moldofsky (1993) describes fibromyalgia as a syndrome of unrefreshing sleep and proposes that it is the result of biological rhythms changed. Studies show that unrefreshing sleep is present in 76-90% of patients with fibromyalgia, compared with 10-30% of normal individuals (HELFENSTEIN et al, 2002). However it is necessary to the study of sleep in fibromyalgia patients without TMD to determine the impact of this combination of sleep pathologies. The sample had a high impact of fibromyalgia on quality of life (FIQ (M1)), with a mean of 7.89 and 10, the maximum possible (Table 1). These results suggest that a combination of both pain conditions, fibromyalgia and TMD may adversely affect the life of the individual. The analysis of the electrical activity of muscles studied and the pain is shown in Table 2. The results suggest that subjects who reported higher pain in the face, showed higher electromyographic activity of masticatory muscles at rest. According to some studies (PINHO et al, 2000; SCHROEDER *et al*, 1991) of TMD patients have increased electromyographic activity of masticatory muscles with the jaw at rest. The electrical activity of the anterior temporalis muscle were higher than the masseter muscle at present study. Another relevant situation is an increased activity of suprahyoid muscle, which does not occur in individuals without dysfunction. Several authors reported that TMD subjects present hyperactivity of the masticatory muscles with the jaw at rest and this may cause ischemia, muscular fatigue, and pain, further aggravating the state of pain in fibromialgia (PINHO *et al*, 2000). This study is preliminary and larger sample is needed to verify the relationship between facial pain and electrical activity of the masticatory muscles with the jaw at rest or other jaw movements and their impact on quality of life and sleep.

CONCLUSIONS

Apparently, increased facial pain is associated with increased electrical activity masticatory muscles of patients with temporomandibular disorders and fibromialgia and they are characterized by poor quality of sleep and life.

REFERENCES

1. Moldofsky H. Sleep Medicine Reviews. 5: 387-98, 2001.
2. Teixeira MJ, Yeng LT, Kaziyama HHS. Rubens Reimão (Org.). Avanços em Medicina do Sono. 169-74, 2001.
3. Balasubramaniam R, DE Leeuw R, zhu H, Nickerson RB, Okeson JP, Carlson C. R. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. Aug;104(2):204-16, 2007.
4. Salvetti G, Manfredini D, Bazzichi L. Bosco M. Cranio: The Journal of Craniomandibular Practice. April (7): 127, 2007.
5. Moldofsky H. A chronobiological theory of fibromyalgia. J Muscul Pain. 1: 49-59, 1993.
6. Helfenstein M, Feldman D. Rev Bras Reumatol. 42: 8-14, 2002.
7. Pinho JC, et al. J Oral Rehabil. 27: 985-90, 2000.
8. Schroeder H. et al., J Oral Rehabil. 18: 301-10, 1991.

Table 1: Classification by RDC / TMD, the mean values (M1) guest Fibromyalgic Impact Questionnaire (FIQ) and the Pittsburgh Sleep Quality Index (PSQI) in the six subjects with fibromyalgia and TMD.

SUBJECTS	RDC/TMD	FIQ (M1)	PSQI SCORE
1	1A	6.28	13
2	1A	7.55	17
3	1B	8.63	15
4	1A	8.11	11
5	1A	8.06	15
6	1A	8.74	18

Table 2: RMS values (μV) of left and right masseter, left and right anterior temporalis and supra-hyoid muscles and VAS (cm) of six subjects with fibromyalgia and TMD.

SUBJECTS	ML	MR	TL	TR	SH	VAS
1	3,02	2,32	4,33	2,14	3,09	2,5
2	1,64	1,28	1,84	2,52	3,4	2,4
3	3,89	8,46	8,09	5,93	8,28	10
4	4,03	2,32	2,35	2,02	2,1	3,3
5	2,73	1,97	2,2	2,06	4,18	1,4
6	1,14	1,24	1,64	2,05	2,15	2,1

31 MASTICATORY MYOFASCIAL PAIN TREATMENT PROTOCOL FOR COGNITIVELY IMPAIRED PATIENTS WITH DISABILITIES

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INTRODUCTION

The masticatory myofascial pain (MMP) evaluation and treatment become more difficult for not-verbal or cognitively impaired patients with disabilities (PWD) (HENNEQUIN, 2000; GABRE, 2002). Myofascial pain can be defined as a regional pain syndrome characterized, partially, by presence of a trigger point in a skeletal muscle tense band, with associated referred pain (JUNQUEIRA, 2009; MENSE, 2008). The cognitively impaired PWD are people who require differentiated treatment for presenting some type of alteration in the cognitive level, associate or not to physical or social alterations or other mental alterations. A deficient pain evaluation in these patients can makes dentists to neglect pathologies or new injuries, when they occur, hindering the identification and the relief of suffering and MMP. The aim of this work was to show a protocol, used by the authors, to MMP treatment of cognitively impaired PWD.

METHODS

This protocol have been applied to all the cognitively impaired PWD, independent of their skin color, sex or age, receiving MMP treatment at the PWD Integrated Clinic of the São José do Rio Preto Dental School - UNIRP, SP, Brazil. The protocol is divided into the following parts:

1. Initial appointments:
    a) Gathering the patient identification and the patient's chief complaint.
    b) Establishing a link between dentist, patient and patient's family and/or caretakers (responsible).
    c) Conditioning the patient.
    d) Stimulating the patient's responsible on supplying information about the patient and its pain.
    e) Acquiring the history of the present illness.
    f) Obtaining the patient's medical history.
    g) Using the Abu-Saad Behavioral Indicators Scale, during the physical examination, for pain evaluation and localization.
    h) Establishing a differential diagnosis.
    i) Acquiring the relevant laboratory and imaging studies.
    j) Making a final diagnosis.
    k) Formulating a plan of action.
    l) Providing a diary of pain.
    m) Educating the patient and/or the patient's responsible.
    n) Reversing oral habits.
    o) Eliminating the risk of drug interactions.
    p) Consulting the PWD physician.
2) Physical therapy and relaxation techniques.
3) Intraoral appliances.
4) Spray and stretch therapy.
5) Trigger point injections and needling.
6) Considering conscientious sedation.
7) Reevaluating the patient.
8) Reducing gradually the appointment frequency at the end of the treatment.
9) Follow up: return over 3 months.

This protocol integrates diverse lines of convergent evidences, including recent researches, to disclose the viability of its clinical application.

RESULTS and DISCUSSION

The link between dentist, patient and responsible is established without haste, conditioning the patient and getting the contribution from the responsible ones. Parents of PWD cognitively impaired, for being more familiarized to the patient behavior; increase their confidence in not verbal expressions of pain presented by the patient (KUNZ, 2007). In this protocol, the Abu-Saad Behavioral Indicator Scale has been used for vocalization (shouting, sighing, crying, moaning and hiccupping), face expression (opening the mouth, closing the eyes, widening the eyes, clinching the teeth, pressing the lips and wrinkling the forehead) and corporal movements (immovable, agitated, protected, shrunken and tense). It is a difficult task to determine the active oral habits presence, and only indirect ways are generally available, such as information given by the room partners of the patient who grinds teeth during sleep. The notations on diary of pain will be done by the responsible ones observing the patient. Cognitively impaired PWD would have to be submitted to an aggressive program of preventive oral health. The dentist must to approach to the patient with empathy and clearly explain all the procedures and instructions. If the patient is not able to understand, the responsible ones must receive all the information. Many oral habits such as chewing gum, sucking, biting or taking to the mouth cloths, pens and other objects, can be eliminated with the aid of the responsible ones. On prescribing medicines, an important condition that dentists should be aware of is the possibility of undesirable drug interactions. Physical therapies such as passive stretching, isotonic and isometric exercises, walking, corporal massage, hot bath, hydrotherapy and recreational games, are part of a domestic program supervised by the responsible ones. PWD highly cognitively impaired have minor acceptance and indication to intraoral appliances. For patients who do not accept the spray and stretch therapy and/or trigger point injection and needling, the conscientious sedation is considered. The patient must be reevaluated in approximately 6 weeks. If there was a good response to the treatment, and the continuation of the treatment will bring an additional improvement, a period of time can be added to the treatment (3 or 4 weeks, for example). At the end of the treatment, the appointment frequency must be gradually reduced, spacing the appointments for each 15 days and later for each month, according to the patient need.

CONCLUSIONS

This protocol application has made possible the MMP treatment success of PWD cognitively impaired at the Dental School - UNIRP, providing comfort and stability to these patients and stimulating the link between dentist, patient and patient's family. This protocol seems to be valuable for evaluation and MMP treatment of PWD who the verbal report is difficult or uncertain.

REFERENCES

1. Gabre P., Sjöquist K. (2002). Spec Care Dentist. 22(5), 174-180.
2. Hennequin M., et al. (2000). Lancet. 356(9245), 1882-1887.
3. Junqueira Mde.S., et al. (2009). Rev Dor. 10(4), 297-303.
4. Kunz M., et al. (2007). Pain. 133(13), 221–228.
5. Mense S., et al. (2008). Dor Muscular: Natureza, Diagnóstico e Tratamento. Manole

32 ELECTROMYOGRAPHIC PROFILE OF WOMEN WITH CHRONIC STRESS AND TEMPOROMANDIBULAR DISFUNCTION – A PRELIMINARY STUDY

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INTRODUCTION

According the literature, the TMD most frequently affects women. Moreover, many studies have been performed on the high prevalence of the emotional factors among women with TMD (Jerjes *et al*., 2008). These factors are related to muscular alterations associated pain and trigger points and other psychological conditions such as depression, anxiety and stress (Dimitroulis, 1998; Bérzin, 2004). The prolonged stress is associated with a state of tension in the masticatory musculature and craniocervical region muscles, common in TMD, and is amenable to measurement by surface electromyography (EMG (Schumann, 1988; Bérzin, 2004). A detailed understanding of the increased muscle activity in individuals with chronic stress can contribute to a more precise and differential diagnosis of the pain symptoms occurring in TMD and moreover to the selection and improvement of efficacious treatment. The purpose of the work was to study the electromyographic profile (EMG) of mastication muscles and craniocervical region muscles in women with chronic stress and pain due to Temporomandibular disorder (TMD).

METHODS

The study involved a sample of 14 women aged 22 to 47 years, with chronic pain due to TMD was submitted a surface EMG examination, with the jaw in rest position, on the temporal, masseter, suprahyoid, suboccipital, sternocleidomastoid and trapezius muscles. The patients were tested in a seated position (resting) and connected to an electromyography (Myotronics K6-1, Diagnostic System). The calibration of the instrument was 1 second/ division, so that the collection totaled 10 seconds, and sensitivity was calibrated to 30 microvolts per division, 10Hz high pass filter and low pass of 500 Hz. Liabilities of electrodes were used Ag / AgCl disposable (Hal Indústria e Comércio Ltda) mounted in pairs on the same basis so that the distance between electrodes, 20mm and 10mm center distance between the edges of electrodes were always the same, advocates of the second SENIAM recommended by ISEK (Hermens *et al*., 1999). After clinical interview, the volunteers were subjected to the psychological evaluation by the Lipp's Inventory of Stress Symptoms for Adults and Goldberg's General Health Questionnaire. Statistical analysis: calculated by chi-square test. Significance level: 5%.

RESULTS and DISCUSSION

The psychological evaluation shows that all the volunteers were diagnosed positive for stress, in the resistance stage. The EMG analysis reveals significant presence of electrical potentials in all the muscles evaluated, even with the jaw in rest position.

There are no indications of significant differences in the percentages of activation for the muscles studied. The EMG results reveals electrical activity, in rest, of some masticatory and craniocervical muscles in individuals with chronic stress and TMD.

CONCLUSIONS

The EMG results confirm the literature findings that allege that there is the electrical activity, in rest, of some muscle groups in individuals with chronic stress and TMD.

The myoelectrical activity was observed in the Temporal, Masseter, Sternocleidomastoid, Trapezius, Suboccipital and Suprahioyd muscles. There are no significant differences in the percentages of activation for the muscles studied.

REFERENCES

1. Bérzin MGR. *Br J Oral Sciences* 2004;**3(10)**:480-83.
2. Bérzin F. *Braz J Oral Sci* 2004;**3(10)**:484-91.
3. Hermens HJ, Freriks B, Merletti R, Stegeman D, Blok J, Rau G, Disselhorst-Klug C, Hägg G. Viena. *Roessingh Research and Development*; 1999.
4. Jerjes W, Upile T, Abbas S, Kafas P, Vourvachis M, Rob J, et al. *Int Arch Med* 2008;**1(23)**:1-13.
5. Dimitroulis G. *BMJ* 1998;**317**:190-194.
6. Schumann NP, Zwiener U, Nebrich J. *Oral Rehabil* 1988; **15(1)**: 35-47.

Figure 1 – EMG activity with the equipment in high sensitivity in women with TMD and chronic stress and the jaw in postural position; Left Anterior Temporal (LAT), Left Masseter (LM), Right Masseter (RM), Right Anterior Temporal (RAT), Left Posterior Temporal (LPT) Left Suprahioid (LSP), Right Suprahioid (RSP), Right Posterior Temporal (RPT), Left Suboccipital (LSO), Right Suboccipital (RSO), Left Sternocleidomastoid (LST), Right Sternocleidomastoid (RST), Left Trapezius (LT) and Right Trapezius (RT)

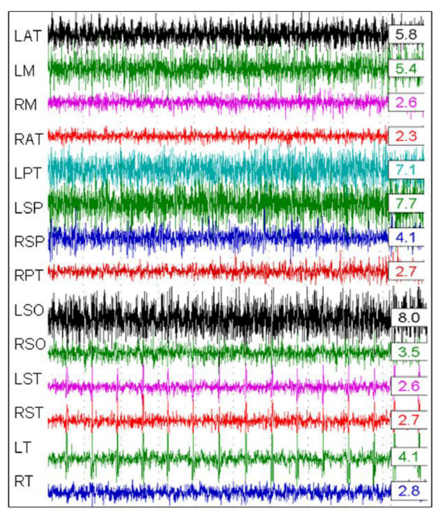

Table 1. Frequency and percentage of muscles with activation (n:14). Muscles with same letter do not differ according to the chi-square test at a significance level of 5% (n: 14)

	Statistics*	
Muscle	Frequency (%)	Chi-square
Temporal	14 (20.59%)	A
Suprahyoid	12 (17.65%)	A
Trapezius	12 (17.65%)	A
Sternocleidomastoid	11 (16.18%)	A
Suboccipital	11 (16.18%)	A
Masseter	8 (11.76%)	A

*Chi-square: 1.7059; DF: 5; Pr > ChiSq: 0.8882

33 ELECTROMYOGRAPHIC AND CEPHALOMETRIC CORRELATION OF MANDIBULAR BIOMECHAMICAL WITH THE PREDOMINAT MASTICATORY MOVEMENT

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INTRODUCTION

The study of the craniomandibular biomechanics is related to the system of predominant lever and of the relation between function and mechanically induced deformations. This study has the purpose of evaluating the chewing muscular dynamics and correlating the chewing movement side that is more vertical and/or more horizontal established by the photomeasurement Planas' Masticatory Functional Angle (MFA) to the muscular activity behavior, shown in the surface electromyography and in the radiographic images.

METHODS

Seventeen people of both sex, medium aged about 25, were selected, white skin and presenting Class I of Angle without apparent sign and symptom. The panoramic radiography and telerradiography in lateral position and surface electromyography were made. The acquisition of radiographic images followed the rules established by the Piracicaba Dental School (UNICAMP). The electromiographic data were obtained bilaterally from the masseter muscles, anterior temporal portion and supra-hyoids at the postural position and isometric position. Medtrace® passive bipolar surface electrodes were used coppled to a pre-amplifier, forming a circuit corresponding to a differential circuit. The registrations of the electric signals were caught by EMG- 800C equipment of Brazil EMG System Ltda with eigth channels, sample frequency of 2 KH and 16 bits resolution, digital filter with a band pass of 20-500 Hz. The bite force measured with a metallic transducer that was connected to a force sensor (Strain Gauge) to measure the deformation of the material model SF4(EMG SYSTEM DO BRAZIL). A mandibular goniometer of the EMG System of Brazil was used to measure the opening size. A comparison and correlation between the groups with MFA < 5° and MFA> 5° through "*t*" Student or a Man- Whitney test according to the normality or not of the distribution, respectively.

RESULTS

The results have shown important differences between the groups with MFA < 5° and MFA > 5° but without sexual disformity to the biting force measurements (38.70 ±, 10.88 and 27.28 ±11.40), for the maximum opening. (40.04 ± 11.82 and 26.86± 11.70) and masseter muscle isometric (174.16± 49.67 and 116.41± 51.11). A strong correlation between the masseter muscles to the biting force ($r = 0.63$ $p = 0.0001$) occurred for the groups with MFA > 5°. On the Hyoid triangle, for both groups, the vertical and angular behavior of the hyoid bone represented by H–H' and PHA showed important correlations to the mandibular dynamics recorded on the panoramic radiography.

CONCLUSIONS

All these results indicate to a strong relationship between the aspects anatomic physiological with asymmetric mandibular function.

REFERENCES

1. Coelho-Ferraz MJP, Bérzin F, Amorim C. Electromyography evaluations of the masticator muscles during the maximum bite force. Rev Esp Cir Oral Maxilofac. 2008; 30(6):420-7.
2. Coelho-Ferraz MJP, Bérzin F, Amorim C, Queluz D.P. Electromyographic Evaluation of Mandibular Biomechanic, Int. J. Morphol.2009; 27(2):485-90.
3. Bibby RE, Preston CB. The hyoid triangle. Am J Orthod. 1981; 80(1): 92-7.
4. Hylander WL. The human mandible: lever or link? Am J Phys Anathropol.1975; 43(2): 227-42.

34 BRUXISM TREATMENT WITH ART THERAPY: _ ARE RESULTS SUSTAINABLE?

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INTRODUCTION

Bruxism is considered a multifactorial psychosomatic disorder, caused by abnormal occlusion as well as psychological factors. However, NÓBILO´s et al (2000), interpretations of the authors are still confused as to the etiology, prevalence and form of appropriate treatment of bruxism. The reversible occlusal therapy with plates will decrease the parafunctional activity and promote orthopedic stability, eliminating the symptoms. This condition will only be maintained while the device is being used. When removed, the pre-existing condition returns (OKESON,2000). Ikebana is an ancient oriental form of art that seeks closeness with nature through techniques of flower arrangements. It plays a vital role in developing the right side of the brain as well as all other forms of artistic perceptions, because perception and expression represent authetic and individual forms and gestures (Teruaki Kita Jima-1999). The symmetrical pentagonal geometry that is present in the formation of flowers is clearly related to the gold ratio and its proportions. The gold ratio represents the maximum use of the harmonic space, in accordance with the expansion of life within the minimum possible area (Marta Povo, 2007).

METHODS

36 controversial individuals phenomenon with bruxism were studied.
2 therapeutic groups were assigned at random (18 patients each) and a group of 18 patients who were not carriers of bruxism, such as the control group, characterized as:
Group with stabilizing plates (A); with stabilizing plates and accompanying ikebana (B) and control group(C).
The stabilizing plates were made in thermally activated resin. The dynamics with Ikebana consisted of 12 sessions of practical lessons of arrangement making that uses natural-cut flowers, and the explanation of the historical and conceptual art of Ikebana (1 per week). Group A was submitted to electromyographic examination before inserting the plate, which received weekly adjustment just for 1 month and then submitted to further electromyographic examination.
Group B was to electromyographic examination before inserting the plate, which received weekly adjustment for 1 month. After this therapy, the Ikebana sessions were increased to 12 (1 per week). Then the patients were submitted to further electromyographic examination.
The non bruxists (group C) were submitted only to electromyographic evaluation.

RESULTS and DISCUSSION

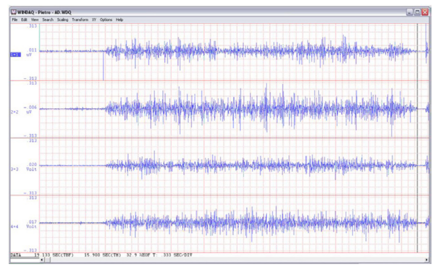
Of the four different muscle only one (right masseter - RMS) was not significant. The criterion for the p-value was the analysis of variance Kruskal-Wallis. (Table 1)
There is a consensus that bruxism and dental pressing are manifestations of anxiety, resulting in muscle hyperactivity associated with a motor response of anxiety itself, covering the neuromotor, cognitive and autonomic components (Molina; Minagi et all).
Bruxism is considered a multifactorial psychosomatic disorder, caused either by abnormal occlusion and by psychological factors. However, NÓBILO´s et al (2000), interpretations of the authors are still confused as to the etiology, prevalence and form of treatment appropriate to bruxism. The condition of relaxation promoted by interocclusal plate will only be maintained while the device is being used. When removed, the pre-existing condition returns. Therefore, the plate does not cure bruxism, but inhibits the tendency to bruxism while it is being used (OKESON, 2000).

CONCLUSIONS

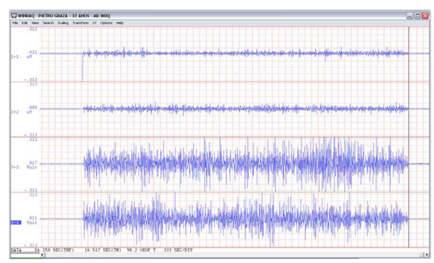
Evidences indicated that Ikebana helped isolated conventional treatment with interocclusal plates to balance mental and emotional aspects that may be related to the origin of bruxism. The supplementary accompaniment with Ikebana could extend the initial result of the isolated use of the plates promoting better health. This lasting synergy should be researched in other studies.

DENTAL PRESS IN SURFACE ELETROMIOGRAFIC

Before



After



REFERENCES

1. Nóbilo KA. Técnica de Nóbilo para o tratamento do bruxismo; caso clínico. Ver. Odontol. Univ. Sto. Amaro, v.5, n.1, p.26-29, jan/jun, 2000
2. Okeson JP. Tratamento das desordens temporomandibulares oclusão. 4ª ed 449p.,São Paulo: Artes Médicas. 2000.
3. Jima TK. O Ikebana e sua influência sobre o cérebro humano. Revista nova era, São Paulo, ano 7 n.32, 1999
4. Povo M. Energia e Arte: teoria da consciência energética. São Paulo: ed. Fenac, 2007, p. 38-39
5. Molina OF. Fisiopatologia craniomandibular: oclusão e atm. São paulo: ed pancast, 1989.
6. Minagi S, Ohmori T, Sato T, Akamatsu Y. Effect of accentric clenching on mandibular diviation in vicinity of mandibular rest position. J. Oral reabil. V.27, n.2, p.174-178, 2000.

Table 1: Change in muscle pressure capacity at the end of study with differences of RMS in the tightening in 3 cycles at the bottom.

Muscle RMS	Control	Plate	Art-plate	p-Value
Right Masseter	0.00	-94.900	-14.350	0.170000
Left Masseter	0.00	-273.920	8.340	0.033029
Right Temporal	0.00	-402.335	-346.975	0.005765
Left Temporal	0.00	-882.045	-353.700	0.010000

35 FRONT-TEMPORAL CRANIOTOMY SURGERY. SPEECH- LANGUAGE INTERVENTION: LONGITUDINAL ASSESSMENT USING ELECTROMYOGRAPHY OF THE MASSETER AND TEMPORAL MUSCLES

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INTRODUCTION

The surface electromyography (EMGs) is used to register the electrical activity of a muscle or of a group of muscles (RIGLER; PODNAR, 2007). It allows the comprehension of the participation of the mandibular muscles in the action of the system and serves as an orientation to possible treatment of this system. (ONCINS; FREIRE; MARCHESA, 2006). The purpose of this work is to demonstrate the use of EMG to record the electrical activity of masseter and temporal muscles before, during and 2 years after the therapeutic process, in the case of a front-temporal craniotomy post-surgery.

METHODS

Forty-four year old patient, female, submitted to frontotemporal craniotomy originating from an aneurysm. The right anterior temporal muscle (RATM) was removed from its place for about 8 hours. During the post-surgery she presented a RATM dysfunction of the right masseter muscle (RMM). She underwent for speech evaluation of the stomatognathic system four months after the surgery. We used the six-inch digital Lee caliper to record the opening of the mouth and the Myograph Eelctrical Analyzer (EMA) electromyography to evaluate the electrical activity. The EMGs were registered in the task of maximal intercuspal, with the processed signal in RMS and measured in microvolts (μV). The miofunction sessions were planned and constantly reviewed by the clinic and complemented by the results of the EMGs. The EMG tests were performed during the evaluation and after five, eight and twelve months of the onset of the therapeutic process (high). After discharge the tests were performed annually for two years.

RESULTS and DISCUSSION

During the speech assessment, there was limitation of mouth opening, frequent headaches, difficulty in chewing any type of food, tyredness to speak and pain in the RMM. The first three complaints are common in patients with temporomandibular disorders. (VAZQUEZ-DELGADO, 2004). The other complains are explained by the underactivity of the muscle group studied after craniotmoy, which was confirmed by EMG tests. The evaluation recorded a maximum of 18 mm in the opening of the mouth. After the thirteenth session it was recorded a 33mm opening without pain and after 24 sessions was recorded 36mm without effort of pain. The results of the electrical activity in maximal intercuspal by EMGs are shown in Table 1. Note that the RATM increased activity assessment until discharge, maintaining this pattern even after a year. The reverse occurred with the MTAE, which decreased the activity and minimized the difference between the sides. As for the massaters, they showed an increase of electrical activity bilaterally, but the difference between the sides was also minimized between the first and last record. The discrepancies between the electrical activity of muscles can cause imbalance in the stomatognathic system (BIANCHINI, 1999), favoring the emergence of complaints such as those reported here, including as a neuromuscular protective mechanism (FELICIO; MELCHIOR; SILVA, 2007). A periodic review of the electrical activity of muscles by EMG proved to be extremely useful during the therapeutic process, contributing to clinical reasoning and treatment planning.

CONCLUSIONS

The case report presented here showed that speech intervention benefited from the findings of the examination of EMGs, suggesting that it may serve as support for other diagnoses and developing more effective treatment planning in the area of orofacial mycology

ACKNOWLEDGMENTS

Thanks to the Centro de Diagnóstico e Tratamento da ATM (CDTATM) to allow the elextromyography exams, offering its facilities, staff and materials.

REFERENCES

1. Bianchini EMG. (1999). Disfunção da articulação temporomandibular: relações com a deglutição e fala. Rev Dent Press Ortodon Maxilar, 4(5), 55-60.
2. Felício CM, Melchior MO, Silva MAMR. (2007). Desempenho mastigatório em adultos relacionado com a desordem temporomandibular e com a oclusão. Pró-fono, 19(2), 151-158.
3. Oncins MC, Freire RMAC, Marchesan IQ. (2006). Análise pela eletromiografia e eletrognatografia. Seu uso na clínica fonoaudiológica. Rev Dist Comun. 18(2),155-165.
4. Rigler I, Podnar S. (2007). Impact os eletromyographic findings on choise of treatment and outcome. Eur J Neurol. 14(7), 783-787.
5. Vazquez-Delgado E, et al. (2004). Psycholoical and sleep quality differences between chronic daily headache and temporomandibular disorders patients. Cephalalgia, 24(6), 446-454.

Tabela 1 – Results of the electrical activity muscle in maximal intercuspal during the speech assessment (A); after 5 months (B); after 12 mouths – high- (C); after 12 meses for high (D) and after 24mouths for high (E), mesure in microvolts (μV). RATM= righ anterior temporal muscle, LATM = left anterior temporal muscle, RMM = right masseter muscle, LMM = left masseter muscle.

origin	RATM	LATM	RMM	LMM
A (μV)	8	87	15	35
B (μV)	21	62	59	66
C (μV)	29	60	53	82
D (μV)	38	81	76	56
E (μV)	44	68	50	47

36 TEMPOROMANDIBULAR DISORDERS AND OROMANDIBULAR DYSTONIA: SPEECH THERAPY

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INTRODUCTION

Dystonia is a neurological disorder characterized by involuntary muscle spasms and can be classified according to the structures affected in focal dystonia, segmental, multifocal, and generalized hemidistonia. (SAS ORDINANCE No. 1014 OF 23 DECEMBER 2002). In segmental dystonia, which occurs oromandibular and laryngeal involvement, involuntary movements and spasms may be present on the lips, tongue, jaw and larynx leading to difficulties in carrying out the stomatognathic functions such as chewing, swallowing and speaking, impairing communication and socialization the individual. The objective of this study was to analyze the results of speech therapy in a patient with oromandibular and laryngeal dystonia with signs and symptoms of temporomandibular disorders (TMD).

Case report

Female patient, 70 years old, with oromandibular and laryngeal dystonia, referred to the multidisciplinary clinic Occlusion, TMD and Orofacial Pain Service "Demystifying Attention to Patients with Special Needs" (DAPE - FORP / USP). The treatment was interdisciplinary and included areas of dentistry, speech therapy and physical therapy, and treatment and medical monitoring performed at the Hospital of FMRP / USP. Specifically, the speech therapy aimed to provide the patient, the performance of the functions of chewing and swallowing with comfort and efficiency.

METHODS

The period of treatment involving the speech therapy was 3 months, and speech therapy and EMG evaluations were made before and after this period. Clinical examination was performed following the protocol *Amiofe* (Felício, Ferreira, 2008), which examines the functioning of the stomatognathic system in three steps: Appearance and posture of the orofacial structures, mobility and functions of breathing, chewing and swallowing, providing scores for each of them, which contributes to the analysis of the evolution of treatment. Electromyographic analysis was performed using the electromyography-Br1 software with differential active electrodes (silver bars with 10 mm long, 2 mm wide and 10 mm distance between them, 20x gain, and input impedance 10 GΩ relationship and common mode rejection of 130 dB). Differential active electrodes surface were placed on the skin, bilaterally in the masseter, temporal and *orbicularis oris*. A ground electrode was fixed to the skin over the region of the sternum. The electromyographic signals were analogically amplified with a gain of 1000x, filtered by band pass filters to eliminate noise 0.01-1.5KHz and sampled by a board A / D converter of 12 bites with acquisition frequency of 2 kHz.

RESULTS and DISCUSSION

According to the protocol used to evaluate speech, after therapy the patient had higher scores for the mobility of orofacial structures and functions of chewing and swallowing, reflecting the positive results of the proposed therapy, as in previous works that used this protocol a population with TMD (Felicio et al, 2008; Melchior, 2008). The results of electromyographic masseter and temporal muscles showed increased activity on the right side, showing more effective responses to speech therapy this way. The right side is the side to which the jaw deviates as a result of dystonia and for which the patient had an easier time controlling voluntary movements. The *orbicularis oris* muscle showed an increase of electromyographic activity, and efficiency in their mobility after training in therapy, showing the exercises typically offered to individuals with TMD changes in mobility lip (Melchior, 2008; Felicio, 2008, 2009), were also positive for this patient who presented dystonia associated.

CONCLUSIONS

According to the results obtained, the speech therapy in the context of multidisciplinary care, contributed to enable the realization of chewing and swallowing no pain, no gagging, no escape of food, contributing to quality of life of the patient.

REFERENCES

1. SAS Ordinance no. 1014 of 23 December 2002: Clinical Protocol and guidelines for treatment - dystonias.
2. Felicio CM, Ferreira CLP. (2008). Protocol of orofacial myofunctional evaluation with scores. Int. J. Pediatr. Otorhinolaryngol.v.72, n.3, p.367-75.
3. Felicio CM, Melchior MO, Ferreira CL, Silva MAMR. (2008). Otologic symptoms of temporomandibular disorder and effect of orofacial myofunctional therapy. Cranio, 26(2):118-25.
4. Melchior MO. (2008). Analysis of the effect of therapy miofunctional in cases of TMD by clinical protocols. 309f. Dissertation (Master) - Faculty of Medicine of Ribeirão Preto, USP.
5. Felicio CM. (2009). Desordens Temporomandibulares: Terapia Fonoaudiológica. In:___ Interfaces da medicina, odontologia e fonoaudiologia. cap 9. Barueri. Pró-fono.

37 FREQUENCY OF REFERRED PAIN FROM THE CERVICAL REGION IN PATIENTS WITH TEMPOROMANDIBULAR DISORDERS

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INTRODUCTION

The term Temporomandibular Disorders (TMD) refers to a group of clinical conditions that involve the temporomandibular joint and associated tissues, which may manifest as pain in the temporomandibular region, limitations in jaw movements, and temporomandibular joint sounds such as clicking or crepitus during jaw movements (De Leeuw, 2008). The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) (Dworkin, 1992) was created to provide diagnostic parameters to allow standardization and replication of research approaches of most TMD conditions, and it has been revised and upgraded by the Consortium for RDC/TMD- Based Research created in 2004 (Anderson, 2010).
One of the subtypes of TMD is myofascial pain that is a masticatory muscle disorder characterized as a localized muscle pain accompanied by referred pain to another region (De Leeuw, 2008). Some referred pain on the head may be originated by trigger points from the cervical region (Fernández-de-las-Peñas, 2007).
The aim of this study was to assess the frequency of patients with TMD and referred pain from the cervical region, and the correlation of palpation sites with the referred pain region.

METHODS

This is a retrospective study using clinical records of 419 patients (368 female and 51 male) seen in the TMD and Orofacial pain Service at the Federal University of São Paulo-UNIFESP, Brazil, who presented TMD and referred pain in the palpation exam. All were submitted to muscle palpation according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). Although RDC/TMD doesn't include palpation exam of the sternocleidomastoid and trapezius muscles region, and suboccipital region, they were also examined. The regions were palpated on both sides. All patients gave informed consent to procedures approved by the UNIFESP/HSP Research Ethics Committee (1987/09).

RESULTS

From all the 419 clinical records reviewed, 374 (89.26%) patients reported referred pain from at least one of the three cervical regions analyzed. Considering the left and right sides, and the fact that the presence of the referred pain can be originated in one or more of the three cervical regions, depending on the patient, it was observed that: 1- region corresponding to the sternocleidomastoid muscle had referred pain in the right side n=163 (43.6%) and left side n=146 (39.0%); 2- region corresponding to the trapezius muscle had referred pain in the right side n=71 (19.0%) and left side n=64 (17.1%); 3- suboccipital region had referred pain in the right side n=58 (15.5%) and left side n=65 (17.4%). The highest incidence of referred pain was observed at the posterior and lateral cervical region (PLCR), temporoparietal region (TPR) and lateral facial region (LFR). The figures shows the referred pain sites from specific areas of the cervical region in decrescent numerical order of frequency.

CONCLUSIONS

It's possible to state that, besides the other palpated regions, the incidence of referred pain to the head is high when structures from the cervical region were palpated. So, the clinician should have in mind that, although the presence of myotome, dermatome and sclerotome differences, the patient could refer pain originated from the cervical region to areas of the head.

REFERENCES

1. Anderson G, et al. (2010). Research diagnostic criteria for temporomandibular disorders: future directions. J Orofac Pain; 1:79-88.
2. De Leeuw R (ed). (2008). Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management, ed 4. Chicago: Quintessence,
3. Dworkin SF, LeResche L. (1992). Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications. J Craniomand Disord; 6(4): 301-355.
4. Fernández-de-las-Peñas C, et al. (2007). Myofascial trigger points and sensitization: an updated pain model for tension-type headache. Cephalalgia,27:383–393.

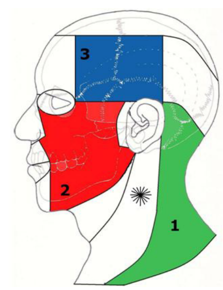

FIG. 1 - Left side view showing the region corresponding to the sternocleidomastoid muscle (*), which was palpated, and the regions of referred pain occurrence, in descrescent numerical order (1 posterior and lateral cervical region; 2 lateral facial region; 3 temporoparietal region).

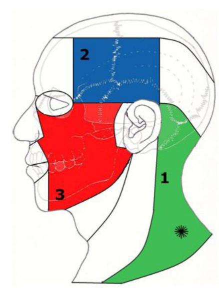

FIG 2 - Left side view showing the region corresponding to the trapezius muscle (descending part / upper) (*), which was palpated, and the regions of referred pain occurrence, in decrescent numerical order (1 posterior and lateral cervical region; 2 temporoparietal region; 3 lateral facial region).

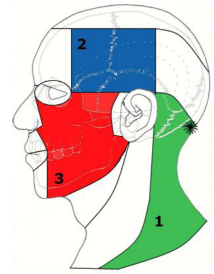

FIG 3 - Left side view showing the suboccipital region (*), which was palpated, and the regions of referred pain occurrence, in decrescent numerical order (1 posterior and lateral cervical region; 2 temporoparietal region; 3 lateral facial region).

38 MAGNETIC RESONANCE IMAGING EVALUATION OF THE TEMPORALIS MUSCLE

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INTRODUCTION

The description of a new muscle at the region where the head is also the temporalis muscle, in 1996, reported as an entity never before mentioned in the literature (**Dunn** *et al*.**, 1996**), initiated a great discussion. The study of muscle in question is justified to allow the establishment of the correct region where it meets the purpose of describing the correct anatomy, correlating it with other masticatory muscles in the region, the temporomandibular joint and possible involvement in mandible kinematics. In view of these considerations, it was proposed in this work to study the depth and volume of the temporalis muscle through images of nuclear magnetic resonance. The study analyzed the wombs (portions) superficial and deep muscle bilaterally in individuals of both male and female gender. And if there are no differences regarding gender and side.

METHODS

This research was conducted at the Faculty of Dentistry of Piracicaba, State University of Campinas (UNICAMP) and SIDI, Medical Imaging, located at Ipiranga avenue,1801, ground floor and 2nd floor in the city of Porto Alegre. Were evaluated clinically and by MRI nuclear 40 temporalis muscles of 20 individuals, 10 male and 10 female patients aged 18 years and a maximum of 46 no symptoms of temporomandibular disorders and toothed.

Clinical examination included palpation of masticatory muscles, the measurements of maximum mouth opening and remote interincisal, laterality, protrusion, and examination of cranial nerves. The nuclear magnetic resonance was performed in the mandible rest with the lips lightly touching.

A descriptive analysis of data was performed, which were calculated the frequency and percentage of each variable.

RESULTS and DISCUSSION

The morphology of the portions (wombs) of muscle, the entire sample had two, one deep and one shallow. In all cases the deep portion of fruit was higher than the superficial. All portions observed and evaluated were identified as belonging to the temporalis muscle. The volume of the temporal muscle of each volunteer and their average in relation to sex and side was calculated, as well as his overall average volume regardless of sex and side, resulting in 146.58 cm ³.There was also an average regardless of gender resulting in a percentage of 6.82% higher on the left than the right. There was a comparison between the average volume of male and female resulting in a difference of 30% more in males. The percentage difference in each side, were calculated by gender, which we obtained the following results: for men on the left side was 9.73% higher than the right side and female on the left side was 2.48% higher than the right.

The volume of muscle in the female aspect right craniocaudal ranged between 7.9 and 10.3 cm ³ and the left was between 7.6 and 10.7 cm³. In the anterior-posterior aspect of the right female ranged between 7.1 and 8.5 cm³ and the left was between 6.9 and 9.0 cm³. The latero-lateral aspect of the right female ranged between 1.1 and 1.9 cm³ and the left ranged between 1.4 and 2.0 cm³. The volume of muscle in the male right craniocaudal aspect ranging from 8.9 to 11.1 cm ³ and the left was between 9.3 and 11.6 cm³. In the anterior-posterior aspect of the right male ranged between 7.6 and 10.5 cm ³ and the left was between 7.7 and 10.4 cm³. The latero-lateral aspect of the right male ranged between 1.7 and 2.1 cm³ and the left ranged between 1.6 and 2.2 cm³. The depth of the temporal muscle of each volunteer and their average in relation to gender and side was calculated. Was also calculated the overall average depth regardless of gender and side resulting in 1.55 cm. There was also an average regardless of gender resulting in a percentage of 6.83% higher on the right than the left. There was a comparison between the average depth of men's and women resulting in a difference of 1.91% more than in males. The percentage difference in each side, by gender was calculated, in which we obtained the following results: for males the right side was 6.74% higher than the left side and in females the right side was 7.5% higher than the left. The depth of the right female muscle ranged between 1.3 and 1.8 cm and the left was 1.1 to 1.6 cm. In the right male muscle ranged between 1.2 and 2.3 cm left and ranged between 1.3 and 2.1 cm.

Many authors agree that there is an independent muscle in the region where it is also the m. temporalis and Dunn et al. (1996), Mahan (1996), Akita, Shimokawa and Sato (2001). Our study does not agree with these findings, since the magnetic resonance images clearly delimit the temporalis muscle, without the presence of any other muscle in the region where it is located. Gaudy et al. (2001) argue that the nuclear magnetic resonance allowed to show the different anatomical limits of the temporalis muscle clearly, and that the boundaries appear more well-defined images in nuclear magnetic resonance that of their dissections. This reinforces the results of this study. While agreeing with the work of Emshoff et al. (1999), the data obtained in this study were done in asymptomatic patients for temporomandibular disorders which did not allow a discussion of the data, since in the presence of TMD could be some change in the volume of the temporalis muscle. In studies of Martin and Tarek (2007) can not correlate their data with this study because they were calculated volumes of skeletal muscle, but not the temporalis muscle. These latter considerations suggest the need for more studies involving the volume and depth of the temporalis muscle.

CONCLUSIONS

The temporalis muscle showed two distinct parts, one deep and one superficial, and the depth was always greater. The volume of muscle left introduced him self larger than the right and the depth of the right presented itself larger than the left, both independent of gender. In male was observed that this muscle has greater volume and depth than females. Within the conditions of this study it was concluded that the nuclear magnetic resonance enabled to identify this region as being the temporal muscle and not sphenomandibularis muscle.

REFERENCES

1. Akita K, Shimokawa T, Sato T. Aberrant Muscle Between the temporalis and the lateral Pterygoid Muscles: M. pterygoideus proprius (Henle). Clin Anat. 2001, 14: 288-91.
2. Dunn GF, Hack GD, Robinson WL, Koritz RT. Anatomical Observation of the Craniomandibular Muscle Originating from the Skull Base: The Sphenomandibularis. J Craniomandibular Pract. 1996 Apr; 14 (2): 97-103.
3. Gaudy JF, Zouaoui A, Bri P, Charrier JL, Laison F. Functional anatomy of the human temporal muscle. Surg Radiol Anat. 2001, 23: 389-98. Erratum in: Surg Radiol Anat. 2003, 25: 79.
4. Mahan PE. Clumpers and Splitters [concepts]. J Craniomandibular Pract. 1996 Apr; 14 (2): 90-1.
5. Wippold FJ. Head and Neck Imaging: The Role of CT and MRI. J Magn Reson Imaging. 2007; 25: 453-65.

39 SPEECH EVALUATION IN CHILDREN WITH TEMPOROMANDIBULAR DISORDERS

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INTRODUCTION

The speech articulation is a sensory-motor process which involves the active regulation of strengths among the muscular system and the vocal tract relating itself with structures of conformation and amplitude of mandibular movements produced by the temporomandibular joint (TMJ). If the functional adaptations demand exceed the structural and functional tolerance of the TMJ, a temporomandibular joint dysfunction may be triggered, resulting in mandibular movements alteration and consequent stomatognathic functions disorders, as speech. The aim of this was to evaluate the influence of temporomandibular joint dysfunction (TMD) on speech in children.

MATERIAL and METHODS

The sample comprised 152 children (78 boys and 74 girls, mean age 10.05±1.39 years) with TMD or signs and/or symptoms of temporomandibular disorders (TMD), distritibuted in: TMD (n=40), signs and symptoms of TMD (n=68), signs or symptoms of TMD (n=33) and without signs and symptoms (n=11). For the clinical examination of TMD disorders was used the Research Diagnostic Criteria for TMD (RDC/TMD), a clinical dental occlusion was performed and for speech evaluation, in spontaneous situations, 5 pictures of the Yavas´s protocol were used. A list of 40 phonetically balanced words was also applied to evaluate speech repetition. The mandibular movements during the speech were visually evaluated. Speech was recorded in audio to analyze the transcribed phonetic and phonological emissions. The data were analyze by descriptive statistics, Fisher exact or Chi-square ($p<0.05$). The Ethics Committee of the Piracicaba Dental School, University of Campinas, São Paulo, Brazil, approved the research (Process 034/2006).

RESULTS

A slight prevalence of articulatory disturbances, such as substitutions, omissions, and distortions of the sibilants /s/ and /z/ and no deviations in jaw lateral movements were observed, reduction of vertical amplitude was found in 10 children, being the prevalence greater in TMD/ signs and/ or symptoms of TMD children than in the normal children. The tongue protrusion in phonemes /t/, /t/, /n/, /l/ and frontal lisp in phonemes /s/ and /z/ were most prevalent visual alterations. There was a high percentage of children with dental occlusal alterations, and the presence of excessive overjet (≥ 4mm) was presented in proportion significantly higher in groups with TMD and signs and symptoms of TMD.

CONCLUSIONS

There was no association between TMD and the presence of disturbance in speech. The disorders speech most prevalent found, may be associated with malocclusions, in this study.

REFERENCES

1. Bianchini EMG, Paiva G, Andrade CRF. (2007). Pró-Fono,19:7-18.
2. Yavas M., Memeth S. (1991). Theory, research and practica, Loudon, Routledge.
3. Berretin G, Genaro KF, Teixeira ML. (2000). Cefac, 2: 23-9.

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Capes

40 CERVICAL PAIN EVALUATION ON WOMEN WITH AND WITHOUT TEMPOROMANDIBULAR DISORDERS

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INTRODUCTION

Cervical muscles of temporomandibular disorders (TMD) patients has been an object of study of many researchers because of patient's frequent cervical pain complaint (Pallegama, et al., 2004; Ries, et al., 2007). The objective of this study was to evaluate qualitative and quantitatively the presence of cervical pain in temporomandibular disorders women.

METHODS

It was evaluated eleven volunteers between the age of 24 and 29 years old, who accepted to participate of this research. It was applied a RDC/TMD questionnaire as in Dworkin and LeResche, 1992 for TMD diagnosis and then the volunteers were divide into two groups; TMD (n=6) and Control (n=5). In a second evaluation day, in the same week and period, it was carried out the craniomandibular clinical test as in Visscher et.al., 2000, that involved palpation of the sternocleidomastoid, upper trapezius, splenius capitis and levator scapulae, bilaterally; passive and active movements, light manual resistance and isometric movements. It was applied the visual analogue scale (VAS). On a third day it was done an algometry test on cervical muscles and masticatory muscles and a questionnaire of cervical pain. The algometry test was carried out with a digital algometer, a 1cms surface, applied 3 times within 1 minutes interval, held perpendicular to the skin with a pressure rate of 0,5 kgf/cm2/s .

RESULTS and DISCUSSION

In the study group a mean duration of neck pain was 6.7 years and 7.8 years for orofacialpain. The mean pain stated by the patient, analyzed through VAS, in the TMD group was 5.3 cms in cervical region and 3.8 cms in the face. This difference was statistically significant (paired t-student, $p<0.03$). There was a cervical pain report in 100% and 80% of the TMD and Control group respectively. This finding was confirmed by the muscle palpation. Ries and Bézin, 2007 found 65% and 30% of cervical pain in TMD and control volunteers respectively. The difference in the percentage is due to the low sample of our research and to the high sensibility to palpation of the upper trapezius muscles in the control group. When analyzed only muscle pain during movement it was found a 100% of volunteers with pain in TMD group and 40% in the control (table 1). In the movement restriction (isometric contraction) the painful complaint gets lower (table 1).

Table 1. Percentage of volunteers with pain in at least one muscle during cervical movements

	DTM	Controle
Passivo	100.0	40
Ativo livre	66.7	40
Resistido	100.0	40
Isométrico	33.0	20

The study group presented more volunteers with lateral flexion pain for both sides than flexion-extension and rotation in all types of movements except in isometric contraction.

During palpation analysis through VAS it was found a statistically significant difference between groups for the right splenius capitis muscle (t-student, $p<0.04$) and right sternocleidomastoid, mastoid portion ($p<0.03$). Comparing both sides (paired student t-test) the TMD group present statistically significant difference between sides in the splenius captis ($p<0.03$) and sternocleidomastoid muscle ($p<0.04$). The right side was the most painful.

The algometry values were always higher in the control group, but the difference between groups was statistically different only for the right masseter (t-student, $p< 0.04$) (table 2). On table 2, it is also possible to observe the smallest pressure pain threshold , which is in crescent order left and right sternocleidomastoid and right and left splenius capitis for both groups. The mean difference in percentage between groups is 31.93% for the scapulae muscles, 36.22% for the neck muscles and 33.60% for the masticatory muscles. Farella et al., 2000 found statistically significant differences, with lower thresholds for TMD and a percentage difference between groups of 40 to 50% on the mastication's muscles.

CONCLUSIONS

- Orofacial pain complaint longer than cervical pain complaint;
- Mean of cervical pain, stated by the volunteer, higher than orofacial pain;
- Palpation pain in at least one muscle present in 100% on TMD group and 80% on control. Movement pain present in 100% and 40% on TMD and Control respectively;
- More important palpation pain in right splenius capitis and right sternocleidomastoid, mastoid portion in TMD group and between groups;
- Higher pressure pain sensitivity on right masseter in TMD group.

REFERENCES

- Farella M, et al. (2000).J. Oral Rehab. 27, 9-14.
- Pallegama RW, et.al. (2004). J. Oral Rehab. 31, 423-29.
- Ries LGK, Bézin F. (2007). Braz. J. Oral Sci. 20, 1301-07.
- Visscher CM, et al. (2000). Eur. J. Oral Sci. 108, 475-83.

Table 2. Mean, standard deviation (SD) and percentage difference (% Dif) of the pressure pain threshold (kgf/cm2) of volunteers with and without TMD.

	TMD		Control		
	Mean	SD	Mean	SD	%Dif
R UT	1.40	0.64	2.06	0.95	32
L UT	1.38	0.48	1.93	0.91	28
R SPL.	0.79	0.20	1.09	1.34	27.5
L SPL.	0.87	0.21	1.22	0.65	28.7
R Levator	1.69	0.77	2.03	0.66	**16.7**
L Levator	1.72	0.56	2.21	0.58	**22.2**
R SCM	0.55	0.16	0.97	0.47	43.2
L SCM	0.49	0.10	0.90	0.46	45.5
R M	**0.88**	**0.29**	**1.33**	**0.34**	33.8
L M	0.84	0.19	1.68	1.02	**50**
R T	1.17	0.28	1.49	0.49	21.4
L T	0.97	0.18	1.37	0.73	29.2

UT= upper trapezius. SPL=splenius capitis. Levator= levator scapulae. SCM= sternocleidomastoid M= masseter e T= temporal

41 TREATMENT INTERDISCIPLINARY BETWEEN DENTISTRY AND PSYCHOLOGY OF PATIENT BRUXIST: EVALUATION ELETROMIOGRAPHIC

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INTRODUCTION

Bruxism is considered an involuntary and unconscious disturbance of movement, characterized by the excessive pressing and/or grinding of the teeth and could happen during the sleep or in vigil. (Maciel, 2010). The causes of bruxism during the day and of bruxism during sleep are multifacceted, frequently interrelated in stress periods, anxiety and emotional disorders in which behavioral disturbances and alterations in the habitual patterns of the sleep occurs (Kato 2001). Approximately 40% of the patients complain of headache and orofacial pain, mandibular rigidity, cervicalgias, sore throat and toraxic-abdominal pains (Bader, 2000). It can ocurr restless legs syndrome and periodic movements of the members. Clinicaly it can be observed masticary automatisms and orofacial movements (Lavigne, 1996). It could be affirmed, through eletromiographic (EMG) analyzes, that the use of the rigidity occlusal plate, in patients with TMD reduces muscular tonus besides promoting orthopedical stability, among the arches, and remission of the symptoms (Schuller, 1981). The EMG in dentistry is an advanced technique, used recently as one of the most useful resources for the diagnosis and evaluation of the function of the skeletal muscles (Bérzin, 2001).
The cognitive behavioral therapy (CBT) has been used in an interdisciplinar form with dentistry, simultaneous with the stabilizing plate (Siqueira, 2008). The CBT identifies thoughts and disfuncional behaviors that interfere in the muscular tension, to favour cognitive and behavioral changes. Okeson 1992, affirms that occlusal factors are not the only ones in etiology of bruxism. There are several alternatives to minimize the adverse consequences of bruxism, being the interoclusal plates and the programs of control of the stress one of the approaches more commonly used for a long term treatment.
The objective of this work was to show a clinical case of a bruxist patient treated simultaneously with estabilizing interocclusal plate and individual session of CBT.

METHODS

Patient Mr IHC, 20 years old, male, sought the TMD clinic of Federal University of Pernambuco (UFPE) - Brazil, mainly complaining of pain in the masseter area and in the pterygoid lateral in opening, protrusion against pressure and opening against pressure; clicking of left TMJ and limitation of buccal opening. He affirms interruption of the sleep with several awakes. Diagnosed as diurnal and nocturnal centric bruxist. He shows signs of anxiety, as tics, stereotyped movements of clicks of fingers, neck and excessive movements of legs.
In the Beck inventory of the anxiety it is considered as moderate the items of the dormancy and tingling in the legs, incapacity of relaxation, indigestion, discomfort in the abdomen and strong restlessness.
The stabilizing plate was made in thermopolimerized acrylic, presenting flat surface and offering freedom of excursive movements.
The CBT was accomplished in 16 sessions, with duration of 45 minutes, once a week. It was registered the muscular activity in mandibular rest, through eletromiographic. The registration of the sign had duration of 30 seconds and it was verbally guided. Result in RMS (table1). The calculation of the average of the electric activity of each examined muscle (masseter and temporal) can be observed through the total average of the total time of the registration.

RESULTS and DISCUSSION

Within 2 months of the use of the plate the patient showed relief of muscular pain, comfort in the buccal opening (from 31mm to 52 mm of the VAS rule). During the psychotherapy process it was observed a decrease of the anxiety signs, easiness in naming feelings and of expressing thoughts. Okeson (1992) affirms that the occlusal factors is not the only ones in the etiology of the bruxism and Cestari (2002) reiterates that if it was only an oclusal subject, all the patients would answer favorable to correction of the occlusion.

CONCLUSIONS

Anxiety, stress and emotional disorders have influence in the habitual alterations of the sleep in the bruxism, justifying thus the inclusion of psychotherapy together with dentistry in the treatment of it. With sixteen cognitive behavioral therapy, sessions and the use of the stabilizing plate was not possible to identify decrease of the amplitude of eletromiographic sign in mandibular rest position.

REFERENCES

1. Maciel RN. (2010). Bruxismo, Artes Médicas.
2. Kato T, et al. (2001). Bruxism and orofacial movments during sleep. Dent Clim North Am. 45 (4): 6577-84.
3. Bader G, Lavigne G. (2000). Sleep bruxism: an overview of on oromandibular sleep moviment disorder Sleep. Med Rev. 4 (1): 42-9.
4. Lavigne G, et al. (1996). Sleep Bruxism: validity of clinical research diagnostic criteria in the controlled polysomnographic study J Dent Res. 75 (1): 546-52.
5. Schuller P. (1981) The designates of maxillary occlusal guards in the treatment of acute temporomandibular Joint pain dysfunction (TMF) pacients. Quintessence Int., V.12, P 1295-301.
6. Bérzin F. (2001). Estudo eletromiográfico da hipoatividade da mastigação, em pacientes portadores de desordem crânio-mandibular com dor miofacial. In: Simpósio Brasileiro e encontro internacional sobre dor. São Paulo: SIMBIDOR, P.292.
7. Okeson JP. (1992). Fundamentos de Oclusão e desordens temporomandibulares. 2ª. ed Artes Médicas.

Table 1: Average results of electromyographic (RMS) in Home of the masseter and anterior temporal Bruxist in patients treated simultaneously Board interocclusal and cognitive behavioral therapy (CBT). Results in microvolts.

Dates	Right Masseter	Left Masseter	Right Temporal	Left Temporal
10/09/09	1.9 μV	3.1 μV	5.8 μV	3.0 μV
04/02/09	2.3 μV	3.9 μV	4.2 μV	4.2 μV

42 CHEWING OF PATIENTS WITH MIXED DTM: ELECTROMYOGRAPHIC DIFFERENTIAL ANALYSIS

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INTRODUCTION

Orofacial myofunctional therapists traditionally perform the clinical assessment of mastication. Recently, the electromyography (EMG) has been used to complement the functional assessment. The method of differential analysis of chewing (Differential Lissajous Electromyography) (Kumai, 1988), provides the graphical representation of the potential of the masticatory muscles. Furthermore, quantitative analyses of the patterns of muscular contraction during standardized dynamic activities allow one to assess neuromuscular coordination (Ferrario and Sforza, 1996).
The main of this study was to analyze EMG characteristics of patients with mixed TMD (myogenous and arthrogenous) during standardized dynamic tasks (chewing). Data have been compared to those collected in control subjects.

METHODS

Tweenty-nine patients with mixed TMD, myogenous and arthrogenous, (TMD group) and 18 subjects without signs or symptoms of TMD (C group) participated in the study. TMD subjects were consecutive patients for orofacial pain and TMD treatment on the university, and the C group were volunteers invited to participate in the study. The inclusion criterion for TMD group was to present arthrogenous TMD on the Research Diagnostic Criteria for TMD, axis I (RDC/TMD).
The masseter and anterior temporal muscles of both sides (left and right) were examined. Disposable silver/silver chloride bipolar surface electrodes (diameter 10 mm, interelectrode distance 21±1 mm; Double; Hal Ind. Com. Ltda., São Paulo, SP, Brazil) were positioned on the muscular bellies parallel to muscular fibers. A disposable reference electrode was applied to the forehead.
EMG activity was recorded using a computerized instrument (Freely, De Götzen srl; Legnano, Milano, Italy). The analog EMG signal was amplified (gain 150, bandwith 0-10Hz, peak-to´peak, input range from 0 to 2000 μVs) using differential amplifiers with a high common mode rejection ratio (CMRR = 105 dB in the range 0-60Hz, input impedance 10GΩ), digitized (12 b resolution, 2230Hz A/D sampling frequency), and digitally filtered (high-pass filter set a 30 HZ, low-pass filter set at 400 Hz, band-stop for common 50-60 Hz noise). The EMG potentials produced in the first 15 s of each unilateral chewing were recorded and the following parameters were computed for each of the subjects: (1) masticatory frequency (Hz); (2) symmetry index (SMI%), (3) phase angle (degree) and (4) relative activity of temporal and masseter muscle in work and balancing side (%). Confidence ellipse of the simultaneous differential left–right masseter and temporal activity (Lissajous plot) is a statistical tool to assess the repeatability of the masticatory muscle pattern of contraction during the execution of a standardized movement (e.g. unilateral gum chewing). The differential left–right masseter activity serves as the x-coordinate, and the differential temporal activity as the y-coordinate, in a Cartesian axis representation (Lissajous plot). From the pairs of coordinates, Hotelling's 95% confidence ellipse is calculated. The position of the unknown population centre (the coordinates of which correspond to the population mean values) is estimated by the sample centre. The phase angle gives the inclination of the ellipse relative to the coordinate axes (differential masseter versus temporalis anterior EMG activities), while the amplitude gives the distance of the centre of the ellipse from the centre of the coordinate axes. The confidence ellipse is a region that covers the population centre with a given probability. To assess if the left- and the right-side chewing tests were performed with symmetrical muscular patterns, using the centres of the two confidence ellipses (left and right-side chewing) calculated in each subject, a further index, symmetrical mastication index (SMI = 100, maximal symmetry), was computed as follows. In normal subjects, the centres of the ellipses describing unilateral chewing plotted as a Lissajous figure should be located in the first (right side) and third (left side) quadrants of a Cartesian coordinate system (Kumai, 1993), with about the same amplitude (distance of the centre of the ellipse from the origin of axes), and a 180° difference between the phases (angle between the x-axis and the centre of the ellipse) (Ferrario & Sforza, 1996).
The groups were compared regarding the electromyographic variables by Student-t test for unpaired samples. The significance level was set at 5%.

RESULTS and DISCUSSION

There was statistical difference in the chewing frequency (right and left) between the C and TMD groups ($p < 0.01$). The TMD group had a lower frequency.
There was statistical difference in the symmetry index ($p<0.01$). The C group had a larger symmetry (mean= 62.10%) compared to TMD group (mean = 39.90%).
The phase angle (degrees) was statistically different between the groups in right chewing ($p < 0.05$). The percentage of subjects with normal values of phase to the right (from zero to 90°) was 85% in C and 62.02% in the TMD group. On the left, the percentage of subjects with normal values of phase (180º to 270º) was, respectively 85% and 82.75%. More specifically, in Cartesian coordinates, 37.93% of the TMD group has the right chewing represented in quadrants other than first.
Also in right chewing, there were statistically significant differences between groups in the relative activities of the muscles of both work side as the balancing side ($p < 0.05$). The C group showed larger activity on work side and the TMD group in the balancing side.
These results does not mean that some subjects did not follow the request to chew on the right side, but that even chewing the right side the muscle recruitment was greater on the left side.

CONCLUSIONS

The TMD group showed more frequent and pronounced incoordination of the masticatory function than C group.
The differential EMG will provide useful information for treatment, including orofacial myofunctional therapy, and follow-up.

REFERENCES

1. Kumai T. (1988). Archs Oral Biol, 33, 851-854.
2. Ferrario VF, Sforza C. (1996). Eur J Oral Sci, 104, 511-517
3. Kumai T. (1993). Archs Oral Biol, 38, 467-78.

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43 ELECTROMYOGRAPHIC STANDARDIZED INDICES AND MYOFUNCTIONAL OROFACIAL EVALUATION IN TMD PATIENTS AND HEALTHY WOMEN

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INTRODUCTION

Few researchers have considered the close relationship between the stomatognathic functions, occlusion and the temporomandibular joint (TMJ). However, pain may influence the characteristics of oral sensory-motor system. Thus, together with pain relief, the goals of temporomandibular disorder (TMD) treatments should include reorganization of muscle coordination and recovery of the functionality of the stomatognatic system, reestablishing the possibility to chew, to swallow, and to speak without pain and without exacerbating the problem. Therefore, the examination should allow discriminating subjects with and without TMD, and still providing useful data for therapeutic intervention.

The purposes of this study were to analyze the values of the electromyographic standardized indices, the self perception of TMD signs and symptoms, and the clinical myofunctional orofacial conditions in TMD patients and healthy women, for future use in comparison with data of diagnosis and treatment of OMD and TMD.

METHODS

Forty two subjects with mixed TMD, myogenous and arthrogenous, TMD (TMD group, all subjects were women, mean age 30 years, SD 8) and 18 subjects without signs or symptoms of TMD (C group, all subjects were women, mean age 26 years, SD 6) participated in the study. The RDC/TMD, axis I, was used for classification.

Surface electromyography of the right and left masseter and temporalis muscles was recorded using a computerized instrument (Freely, De Götzen srl; Legnano, Milano, Italy). The conditions investigated were: (a) maximum voluntary dental clench (MVC) with cotton rolls interposed between the first molars/ second premolars (10 mm thick cotton rolls - Roeko Luna); (b) maximum voluntary teeth clench without cotton rolls. The protocol described by Ferrario et al. (2006) was used to obtain a set of standardized electromyographic indices. The test–retest recordings were made for a 63% subset of the sample. For each subject, the EMG potentials recorded during the MVC tests were expressed as percent of the mean potential recorded during the MVC on the cotton rolls (unit: µV/µV x 100). All following calculations were made with the standardized potentials.

The ProTMDmulti-part II questionnaire (Felício et al, 2009a) was used to determine the severity of perception of TMD signs and symptoms by the subjects.

The components of the stomatognathic system were evaluated in terms of appearance/posture, mobility and performance during the functions, according to the Orofacial Myofunctional Evaluation with Scores – OMES Protocol (Felício, Ferreira, 2008).

Data analysis

Descriptive statistics were computed for the analyzed variables. The EMG indices reproducibility was calculated by Student's t-Test for paired samples, considering 63% of the sample. The Technical Error of Measurement (random error) was also computed. Categorical variables were analyzed by non-parametric statistic, Mann-Withney test, and continuous data by parametric statistic, Student t-tests for unpaired samples. The calculations were made using the Statistic data analysis software. Significance was set at 5% ($P < 0.05$).

RESULTS and DISCUSSION

The mean value of the symmetry in the muscles were significantly larger in healthy subjects (POC temporalis = 87.85±2.08%, POC masseter = 86.50±1.63%) than TMD patients (POC temporalis = 78.51±17.66%, POC masseter = 78.64±11.89%) ($p < 0.05$). The potential lateral displacing component was larger in TMD patients (TC = 16.11±17.66%) than in healthy controls (TC = 8.68±1.20%) ($p < 0.05$). No differences were found for total muscular activity and relative activity ($p > 0.05$). For all indices, there was good reproducibility and the test-retest random error was lower than or close to the intragroup standard deviation, showing the good reproducibility of the indices. Current mean values were in agreement with data obtained in previously analyzed control groups (Ferrario et al, 2006; Felício et al, 2009b) and in arthrogenous TMD patients (Tartaglia et al, 2008).

The TMD group reported significantly higher ($p < 0.05$) severity for all signs and symptoms, as previously reported (Felício et al, 2009a). The most severe signs/ symptoms were muscular pain, TMJ pain, and TMJ noise, in accord with those most frequently reported in literature.

The orofacial myofunctional condition was worse in TMD than in control subjects ($p < 0.05$). Thus, the OMES protocols also allows differentiation between healthy subjects and TMD patients.

The sequence of factors and events leading to TMD may vary but, once the problem sets in, the stomatognathic system is no longer able to withstand the functional loads without the occurrence of some discomfort, pain and/or compensation. Thus, in the investigation of signs and symptoms of TMD it is important to perform a clinical examination directly focusing on orofacial myofunctional conditions.

CONCLUSIONS

The protocols allowed to well differentiate female control subjects and TMD patients. These results supports the importance of clinical and instrumental examination of the stomatognathic system, as well as questionnaires with numerical scales combined for TMD diagnosis; all of them will provide useful information for treatment, including orofacial myofunctional therapy, and follow-up.

REFERENCES

1. Felício CM, et al. (2009a). Cranio. 27(1), 62-67.
2. Felício CM, et al. (2009b). J Oral Rehabil. 36(8), 577-83.
3. Felício CM, Ferreira CLP. (2008). Int J Pediatr Otorhinolaryngol 72, 367-375.
4. Ferrario VF, et al. (2006). J Oral Rehabil. 33, 341-348.
5. Tartaglia GM, et al. (2008). Man Ther.13, 434-440.

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44 PROTOCOL OF BIOFEEDBACK ELECTROMIOGRAFY FOR PATIENTS WITH OROFACIAL PAIN TRIGGERED BY PARAFUNCTIONAL DENTAL CLENCHING

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INTRODUCTION

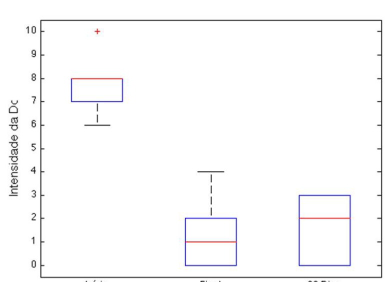
Parafunctional dental clenching or bruxism may be related to clinical cases of Temporomandibular Disorders (TMD), an etiological factor which sustains the disease of major importance (Faot, 2008). Frequently, the masseter and temporal muscles may be affected in TMDs (Pertes & Gross, 2005). This musculature helps to lift the mandible, establishing a framework of headache associated with muscular tension. Electromyography biofeedback is a therapeutic modality capable of helping in the identification and treatment of TMD, assisting to mitigate symptoms, especially the pain, and also preventing its recurrence (Crider & Glaros, 1999).

METHODS

Ten patients were selected, all female and aged between 18 and 65 years old, which were TMD and with signs and symptoms including muscle pain and parafunctional dental clenching. These patients were part of the Program for Reception, Treatment and Monitoring of Patients with TMD and Orofacial Pain of Faculty of Dentistry - Federal University of Uberlandia (PRODAE - FOUFU). The patients answered some questions of the screening form and then filled in a Analogue Visual Scale (AVS) to measure pain intensity and also filled in a form for calculating the Fonseca Clinical Index (Fonseca et al (1994)), for assessment of the severity of TMD. Subsequently, it was carried out the anamnesis and the intra and extra oral clinical exam, and completing the Dental Clinical Form recommended for treatment at PRODAE and electromyographic examination. The therapy involves the application of biofeedback electromyography or miofeedback, associated with guidance on how the behavior of a patient can lead to dental clenching. Eight biofeedback sessions were proposed, each one lasting 30 minutes and schedule twice a week. The miofeedback and electromyographic examination were performed in 3 repetitions lasting 10 seconds each, at maximum voluntary contraction (MVC), at dental contact and at rest, with a 2-minute relax between each exercise. After 30 days of the end of the eighth session EAV and electromyography exam were repeated in order to assess the patient's behavior in the absence of biofeedback. A diary was also delivered to a patient to record the episodes of pain and at which conditions they occurred.

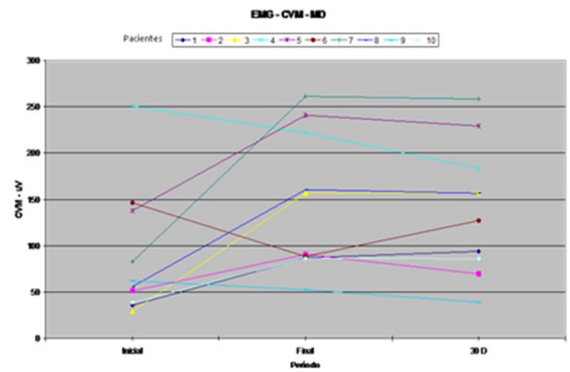
RESULTS and DISCUSSION

TMD patients undergoing miofeedback therapy were initially classified according to the Index of Fonseca Clinical Index (Fonseca et al (1994)), with 50% having severe temporomandibular dysfunction and 50% moderate. Regarding to pain complaints, at the beginning all volunteers (100%) reported pain which decreased its intensity at the end of a session, and as well as after 30 days of treatment, according to AVS.



Graphic 1 - AVS analysis: patients at the beginning of treatment, at the end of the eighth session and after 30 days of the eighth session

Graphic 1 shows the behavior of patients at the beginning, at the end and after 30 days of observation of the treatment. In the last two periods there were 40% of volunteers with no pain complaints and for the remaining 60% a reduction in painful episodes. According to data from analog visual scale (measured in cm), the average pain was initially 7.8 (± 1.39), decreased to 1.2 (± 1.39) at the end of treatment and remained at 1.5 (± 1.35) after 30 days of monitoring.



Graphic 2 – RMS analysis in MVC: patients at the beginning of treatment, at the end of the eighth session and after 30 days of the eighth session

The RMS value of the EMG signal of right masseter, in MVC, was evaluated at the initial examination, at the end of the eighth session and after 30 days, for each patient (Graphic 2). The RMS analysis shows an increase in electromyographic activity as soon as the patient did not feel any pain. Statistical analysis by t test shows that for the level of 95%, the t value found ($t = 3.14$) allows the conclusion that the RMS in MVC in both initial and final phases are different in the right masseter (increase of activity).

CONCLUSIONS

The protocol developed was effective in the management of dental clenching, with pain reduction in 100% of the patients who participated in the research, either at the end of treatment and after 30 days of follow-up. There were 40% of patients who had complete elimination of pain. There was an increase of electromyographic activity in the masseter muscle, in MVC, in 8 of 10 patients treated. The patients reported a better understanding of the events of pain and consciously began to prevent them to unleash painful processes.

REFERENCES

1. Crider AB, Glaros AG. A Meta-Analysis of EMG Biofeedbak Treatment of Temporomandibular Disorders. J. Orofacial Pain 1999; 13: 29-37.
2. Faot F, Custódio LG, Melo ACM, Hermann C. Bruxismo – Parte 1. J. ILAPEO 2008; 1(1): 12-16.
3. Fonseca DM, Bonfante G, Valle AL, Freitas SFT. Diagnóstico pela anamnese da disfunção craniomandibular. RGO. 1994; 42(1): 23-28.
4. Pertes RA, Gross SG. Tratamento clínico das disfunções temporomandibulares e da dor orofacial. São Paulo: Quintessence; 2005.

45 ELECTROMYOGRAPHIC EVALUATION DURING MASTICATION OF INDIVIDUALS WITH TEMPOROMANDIBULAR DISORDER BEFORE AND AFTER GLOBAL POSTURAL REEDUCATION (GPR)

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INTRODUCTION

Temporomandibular disorder (TMD) consists in orofacial signs and symptoms such as pain and changes in the pattern of activation of masticatory muscles (RODRIGUES et al., 2004). Surface electromyography (sEMG) can assess, noninvasively, changes in myoelectric activity (DE LUCCA, 1997).
The objective of this study was to investigate the behavior of the electrical activity of masticatory muscles (masseter and anterior part of the temporal) during mastication in the TMD patients, before and after Global Postural Reeducation (GPR).

METHODS

20 volunteers of both genders, mean age of 27.8 years old took part in the study. The diagnosis of TMD was obtained by the instrument Research Diagnostic Criteria for TMD (RDC / TMD) (DWORKIN e LE RESCHE, 1992).
The EMG recordings were analyzed according to the International Society of Electromyography and Kinesiology (ISEK). EMG signals from Masseter and Temporal (anterior fascicle) were recorded during French bread mastication for 3 cycles on rhythm of 40 bpm set by metronome Cherub Digital– Type WSM 001[a].
The EMG signals were collected and processed in RMS (Root mean square) (DE LUCA, 1997). After 10 sessions of the GPR (SOUCHARD, 2004), the EMG evaluation was repeated. To compare the
data the Wilcoxon test was used and it was considered the significance level of 5% ($p<0,05$).

RESULTS and DISCUSSION

There was an increase in all assessed muscles activity, with statistical significance on the left masseter ($p = 0,03$), right and left temporal ($p=0,00$ and $p=0,04$) after the GPR. These results show an improvement in the muscle length-tension, since, through the eccentric isometric contraction promoted by the GPR, there is an increase in the number of sarcomeres in series (SOUCHARD, 2004). This can have produced an increase in the number of motor units and, therefore, the higher levels of myoelectric activity (BÉRZIN, 2004).
It was also observed predominance of EMG activity in the anterior temporal on the masseter muscles, which characterizes a muscular between them. After the GPR, there were increases of these potentials, but with persistence of this imbalance. BÉRZIN(2004) states that this is a characteristic pattern in patients with TMD.

CONCLUSIONS

The GPR improved the EMG activity of masticatory muscles during mastication in TMD patients. However the asynchrony between the temporal and masseter muscles was not corrected.
This study, therefore, comes to contribute with objective evidence for implementation of the GPR in patients with TMD.

REFERENCES

1. Rodrigues D, et al. (2004). Braz J Oral Sci. 3, 510-15.
2. Bérzin F. (2004). Braz J Oral Sci. 3, 484-91.
3. De Luca CJ. (1997). J Appl Biomech. 13, 135-63.
4. Dworkin SF, Le Resche L. (1992). J Craniomandib Disord.6, 301-55.
5. Souchard PE. (2004) Reeducação postural global: método do campo fechado. Ícone Editora.

46 INFLUENCE OF THE MOBILIZATION IN TEMPOROMANDIBULAR JOIN TO SELF-PERSEPTION OF PAIN AND ELECTROMYOGRAPHIC SIGNAL DURING MASTICATION IN PATIENT OF FEMALE SEX WITH DTM MYOGENIC (STUDY PILOT)

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INTRODUCTION

The temporomandibular disorders (TMD) is a term used to characterize changes in the masticatory system that lead to alterations different in the masticatory muscles, the TMJ and associated structures, interfering with functions as the chewing, swallowing and phonation. Any disturbance in these structures can cause imbalances in the tonic postural system (Goldstein, 1999).
The literatures there are few reports on the use of joint mobilization techniques as a resource used in the treatment of TMJ.
The use of structural techniques of mobilization have important objective restoring function and mobility.
The objective of this pilot study was investigate the influence pre and post only session treatments of joint mobilization on the electromyographic activity masticatory muscles in the mastication moment and self-perception of pain in a female patient with TMD.

METHODS

The experimental procedures and documentation of the use of the technique were developed in the Laboratory of Electromyography, Faculty of Dentistry of Piracicaba with 1 woman with 27 years of age with TMD. For the evaluation of signs and symptoms of TMD was applied to the evaluation protocol of the presence of signs and symptoms of the Research Diagnostic Criteria (RDC). The joint mobilization was used to "pull the condyle" in cranio caudaldirection. We performed three sets of 10 repetitions, and the tenth repetition maintained to the extent permitted for 20 seconds. Implementation was coordinated by the metronome beats Taktell ®. The electrical activity of the left temporal and right masseter and left and right was obtained by a module of data acquisition DataHominis Technology Ltd. and the data analyzed in Myosystem Br1 software, version 2.22. 3 collections. Were realized 3 performed before and after therapy, and carried out the averages. The analysis was conducted by the symmetry (marked test orders). For the assessment of pain was used Visual Analogue Scale (VAS). All the above assessments were performed before and immediately after treatment with joint mobilization.

RESULTS and DISCUSSION

The application of EVA pretreatment showed a scale of 0 to 10 the value 5, since after treatment this value decreased to 2.5, showing a 50% reduction in pain.

Table 1 – Average RMS of the left temporal (LT), Right Temporal (RT), Left Masseter (LM) and right masseter (RM).

Muscles	Pre	Post
LT	58,43	39,91
RT	33,81	52,44
LM	77,39	74,93
RT	50,49	74,57

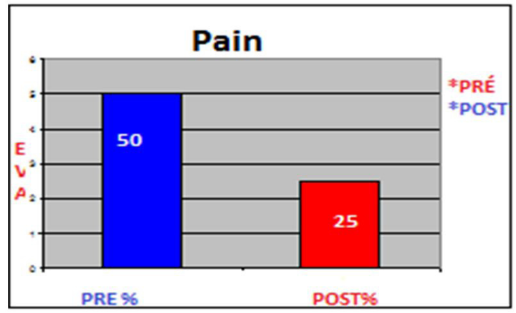

Figure 1 – Self-perception of pain in patient of female sex with TMD, pre and post only session treatments of joint mobilization.

By analyzing the symmetry between the muscles was observed that the temporal muscles worked in 73.4% of symmetry and after treatment joint mobilization of the TMJ, the symmetry increased to 86.5%. For the masseter muscle, there was a symmetry of 79% and after treatment too increased to 99.8. (Figure 2).

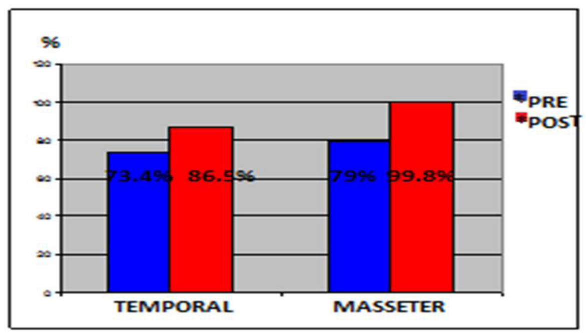

Figure 2 – Variation in percentage of the muscles symmetry in masticatory moment pre and post only session treatments of joint mobilization.

CONCLUSIONS

The scope of the TMJ joint mobilization promoted a 50% improvement in the pain of the patient improved and promoted functional muscle during mastication increasing muscle symmetry between the left anterior temporal and right masseter and between the left and right.

REFERENCES

1. Bienfait M. As bases da fisiologia da terapia manual. [tradução] Ângela Santos]. São Paulo: Summus 2000.
2. LeReche L. Assesment of physical and behavioural outcomes of treatment. Oral Surg Oral Med Oral.

47 IMMEDIATE EFFECTS OF UPPER CERVICAL MANIPULATION ON ELECTROMYOGRAPHIC SIGNAL OF CERVICAL MUSCLES IN WOMEN WITH TMD

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INTRODUCTION

Temporomandibular disorder (TMD), characterized by pain in the orofacial region, can be associated with pain and discomfort in the cervical muscles (AAOP, 2009). Clark et al. (1993) observed coactivation of the sternocleidomastoid (SCM) and masseter muscles during maximum closure of the mouth, suggesting that these muscle groups act as synergists in this function. Synergy occurs due to a neurologic interrelation between the temporomandibular joint (TMJ) and the cervical segment.

The neurologic interrelation is a result of the trigeminal caudal nucleus, where convergences of afferences from cervical levels (C1, C2, and C3) and orofacial region (trigeminal nerve) occurs (Marfurt and Rajchert, 1991). For Alcântara et al. (2002), the nociceptive afferences which originate from the TMJ may cause hyperactivity of the upper cervical muscles and, consequently, reduce mobility of C1. In order to revert such situation, one may use manipulation of the upper cervical spine, for it aims in reestablishing joint range of motion (Vernon, Humphreys and Hagino, 2007) and promoting muscular relaxation (Herzog, Scheele and Conway, 1999) by neurologic pathways.

The objective of this study was to evaluate the immediate effects of upper cervical manipulation on the electromyographic signal (EMGS) of cervical muscles in women with TMD.

METHODS

Five women were selected, ages between 20 and 37 (25.8±6.8) years, with TMD diagnosed by the RDC/TMD, and received two manipulations to the upper cervical column.

For the manipulation procedure, the volunteers remained in supine position while the therapist passively performed slight cranial traction of the head with rotation of the head, and then applied a high velocity and low amplitude thrust for rotation to the right side, followed by the same procedure with rotation to the left side.

The immediate effects of manipulation on electromyographic signal (EMGS) of the trapezius (superior portion) and SCM muscles were evaluated bilaterally.

For the electromyographic assessment, an electromyograph EMG1000 (Lynx®) was utilized, with 16 bits of resolution, interfaced with a microcomputer, as proposed by Guirro, Forti, and Rodrigues-Bigaton (2006), with simple differential electrodes (Lynx®). Amplifications of 1000 times, with filter of 20-1000 Hz and sampling frequency of 2000 Hz were also utilized. The electrodes were positioned bilaterally on the belly of the trapezius (superior portion) and SCM muscles, according to Cram et al. (1998), while the reference electrode was placed over the manubrium bone.

The EMGS was collected during isometric activity and during rest, for five seconds each, and the data was processed with Matlab® 6.5.1 software, utilizing a specific function for calculation the Root Mean Square (RMS). In sequence, a comparison of RMS values from before and immediately after manipulation was realized by utilizing the Anova F statistical test.

RESULTS and DISCUSSION

There was significant reduction in EMGS in the resting condition for both trapezius muscles (superior portion), as seen in table 1, which concurs with the findings of DeVocht et al. (2005), where the immediate effects of lumbar manipulation on lumbar paravertebral muscles was studied in patients with low back pain, and a similar reduction in EMGS immediately after manipulation was observed when compared to pre-intervention.

There was significant increase in EMGS during isometric activity for the right trapezius muscles (superior portion) and the left SCM (table 1), which concurs with Colloca and Keller (2001), where they evaluated the immediate effects of vertebral manipulation on the lumbar spine in volunteers with low back pain, and observed significant increase of the isometric EMGS of lumbar paravertebral muscles.

The comparison with studies regarding the lumbar spine is based on the lack of research in the literature that utilized cervical manipulation in conjunction with electromyography.

Table 1

	Rest			Isometry		
	Pre intervention	Post intervention	P	Pre intervention	Post intervention	P
TrapR	1.21±0.24	0.63±0.13	0.017*	0.73±0.28	1.01±0.17	0.04*
TrapL	1.14±0.42	0.54±0.32	0.004*	0.60±0.19	0.65±0.12	0.65
ECMR	0.73±0.29	0.49±0.10	0.09	0.56±0.27	0.55±0.16	0.99
ECML	0.57±0.29	0.36±0.13	0.12	0.30±0.15	0.41±0.11	0.01*

* significant difference
†Test: ANOVA F

CONCLUSIONS

It is concluded that manipulation of the upper cervical spine decreases electromyographic activity of the trapezius muscles (superior portion) during resting condition and increases electromyographic activity of the right trapezius (superior portion) and left SCM during isometric contraction in women with TMD.

REFERENCES

1. Guidelines. (2003). *Cranio*.21(1),68-76.
2. Clark GT, Browne PA, Nakano M, Yang Q. (1993). *J Dent Res*. 72(11),1499-502.
3. Marfurt CF, Rajchert DM.(1991). *J Comp Neurol*. 303(3), 489-511.
4. Alcantara J, Plaugher G, Klemp DD, Salem C. (2002). *J Manipulative Physiol Ther*. 25(1), 63-70.
5. Vernon H, Humphreys K, Hagino C. (2007) *J Manipulative Physiol Ther*. 30(3), 215-27.
6. Herzog W, Scheele D, Conway PJ. (1999). *Spine*. 24(2), 146-52.
7. Cram et al. (1998). Gaithersburg, Maryland: Aspen Publishers.
8. Colloca CJ, Keller TS. (2001). *J Manipulative Physiol Ther*. 24(8), 489-500.
9. DeVocht JW, Pickar JG, Wilder DG.(2005). *J Manipulative Physiol Ther*. 28(7),465-71.

48 USE OF THE BOTULINUM TOXIN LIKE COMPLEMENTAL TREATMENT OF THE INTEROCLUSAL SPLINT IN DTM: ACCOMPANIMENT ELETROMIOGRAPHIC

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INTRODUCTION

TMD is a complex multifactorial disorder, that disturbs the stomatognathic systm, and involves muscular aspects (TMJ), articulation, psychic and the nervous system (Bérzin, 2001).
It is believed that a contraction initiated in the vertical masticatory muscles could extend in descending chain for the adjacent, cervical, superficial, intermediate and deep muscles (pain located in the occiptal area, being projected for front areas, temporal, orbital and vertex). (Motoyoshi, 2000).
Okeson (2000) affirmed that the interocclusal plates can work as a diagnosis, and it is very important that, when this apparatus reduces the symptoms, the necessary relationship of cause and effect be identified before an irreversible therapy is applied.
The Botulinum Toxin type A promotes a relaxation of the musculature, causing a decrease in the pain. Such painful syndrome happens when there are muscular spasms caused by muscular hiperactivity, distention or muscular contraction. These effects will cause pain and unbalance the mandibular functions (Lindern, 2001).
The Botulinum Toxin type A provokes a reversible chemical denervation generating a distal axonal degeneration and prolonged action, but transitory on the operation of the motor plate.
This way reducing the tonic muscular activity or excessive phasic, thus increasing the active and passive motricity, allowing a longer stretch of the injected muscles (Freund & Medix, 2002).
The Eletromiography (EMG) in Dentistry, is an advanced technique, used recently as one of the most useful resources for the diagnosis and evaluation of the skeletal muscles function (Bérzin, 2001).

METHODS

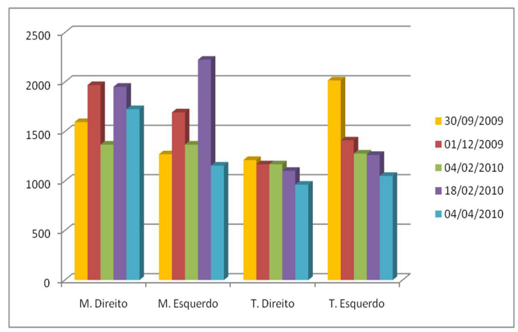
Mrs. NCM, 47 years, married, smoker, user of Dorflex P (Paracetamol + caffeine + cloridrate of Orfenadrine) and Rohypnol (Flunitrazepam), complaining of pain in the lateral pole of left TMJ reaching the occipital area descending until the muscle of the trapezium. She also complained of pain during mastication on this same side, bilateral click in buccal opening and closing, dislocation of the medium line ipsilateral and limitation of the buccal opening. A decrease of the articulation spaces of left TMJ was verified through a panoramic digital X ray exam. It was indicated the use of the interocclusal stabilizing plate made of thermopolimerized acrylic with plain occlusal surface in the upper arch.
One and a half month after the installation of the interocclusal plate it was administered 100U of the Botulinum Toxin type A diluted in physiologic serum in the masseter and temporal muscles. An eletromiographic monitoring of surface of the muscles mentioned was done before the installation of the interocclusal plate and also a monitoring of the treatment with the botulinum toxin drug (Grafic 1).

RESULTS and DISCUSSION

In spite of the effectiveness of the Botulinum Toxin type A shown in many works (Freund et al, 1999; Lindern, 2001), there are authors that do not believe in its relationship with the improvement of the algic condition (Clark, 1999; Wheeler et al., 1998). However the clinical observation and the analysis of the works confirm its effectiveness (Dutton, 1996).
The action of the neurotoxine does not affect the central nervous system (CNS), there is no blockage of the liberation of the acetilcoline or any other transmitter in CNS, since in normal situations, it does not surpass the blood-brain barrier (Baiocato et al 1999).
Two months after insertion of the plate and fifteen days BOTOX A was injected, the mouth opening developed from 30 mm to 42mm. The bilateral click disappeared. There was mandibular centralization and the pain (VAS) descended from 8cm to 5 cm).

CONCLUSIONS

New experiments should be implemented together with the plate seeking to increase the effectiveness of the it. Clinical and eletromiographic monitoring are recommended during three months after the therapy with the drug (BOTOX A).



Grafic 1: Eletromiographic Monotoring

REFERENCES

1. BÉRZIN F. Estudo eletromiográfico da hipoatividade da mastigação, em pacientes portadores de desordem crânio-mandibular (DCM), com dor miofacial. In: SIMPÓSIO BRASILEIRO E ENCONTRO INTERNACIONAL SOBRE DOR, 5. 2001. São Pauli. Anais... são Paulo: SIMBIDOR, 2001. p.292.
2. Motoyoshi M et al. Biomechanical influences on the upper vertebral during mastication, on examination using the finite element method. Ortodontic waves 2000; 59:183-190.
3. Freund, Dr Robert. MEDIX. BOTOX é efetivo no alívio da dor de cabeça. Acesso em http://www.emedix.com.br/not2000/00mar28utor-bei-cefaleia.shtml.
4. Clark GT. The use of botulinum toxin for the treatment of temporomandibular disorders: preliminary findings. Discussion. J Oral Maxillofac Surg, Philadelphia, v.57, n.8, p.920-921, Aug.1999.
5. Wheeler AH, et al. A randomized, double-blind, prospective pilot study of botulinum toxin injectioon for refractory, unilateral, cervicothoracic, paraspinal, myofascial pain syndrome. Spine, Philadelphia, v23. n.15, p.1662-1667, Aug. 1998.
6. Dutton JJ. Botulinum-A toxin in the treatment of craniocervical muscle spasms: short and long-term, local and systemic effects. Surv Ophthalmol, Brokline, v.41, n.1, p.51-65, Jul./Aug.1996.
7. Baiocato AC, Rozestraten FS, Oliveira TR. Uso da toxina botulínica tipo A como coadjuvante no tratamento da espasticidade. Vol XII, n2, out/99. Curitiba: Ed Universitária Champagnat, 1999.
8. Okeson JP. Tratamento das desordens temporomandibulares e oclusão. 4a. Ed, São Paulo: Artes Médicas, 2000.

49 ANALYSIS OF FREQUENCY MEDIAN OF MASTICATORY MUSCLES IN WOMEN WITH TMD

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INTRODUCTION

The temporomandibular disorders (TMD) is characterized by several signs and symptoms such as pain and changes in the electrical activity of masticatory muscles (Zuccolotto et al., 2007).
The EMG is a resource used in the diagnosis of TMD, as their achievements to note that patients with TMD, when compared to healthy individuals, have chewing cycles of shorter duration, hyperactivity of masticatory muscles during mandibular rest and less muscle activity jaw elevator during isometric contractions (Svensson et al., 1998).
The median frequency is one way of analysis of the electromyographic signal and provides a reliable estimate, consistent and unbiased conduction velocity of muscle fibers (De Luca, 1997). Changes in median frequency may indicate fatigue and muscle abnormalities of the neuromuscular system (Lindstrom et al. 1970).
The aim of this study was to evaluate the electromyographic activity of masticatory muscles of women with and without TMD.

METHODS

Were selected by the Diagnostic Criteria for Research in Temporomandibular Disorders (Research Diagnostic Criteria for Temporomandibular Disorders - RDC / TMD) (Dworkin and Le Resche 1992), 13 women (mean age 23 ± 4.02 years) with diagnosis of TMD considered TMD group, and 7 women (mean age 25 ± 5.2 years) without TMD diagnosis, considered control group.
The volunteer group had TMD pain or fatigue in the muscles of mastication during functional activities, and occlusal parafunction crack in ATM. The control group showed no signs or symptoms of TMD.
For the electromyography test was used electromyography EMG1000 (Lynx®) with 16-bit resolution and input range of ± 1 volt, and a microcomputer, as proposed by Guirro et al. (2006), with simple differential electrodes (Lynx®). Amplification of 1000 times with bandpass filter of 20-1000 Hz and sampling frequency of 2000 Hz.
The electrodes were placed in the belly of the masseter and anterior temporal bilaterally according Cram et al. (1998), after cleaning the skin with alcohol 70%. The reference electrode was placed on the sternal and the EMG signal was collected during rest and isometric contraction for 5 segunds.
The electromyographic signal processing was performed in Matlab 6.5.1, using a specific function, for calculating the median frequency (MF). Was performed comparing the values of FM of the muscles evaluated among the control group and the TMD group. Statistical analysis used the Mann-Whitney test, with critical level of 5% ($p < 0.05$).

RESULTS and DISCUSSION

As results, no significant difference in the temporal and masseter muscles bilaterally between TMD group and control group, in agreement with the experiment of Caria et al. (2009) examined the masseter and temporal in symptomatic and asymptomatic and received no significant difference in FM during chewing, indicating the absence of muscle fatigue in their muscles.
These results can be attributed to not local ischemia, which was reported by Christensen (1979), as one of the responsible for fatigue. The author also states that the local ischemia of the masseter and temporal is caused by continuous contraction (isometric) and it participates in the process of fatigue. The results of this study show no difference in the values of median frequency between the groups, indicating no fatigue for both the control group and the group of TMD, which may be due to the short contraction isometric.

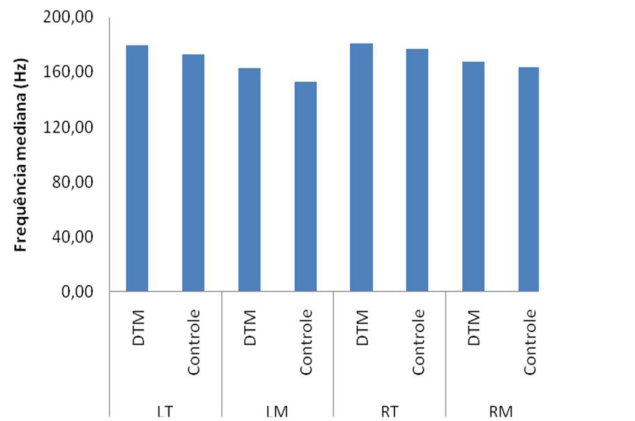

Figure 1: Mean values of median frequency of the left temporal (LT), left masseter (LM) right temporal (RT) and right masseter (RM) between TMD group and the control group during isometric contraction of jaw elevator muscles.

CONCLUSIONS

There was no significant difference between groups in temporal and masseter muscles bilaterally during isometric, these results confirm the absence of signs of muscle fatigue during isometric, even in individuals with TMD, possibly due to the short period of mastication.

REFERENCES

1. Caria, et al. (2009). Acta Odontol Latinoam. 22(2).
2. Cram, et al. J. (1998). Aspen Publication.
3. Christensen. (1979). J Oral Rehabil, Oxford.6,119-36.
4. De Luca. (1997) J. App. Biomech, 13, 135-163.
5. Dworkin SF, LeResche L. (1992). J Craniomandib Disord, 6(4), 301-55.
6. Guirro, et al. (2006). Electromyogr Clin Neurophysiol. 46: 391-99.
7. Lindstromet, et al. (1970). Electromyography, 4:341.
8. Svensson, et al. (1998). J Orofac. Pain. 12:7-16, 1998.
9. Zuccolotto, et al. (2007) Gerodontology. 24: 105-110.

50 ELECTROMYOGRAPHIC ANALYSIS OF NECK MUSCLES WOMEN WITH AND WITHOUT TEMPOROMANDIBULAR DISORDER

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INTRODUCTION

The temporomandibular disorders (TMD) is characterized by different signs and symptoms such as difficulty in chewing, pain (Ozan et al, 2007;) and changes electromyographic activity of masticatory muscles and neck as it is related to hyperfunction or dysfunction of these muscles and cervical spine dysfunction (Stiesch-Scholz et al., 2003). Often with TMD report symptoms such as headache and presence of tension in the neck (Ciancaglini, Radaelli, 2001) leading to associations such as the increased activity of neck muscles.
The aim of this study was to evaluate the electromyographic activity of neck muscles in women with and without TMD.

METHODS

Were selected 7 women in the TMD group (23.14 ± 3:58 years) and 7 women in the control group (25.29 ± 5.31 years), classified according to Research Diagnostic Criteria for Temporomandibular Disorders (RDC / TMD). For the electromyography test was used electromyography EMG1000 (Lynx ®) with 16-bit resolution and input range of ± 1 volt, and a microcomputer with simple differential electrodes (Lynx ®). Amplification of 1000 times with bandpass filter of 20-1000 Hz and sampling frequency of 2000 Hz.
The electrodes were placed in the belly of the trapezius (TRAP), sternocleidomastoid (SCM) and suprahyoid (SH), according to Cram, Kasman and Holtz (1998), after cleaning the skin with alcohol 70%. The reference electrode was placed on the sternal.
The electromyographic signal was collected at rest and the isometric contraction of jaw elevator muscles.
For normalization was used as reference value the average value of RMS obtained from a control group both at rest and the isometric jaw elevator muscles.
The electromyographic signal processing was performed using the Matlab ® 6.5.1, using a specific function to calculate the Root Mean Square (RMS). Was then performed comparing the RMS values between the control and TMD, using for this the Mann-Whitney test, with critical level of 5% ($p < 0.05$).

RESULTS and DISCUSSION

The results found there was significant difference between the muscle ECM, SH and TRAP at rest (Figure 1), this result agrees with the findings of Pallegama et al (2004), which through electromyography evaluation of cervical muscles during rest obtained significant difference in these muscles by comparing the symptomatic with asymptomatic. According to the work done by Clark (1993) and Ehrlich (1999), different activities can alter the masticatory electromyographic signal of the cervical muscles. The authors observed, using electromyography, which the isometric contraction of maximum clenching dental promotes significant co-contraction of the ECM.
During isometric significant difference only for the ECM and SH (Figure 2), this result agrees with the findings of Ciuffolo (2005) which, by means of electromyographic examination of the cervical muscles, did not observe changes in the electromyographic signal of the trapezius, but on sternocleidomastoid and suprahyoid.

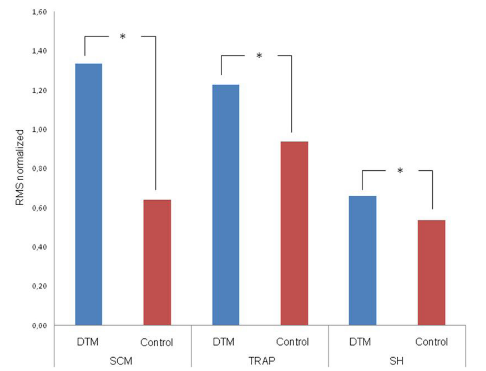

Figure 1. Comparison of mean normalized RMS muscle sternocleidomastoid (SCM), trapezius (TRAP) and supra-hyoid (SH) between the control and TMD, obtained at rest. * Significant difference

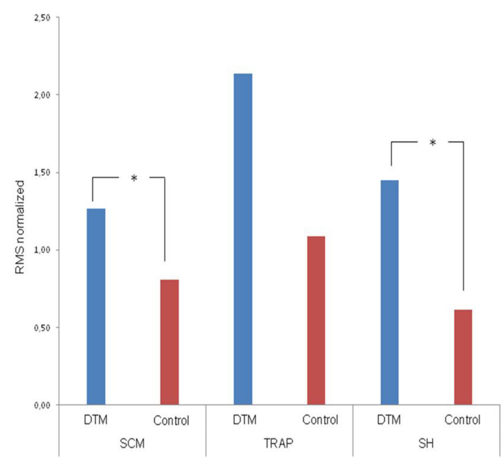

Figure 2. Comparison of mean normalized RMS muscle sternocleidomastoid (SCM), trapezius (TRAP) and supra-hyoid (SH) between the control and TMD, obtained in the isometric contraction of jaw elevator muscles. * Significant difference

CONCLUSIONS

It can be concluded that both at rest and in the isometry there were significant difference between groups, these situations the collection of volunteers with TMD showed increased activity of the muscles.

REFERENCES

1. Ciancaglini R, Radaelli G. (2001). J Dent Bristol. 29(2):93-98.
2. Ciuffolo, et al.(2005). J Oral Rehabil, 32, 79-84.
3. Clark, et al (1993). J Dent Res. 72, 149-502.
4. Ehrlich, et al. J Orofac Pain, 13:115-20, 1999.
5. Cram JR, et al. (1998). Aspen Publication. 408p.
6. Ozan, et al. (2007). J Contemp Dent Pract, 8(4), 35-42.
7. Pallegama, et al. (2004) J Oral Rehabil, 31, 423- 429.
8. Stiesch-Scholz, et al.(2003). J Oral Rehabil. 30, 386-391.

51 CONTRIBUTION TO DIAGNOSIS IN FUNCTIONAL MAXILLARY ORTHOPEDICS: AN ELECTROMIOGRAPHIC STUDY OF CHEWING SIDE PREFERENCE

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INTRODUCTION

One important goal for malocclusion treatments in Dentistry is to reach a perfect occlusion that allows an efficient chew. It is very important for the specialties that treat malocclusions, like Functional Maxillary Orthopedics (FMO), to have an extensive knowledge of masticatory patterns. Mastication muscles function in habitual chew and the relation of preferred chewing side with the mandibular movements need more research, and that was the motivation for this investigation :the correlation between mandibular trajectory view in frontal plane (by Planas Masticatory Funcional Angle/ PMFA) and preferred chewing side. Another goal was to verify the viability of Surface Electromyography (sEMG) as a tool to identify preferential side for chew.

METHODS

Twenty volunteers with full natural dentition, no orofacial pain signs and symptoms, and no systemic disorders that could falsify the results were observed during habitual chewing. All subjects were questioned about chewing side preference. The PMFA was identified by pictures and intra-oral film records. The sEMG registration was made in isotonic contraction from masseter muscle and anterior temporalis muscles. The EMG signals were recorded through cumulative surface Electromyography (sEMG) during 25 seconds of peanuts habitual chew (Figure 1).

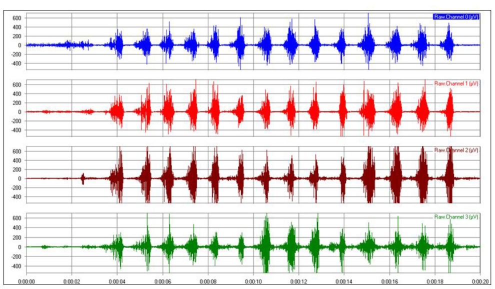
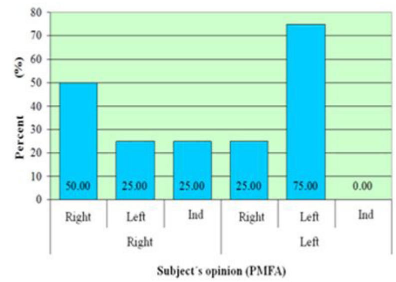


Figure 1 – The EMG signals were processed by 4,18 AqDAnalysis *Software Lynx Electronics Ltda. (Brasil)*. The sEMG registration (Raw) was made in isotonic contraction from bilaterally masseter superficial and anterior temporalis muscles, during 25 seconds of peanuts habitual chew. Example: Subject TRA: Chanel 0: Left Temporal; Chanel 1: Right Temporal; Chanel 2: Left Masseter; Chanel 3: Right Masseter.

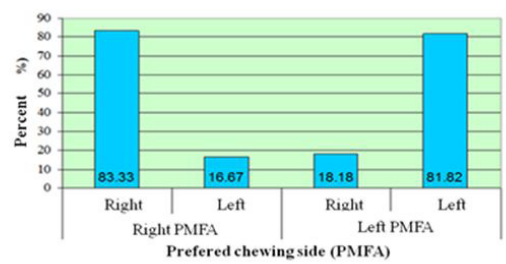
EMG activity was recorded by an eight-channel instrument (Lynx Electronics - EMG 1000). The analogical EMG signal was amplified with a gain of 50, a bandwidth 20 to 1000 Hz. The electrodes used for the study were passives and pre jellified (Hall Indústria e Comércio LTDA). In each session the masticatory movements were recorded to count the number of cycles in each side. The preferred chewing side was determined through the evaluation of the recorded tapes and these results were related with PMFA and EMG records from superficial masseter and temporal muscles.

RESULTS and DISCUSSION

Data was processed through the SAS[1] System. The percents of preferential chewing side by the evaluation of subjects'opinion were: 55% to the left, 35% to the right and 10% for both sides. The chewing side preference in this study was obtained by the numbers of masticatory cycles for each side (by evaluation of the record tapes) and the results were: 50% to the left, 40% to the right and 10% with equal masticatory ciyles for right and left. Many researches found a high prevalence of chewing side preference, but with different percents (Stohler, 1986; Wilding e Lewin, 1991), and others found a low prevalence (Gillings, 1977; Paphangkorakit et al, 2006). These differences may be explained by the different methodology used. The correlation between PMFA and the subjects' opinion (Graphic 1) and the correlation between the PMFA and preferred chewing side by evaluation of film registration were important (Graphic 2). A correlation between sEMG signals of maximum amplitude and the PMFA were found through the linear functions. Planas (1994) and Simões (2003) also found a correlation between PMFA and chewing side preference.



Graphic 1 – Preferential chewing side proportion by subject`s opinion and by Planas Masticatory Functional Angle (PMFA). N:20



Graphic 2 - Preferential chewing side proportion by evaluation of the record tapes and by Planas Masticatory Functional Angle (PMFA). N: 17.

CONCLUSIONS

Data analysis of this research allowed us to conclude that there are important correlations between PMFA and preferred chewing side (evaluate by subject`s opinion) and between PMFA and preferred chewing side (obtained by the evaluation of the record tapes). The determination of PMFA, using Surface Electromyography (sEMG) as a tool, was possible by the evaluation of maximal amplitude sEMG signals from temporal and masseter muscles in habitual chewing.

REFERENCES

1. Bérzin F, Sakai E. (2004). Nova Visão em Ortodontia e Ortopedia Funcional dos Maxilares, 311-330.
2. Gillings BRD. (1977). J Dent Res, 56, Abstract D195.
3. Paphangkorakit J. (1949). Am J Orthod, 35, 837-857.
4. Planas P. (1994). Rehabilitación Neuro-Oclusal.2.ed, 355p.
5. Simões WA. (2003). Ortopedia Funcional dos Maxilaresvista através da Reabilitação NeuroOclusal.2.ed. 1024p.
6. Stohler CS. (1986). Archs Oral Biol, 31, 10, 669-678.
7. Wilding RJC, Lewin A. (1991). Archs Oral Biol, 36, 7, 519-523.

[1] SAS Institute Inc. The SAS System Release 9.02, SP2. SAS Institute Inc, Cary:NC, 2002.

52 ELECTRODIAGNOSIS ON MEDIAN NERVE INJURIES: CASE STUDIES

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INTRODUCTION

The electrodiagnostic is an exam that checks the neuromuscular activity using different kinds of electrical stimulation. Through observation and palpation of muscle contraction is possible to determine the degree of innervation of the muscles.

When a peripheral nerve injury occurs, the muscle loses the capacity for rapid response observed by the abrupt contraction followed by rapid relaxation when subjected to electrical stimulation. Depending on the injury, intensity and width of the pulse of the stimulus will overcome the normal range. This variation of the response is called the degenerating reaction [Ervilha, et al. 1997].

The electrodiagnostic allows the analysis of neuromuscular response through some different electrical stimuli, wich are: reobase, chronaxie and accommodation, exponentially and rectangular. Reobase is the lowest intensity needed to produce muscle contraction, the pulse duration (T) remains at 1000ms and the rest (R) remains at 2000ms. The chronaxie is the smallest width of the rectangular pulse with intensity twice the value of reobase for the production of contraction. Accommodation is the minimum current required to produce muscle contraction, with T = 1000ms and R = 2000ms, with an exponential pulse [Operation Manual NeMESyes 941 - Quark].

This study aimed to examine the response of bilateral opposing muscle of thumb, through the electrodiagnosis in patients who underwent surgical repair of the median nerve.

METHODS

We selected 3 individuals with lesions of the median nerve at the wrist and that the cause of the injury was injury with sharp objects. All performed the neurorrhaphy. Patients were seated with the forearm, wrist and hand supported so comfortable.

The electrodiagnosis was done using the apparatus NemeSys 941 brand QUARK, and was selected SMS for the current location of the motor point. This was placed the pen electrode (cathode) and the contralateral limb, the electrode plate (anode) to close the circuit. Values were obtained from reobase, chronaxie, accommodation, 9 points on the graph exponential and 12 points on the graph rectangular. For each participant was performed electrodiagnosis on the injured and repaired and also on the healthy side.

RESULTS and DISCUSSION

From the analysis of the healthy side of individuals was observed that the reobase was around 4.16. The chronaxie has 1.16 which was within the expected range for normal is 0.1 to 0.2. Regarding the accommodation did not follow exactly the expected values that were a little over twice the reobase in this study showed slightly lower values than doubled. (Table 1).

Table 1. Values reobase, chronaxie and accommodation of the healthy side (LS) of 3 patients.

LS	REO	CRON	ACOM
1	4.5	0.2	9.0
2	4.0	0.1	6.5
3	4.0	0.2	6.5

Observing the injuried individuals, it was noted that the value of reobase was lower compared to the healthy, being around 2.16. The chronaxie was far beyond the standard, being 18.51. This value was high due to the fact that one of the patients had chronaxie of 50, indicating total lesion (neurotmesis). The accommodation has 3.33 and remained outside of the pattern of twice the reobase, staying under it (Table 2). Values reobase and / or high chronaxie denote process of muscle denervation (Licht, 1970) quoted by [Lana et al. 2007].

Table 2. Values reobase, chronaxie and accommodation of injured side (LL) of 3 patients.

LS	REO	CRON	ACOM
1	2.0	3.0	4.0
2	1.5	50.0	2.5
3	3.0	2.5	3.5

The average values of exponential and square curves, obtained on the injured side, are shown in Figures 1 and 2.

Analyzing the figures may be noted that in the occurrence of injuries, the curves lose their standard shape.

Figure 1. Average points of the curves of the square (pink) and exponential (blue) currents on the healthy side of the 3 individuals.

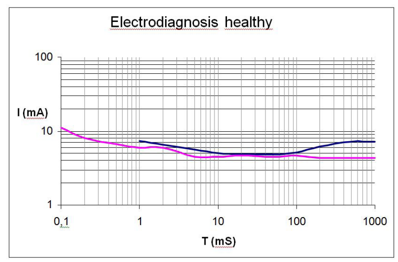
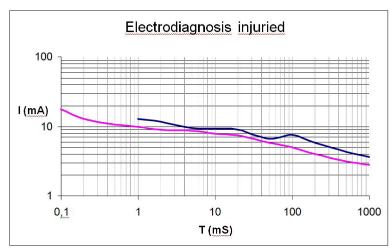


Figure 2. Average points of the curves of the square (pink) and exponential (blue) currents on the injured side of the 3 individuals.



CONCLUSIONS

According to other studies, different values from what´s considered normal for all variables indicate muscle denervation, although the process of nervous plasticity and the various factors that interfere during the recovery phase should be considered. So the values can vary among individuals and it is important to use the contralateral limb as standard, and often re-evaluate the muscle.

REFERENCES

1. Ervilha UF, Araujo RC, (1997). Estudo Sobre a Freqüência de Distribuição da Cronaxia e a sua Correlação com Distintos Graus de Lesões Nervosas Periféricas. Revista Brasileira de Fisioterapia. Vol. 1, N. 2
2. Lana GC, André ES, (2007) Investigação comparativa entre a laserterapia e a estimulação elétrica muscular sobre a regeneração nervosa periférica em ratos Wistar. Dynamis revista tecno-científica Vol.13, N.1, 113-119.
3. MANUAL DE OPERAÇÃO – NeMESys 941
4. QUARK- PRODUTOS MÉDICOS

53 PROTOCOL FOR ASSESMENT OF SURFACE ECTROMYOGRAPHY TO CERVICAL MUSCLES

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INTRODUCTION

The assessment of skeletal muscle, especially the neck, has a significant importance, since the influence of stress and posture on the skeletal muscle chenges is the first overload factor commonly observed. A practical way to investigate the skeletal muscle conditions, especially of the cervical muscles, in respect of action, establish the surface electromyography (sEMG) (TANK et al., 2009). The aim of this article were to present a proposal sEMG assesment protocol of neck muscles.

METHODS

During the years 2009 and 2010, a EMG Brazilian researchers group, with a large research and clinical practice experience, meeting periodically to discuss the needs of a sEMG specific protocol for analysis of the sternocleidomastoid muscle (ECOM) and upper fibers trapezius. The researchers taken the existing publications as reference, about the theme, which was evidenced a need for standardization, clarity and more specificity for evaluation of the proposal muscle to be more reproducibility. The protocol was based on the cleanliness of the area assessed, on the electrodes placement and positioning, in the tasks performed to collect the electrical sign and the parameters to be withdrawn from the electromyographic signal.

RESULTS and DISCUSSION

The electrodes were placed as following instructions for the ECOM: midpoint of the muscle belly, 4cm from the mastoid (COSTA, 1990), and to the upper trapezius: 50% of the distance between the acromion and spine of C7 (SENIAM, 2010), bilaterally for each muscle. The actions to capture better the electral record muscle were the agreement of cervical rotation and flexion from right (to better capture left ECOM) and rotation combined with cervical flexion to the left (to better capture the right ECOM). For the upper trapezius, the elevation of both shoulders. Those maneuvers were used as to normalize the signal (5s contraction for each activity), till the proposed activities, called Maximum Volunteer Activity Resisted (M_{AVR}). For each M_{AVR}, has 5s:10s (contraction X relaxation), to 3 replicates (KAKIHARA et al., 2007), followed by 1 minute of rest. The average EMG sign of rest, were considered 100%. The averages of proposed activities had became an total average for each activity, representing a percentage of rest.

CONCLUSIONS

This article presented the sEMG assesment protocol for the cervical muscles, allowing professionals healt care, more information about this.

REFERENCES

1. Tank FF, et al. (2009). Influência da distância intereletrodos e da cadência de movimento no domínio da frequência do sinal de EMG de superfície. Rev Bras Med Esporte, 15(4):272-76.
2. Costa D. (1990).Electromyographic study of the sternocleidomastoid muscle in head movements. Electromyography and clinical neurophysiology,30(17).
3. SENIAM (2010). "SENIAM:European Recommendations for Surface Electromyography." [Acesso em: 13 fev 2010]; Disponível em: http://www.seniam.org
4. Kakihara CT, et al.(2007). Effect of functional training for thepelvic floor muscles with or without electrical stimulation in cases of urinary incontinence following radical prostatectomy. Rev Bras Fisioter,11(6).

Table 1: Protocol and assessment protocol of sEMG to ECOM and upper trapezius.

1ª Phase	**Preparing for the test:** • Clean with cotton and ethanol about 70% on the area of ECOM and upper trapezius location (bilaterally). • The voluntary standing up, on an usual and comfortable posture, without socks or shoes, no shirt (for men) or top (for women), looking forward, with their arms along the body (rest) without look the screen computer, thus avoiding the visual feedback and possible influences on assessment.
2ª Phase	**Placing the electrodes:** • Reference electrode in the right ulnar styloid process to reduce electrical interpositions crash outside. • Capture electrode in the midpoint of ECOM muscle belly, to 4cm from the mastoid process along the muscle fibers (bilaterally). Bipolar configuration. • Upper trapezius capture electrode into 50% of the distance between acromion and C7, along the muscle fibers (bilaterally). Bipolar configuration. • Inter-electrode distance about 1,5 cm. • Electromyography with 4 channels enabled, whem the odds were agreed for the left side, and the others to the right side. 1 and 2 → ECOM. 3 and 4 → Upper Trapezius.
3ª Phase	**Standardization signal: Maximum Activity Volunteer Resisted (M_{AVR})** • M_{AVR} maintained for 5 seconds, cervical flexion and rotation, toward the right shoulder, to higher activity of left ECOM. • M_{AVR} maintained for 5 seconds, cervical flexion and rotation, toward the left shoulder for greater activity of right ECOM. • M_{AVR} maintained for 5 seconds, lifting the shoulders, to the upper trapezius (both for the 2 upper trapezius). Note: To carry out only once M_{AVR} in each maneuver with an 10s of interval between them. After end, wait 1 minute to start the next phase.
4º Phase	Proposed Activities: Activity1: M_{AVR} of cervical flexion and rotation toward the right shoulder, to higher activity from the left ECOM. 5s (contraction): 10s (rest), repeating the activity for 3 times. Activity 2: M_{AVR} of cervical flexion and rotation toward the left shoulder for increased activity of right ECOM. 5s (contraction): 10s (rest), repeating the activity for 3 times. Activity3: M_{AVR} lifting the shoulders to the upper trapezius (both for the 2 upper trapezius). 5s (contraction): 10s (rest), repeating the activity for 3 times. Activity 4: End rest for 1 minute, after all the maneuvers.

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54 EXISTENCE OF NEUROPHYSIOLOGY CHANGES IN INDIVIDUALS WITH DOWN SYNDROME

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INTRODUCTION

Aspects such as hypotonia, muscle weakness and cerebellar hypoplasia have been suggested as a cause of delayed motor development (acquisition of motor milestones) for the child with Down syndrome (DS).
The study of the muscle reflex, which is to ensure muscle tone, and is the result of stimulation of the neuromuscular fuse (sensory system) causing reflex contraction of the muscle (motor system) can assist in understanding the role of hypotonia in motor development (delayed the acquisition of motor marcs) of children with DS.
Therefore, the purpose of this study was to analyze and verify the existence of neurophysiological abnormalities in individuals with DS, such as hyporeflexia, static and dynamic, which, if present, may cause impairment in sensory-motor control of muscles, and consequently hypotonia contributing to changes in motor development.

METHODS

After statistical calculation of sample size, with a change of neurophysiological 4% after the deterioration of functional capacity as target variable, assuming α error of 5% and β error of 20%, 24 volunteers were screened with a diagnosis of Down syndrome and 25 volunteers as control group (healthy control), with ages ranging from 16 to 25 years, of both sexes, cognitive thought sufficient understanding of the proposed exercises, ability to remain in standing position without support and not show any disease orthopedic, vestibular, auditory or visual, not take medication that alters nerve transmission, does not have peripheral neuropathy, nor respiratory problems that change the ventilation perfusion.
The electromyographic signal was collected during two different situations: the latency period monosynaptic and dynamic reflex (static).
Latency period dynamic: an average line of the latency period for the muscle response of peroneal muscles, short and long, analyzed in this study, after an induced imbalance in a wooden bank, by its own mechanism, fitted with a switch in your area disarming of the mechanism, being representative of the functional activity of the muscles of each volunteer.
Test monosynaptic reflex patellar and Achilles: it was through the hammer neurological adapted with a switch in your area of percussion.
To test the normality or otherwise of the sample was used the Kolmogorov-Smirnov (KS). As the variables had normal distribution to perform the statistical analysis used the Student t Test to compare the average of data between two groups.

RESULTS

For neurophysiological aspects, it was observed that for all variables analysed, statistically difference ($p < 0.05$) between groups (Table 01).

DISCUSSION

Our results point to a settlement of the choice of methodology, since the other group, our data are similar to studies presented, while pointing out the existence of a significant change driving neurophysiological, as shown by Kayacan, which may mean a marker diagnosis, prognosis or functional, but more studies are needed to verify a strong and positive correlation of the variables analyzed here and advance the proposal suggested.
We think that the difference in the reflex response, found in this study may be related to sensory changes. The medullar reflex occurs by the stimulation of receptors that are present within the muscle (neuromuscular spindle and Golgi complex). These receptors are stimulated by the performance and speed of muscle contraction, and a slow contraction may inefficiently stimulate these receptors.
The inversion of the ankle can be used as a reflex response to maintain the balance in an activity that causes disruption of the ankle, this is due to mecanorecptors that are present in the muscles and ligaments of the joint.
We believe that the hypotonia, resulting in impairment in sensory-motor control, may be associated with the increase of the oscillation, because it is not possible to regulate muscle control to keep in balance.

CONCLUSIONS

For patients with Down syndrome, the existence of neurophysiological changes demonstrated in this study originated from impairment in sensory-motor control, which may account for the decreased muscle tone, are decisive for the changes in motor development of children, which shows important due to neuromuscular disorders that can interfere with functional activities.
Reflex responses are important for sensory-motor control, assessment and interpretation can contribute to further investigations in rehabilitating these individuals.

REFERENCES

1. Pueschel SM. (1990). Am J Med Genet. 7, 52-6.
2. Kayacan O, Beder S, Deda G, et al. (2001). Acta Neurologica Bélgica. 101,160-165.
3. Corrêa JCF, Corrêa FI, Franco RC, et al. (2007) Electromyography and Clinical Neurophysiology. 47, 1-6.

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Table 01. Average data and standard deviations for the latency period of tendon reflexes and dynamic - ankle inversion (of neuropsychological assessments) of volunteers with Down syndrome (DS) and the control group (CG).

	GC n = 25	SD n = 24
Latency RTP (ms)	24.81 (±8.62)*	31.17 (±4.75)*
Latency RTA (ms)	28.29 (±12.31)*	40.92 (±4.14)*
Dynamic Reflex (ms)	68.72 (±4.92)*	94.92 (±2.78)*

P value Student t test: *p < 0.05.

55 NEUROPHYSIOLOGICAL ASPECTS AND THEIR RELATIONSHIP TO CLINICAL AND FUNCTIONAL IMPAIRMENT IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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INTRODUCTION

The neurophysiological alterations often found in patients with chronic obstructive pulmonary disease (COPD) are associated with the severity of the disease. Other factors, such as reductions in body mass index, endurance, muscle strength and other conditions that affect the peripheral skeletal musculature in patients as a whole, may have a negative impact on these neurophysiological aspects and compromise their functional activity.
The purpose of the present study was to assess static and dynamic balance, monosynaptic reflexes, peripheral muscle strength and the sit-to-stand test (SST), relating these neurophysiological responses to the BODE Index in order to identify a possible functional and prognostic assessment for patients with COPD.

METHODS

A cross-sectional study was carried out involving three groups of patients: COPD group (not dependent on oxygen); COPD-O2 group (dependent on oxygen); and control group (CG, healthy individuals paired for age). The following four factors are addressed in BODE Index Evaluation: 1. Body mass index (BMI); 2. Airflow obstruction, assessed from the FEV1; 3. Dyspnea scale; 4. Six-minute walk test (6MWT).
To evaluation tests for neurophysiological aspects was: the electromyographic signal, collected in two distinct situations – monosynaptic reflex and peripheral muscle strength; the pressure plate (MatScan model) was used to analyze oscillations in pressure points in relation to speed as well as anterior-posterior and lateral-lateral displacement, enabling the assessment of balance by means of the center of oscillatory pressure, which is the result of these two variables; the Tinetti Scale was used for the assessment of gait as well as static and dynamic balance; and the patient was instructed, standing up from and sitting down on the chair with no support from the hands, repeating the procedure as many times as possible (Sit-to-Stand Test).
As all data were parametric, one-way analysis of variance (ANOVA) was used to compare the means of the data between the three groups and Tukey's DHS test for the multiple comparisons of means was used in the presence of significance for the analysis between posts. The Student's t-test was used for the comparison of means between the COPD and COPD-O2 groups only for the total BODE Index score. Person's correlation coefficient was used to determine the degree of association between two variables in the same group. The level of significance was set at 5%, with an α of 0.05 and β of 0.01.

RESULTS

The individuals with COPD had a reduced reflex response (evident the by increase in latency time of the patellar and Achilles reflexes), achieved a lower number repetitions on the SST and exhibited lesser peripheral muscle strength on the femoral quadriceps muscle when compared to the CG.
No statistically significant differences were found between the COPD and COPD-O2 groups regarding the neurophysiological aspects analyzed. The BODE Index demonstrated correlations with balance assessment (determined by the Tinetti scale) and the SST.
Both COPD groups had similar characteristics regarding the total BODE score and neurophysiological aspects, which justifies pooling the two groups for the correlation analysis between these variables (COPDt Group). Statistically significant strong and moderate negative associations ($p < 0.05$) for the Tinetti Scale and SST, respectively. Correlations were weak for the other variables.

DISCUSSION

The individuals with COPD had a reduced reflex response, as observed in the increase in latency time regarding the patellar and Achilles reflexes.
These individuals also achieved a lower number of repetitions on the sit-to-stand functional test and had lesser peripheral muscle strength in the femoral quadriceps in comparison to the control group.
However, the oxygen-dependent group with COPD was similar to the non-dependent COPD group with regard to the neurophysiological aspects and BODE Index, despite being different in relation to functional capacity and pulmonary function.
The BODE Index was correlated with the neurophysiologcial evaluations of balance, Tinetti scale and the sit-to-stand test. Both are functional tests and lower scores suggest a worse prognosis for individuals with COPD, which speaks to the need for further investigations.
These tests are easy to administrate, low-cost and feasible, especially the SST, and may represent a new assessment modality for prognoses in COPD that is more easily administered than the BODE Index.

CONCLUSIONS

The patients presented functional and neurophysiological alterations caused by COPD when compared to healthy individuals.
The BODE Index was correlated with the reflex response, strength, Tinetti scale and the sit-to-stand test. All the functional tests are easy to administrate, low-cost and feasible, especially the SST.
These results suggest that lower scores functional refer to a worse prognosis index of mortality for individuals with COPD; however, more studies are needed to identify the causes and effects of these changes and the repercussions that could result in their activities of daily living.

REFERENCES

1. Pitta F, Troosters T, Spruit M, et al. (2005). American Journal of Respiratory and Critical Care Medicine. 171, 972-977.
2. Kayacan O, Beder S, Deda G, et al. (2001). Acta Neurologica Bélgica. 101,:160-165
3. Corrêa JCF, Corrêa FI, Franco RC, et al. (2007) Electromyography and Clinical Neurophysiology. 47, 1-6.

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56 SURFACE ELECTROMYOGRAPHY DURING SWALLOWING IN NORMAL SUBJECTS AND PATIENTS WITH PARKINSON'S DISEASE

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INTRODUCTION

Parkinson's Disease (PD) is a progressive neurological disease characterized by tremors, rigidity, bradykinesia and postural dysfunctions (Linazanoro, 2009). In addition to these symptoms, swallowing dysfunction (dysphagia) is frequent in PD with incidence ranging between 50% and 100% (Carrara-Angelis, 2006). The aim of this work was to study swallowing in patients with PD and normal controls using surface electromyography (sEMG).

METHODS

Subjects were 30 individuals, 15 with idiophathic PD, off medication, mild to moderately advanced Hoehn&Yahr disability score and 15 healthy individuals without neurological disease.
The design of the study was developed to investigate the effects of bolus volume and consistency on swallowing. We compared (1) swallowing of two different volumes of the same consistency (10 and 20 ml of water) and (2) swallowing of equal volume of two different consistencies (10 ml of water and firm yogurt). Subjects were instructed to keep the content in the mouth, swallowing only at the researcher command.
Disposable self adhesive electrodes (Meditrace 200) attached below the chin were used to record the sEMG of the Suprahyoid muscle group (SHG). The ground electrode was attached over the right clavicle. Before attaching the electrodes the skin was cleaned with gauze embedded with 70° alcohol and slightly abraded with abrasive paste (Nuprep). Recordings were done using a model 400c sEMG machine (EMG Systems do Brazil). Signals were amplified (2000 times), band-pass filtered (20-500Hz) and digitized (2 KHz). sEMGs were analyzed using a program developed in Matlab (Mathworks) in our laboratory (Coriolano et al, 2009).
Variables studied were the *duration* (time from the onset to the offset of the sEMG) and the amplitude (the average of the root-mean-square *amplitude* of non-superimposed moving windows of 100 ms) of the swallows. Statistical comparisons were made using a two-way mixed-model analysis of variance (ANOVA). The p critical was 0.05.

RESULTS and DISCUSSION

Figures 1 and 2 and Table 1 summarize the results. There were no significant differences of amplitudes between PD subjects and normal controls, for any volume or consistency. Ertekin at al (2002) studying the swallowing of 3 ml of water in normal subjects and patients with PD also did not found significant differences between their SHG sEMG amplitudes. The usually large inter-individual variability of amplitudes in sEMG studies probably makes more difficult the detection of differences (Vaiman et al., 2004).

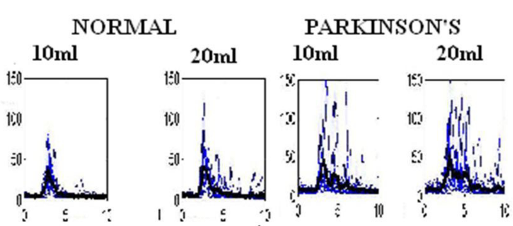

Figure 1 - Swallowing at once of 10 and 20 ml of water. Graphs of amplitude(rms) in mV (y axis) versus time in seconds (x axis). Fine lines are the traces of each individual. The thick line is the average of these traces. The command to swallow was given 2 minutes after the beginning of the record.

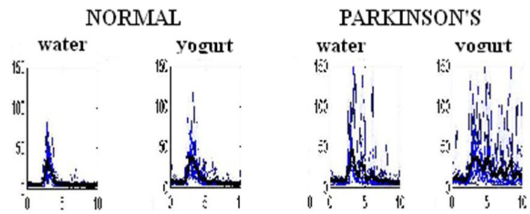

Figure 2 - Swallowing at once of 10 ml of water and yogurt. Graphs of amplitude(rms) in mV (y axis) versus time in seconds (x axis). Fine lines are the traces of each individual. The thick line is the average of these traces. The command to swallow was given 2 minutes after the beginning of the record.

The durations of SHG sEMG were significantly longer in PD subjects than in normal controls, for all volumes and consistencies (ANOVA $p<0.0001$). Eterkin et al (2002) and Potulska et al (2003) also found significantly longer duration of SHG sEMG in PD patients compared to normal controls. They related this finding to the bradykinesia of PD patients.
Amplitude of SHG sEMG was significantly larger and duration significantly longer during the swallowing of 20 ml than 10 ml of water, for both normal and PD subjects (ANOVA $p <0.00001$). Eterkin et al (1997) found significant difference in durations but not in amplitude of SHG sEMG during swallowing of volumes between 3 and 20 ml of water. Group and/or methodological differences may account for the discrepancy.
Amplitudes of SHG sEMG were not significantly different between normal and PD patients during the swallowing of similar volumes (10 ml) of firm yogurt than of water, for either PD or normal subjects. Duration, however, were significantly longer during the swallowing of firm yogurt than of water, for both PD and normal subjects (ANOVA $p<0.0001$). Ruark at al (2002) also found that the duration of SHG sEMG was affected by the consistency of the bolus.

CONCLUSION

SHG sEMG of PD and normal subjects were different during swallowing. In both in normal and PD subjects SHG sEMG was affected by the volume and the consistency of the bolus. Differences in duration are more consistent then differences of amplitude.

REFERENCES

1. Linazanoro G. Parkinsonism and Related Disorders. 2009; 15;401–405.
2. Carrara-Angelis E. ABDR 2006;13:197-207.
3. Coriolano MGWS, et al. This article was submitted to the journal CEFAC), 2009.
4. Ertekin C, et al. The American journal of gastroenterology. 1997;92(11): 2049-2053.
5. Ertekin C, et al. Movement Disorders 2002; 17:5:942–949.
6. Potulska A, et al. Parkinsonism and Related Disorders 2003;9:349–353.
7. Vaiman M, et al. Dysphagia 2004;19:125–132.
8. Ruark JL, et al. Dysphagia 2002; 17:24-33.

Table 1- Swallowing at a time of 10 and 20 ml of water and 10 ml of yogurt consistently. Mean (SD) amplitudes (rms) in microvolts and duration of sEMG in seconds. N = normal, P = Parkinson.

		Volume (water)		Consistency (10 ml)	
		10 ml	20 ml	Water	Yogurt
Amplitude	N	19±8	22±7	19±8	25±8
	PD	22±18	26±17	22±18	26±14
Duration	N	1.7±0.3	2.1±0.8	1.7±0.3	2.3±0.6
	PD	3.1±1.3	3.6±0.8	3.1±1.3	4.0±1.2

57 ELECTROMYOGRAPHY AS METHODOLOGY ACTIVE IN THE CLASSES OF NEUROPHYSIOLOGY AND RESEARCH AREAS "BIOLOGICAL BASIS FOR THE MOTION" - COLLEGE OF PHYSICAL EDUCATION UNIVERSIDADE DO VALE DO ITAJAÍ - Santa Catarina

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INTRODUCTION

This paper aims to describe the use of electromyography as a method for active classes of the discipline of neurophysiology and research areas on "biological basis for the motion", the Faculty of Physical Education, University of Vale do Itajaí, Santa Catarina. Active methodology can be defined as a set of techniques aimed to stimulate the student reflection on certain issues, giving a new meaning to their findings, Mitre (2007). The lessons of anatomy and physiology, in this context gain momentum with the application of electromyography, for example, as in Maldonado, et al. (2007). Authors such as Madeira, (1997), (2004), in his books, externalize the importance of making less monotonous teaching anatomy, making it more attractive and interesting for the formation of a future professional. Guyton (1991) in his preface confirms the association of teaching anatomy and physiology seeking a permanent learning. The experience of the Faculty of Dentistry of Piracicaba with the insertion of electromyography as a long-term research area is also another successful experience.

METHODS

In an appropriate room electromyographic examinations will be conducted in accordance with international standards proposed by the International Society of Electromyography and Kinesiology (ISEK). The eight-channel electromyography, Miotec® brand, acquired in late 2009, will be also used in the research area "biological basis for the motion" of the course in association with other disciplines such as kinesiology, exercise physiology as well as other related UNIVALI faculties.
The contents of neurophysiology, plus other previously taught (biological basis I and II) as osteology, arthrology and miology, will be the bases to the understanding of the electromyographic technique as mobile and fixed inserts, ratio of motion, kinesiology, motor point location in addition to its prescription.
As an active methodology, electromyography leads the student to evaluate the contents offered starting at a dynamic observation of the nerve impulse generator of motion associating the prior knowledge described, subject to review in pathological situations (problematizations), inclusive.
Parallel to this, works along the research area "biological basis for the motion" will be optimized for students interested in that area, as they go through the discipline of neurophysiology.

RESULTS and DISCUSSION

The results expected are a greater disclosure of electromyography as a simple, non-invasive (surface electromyography) and dynamic, diagnose help for both physiological (kinesiology) and pathologies. Within the active methodologies, this is the expected result: the transition from naive consciousness to critical consciousness requiring creative curiosity, inquisitive and always unsatisfied, of an active subject, who recognizes the reality as changeable, Mitre (2007).
The anatomy and physiology become critical and applied as seen in: Madeira, (1997) e (2004), Guyton (1991), Moore and Dailey (2007) Gray (2007).

CONCLUSIONS

The Faculty of Physical Education, created in 2004 with a degree and in 2007 with a BA has set in their political and pedagogical project, the articulation of content aiming at a clearer, critical and reflective understanding, contributing to the formation of an egress ethical, entrepreneurial, human and committed to the paradigm shifts, associating education and health to the improvement of life quality. The proposed insertion of electromyography as a method of active methodology in classes of neurophysiology and in researches of the physical education course as well as partnerships with other faculties is to contribute to a higher education qualification in this area.

REFERENCES

1. Guyton AC. Neurociência Básica (1991). Guanabara Koogan.
2. International Society of Electromyography and Kinesiology (ISEK) – HTTPS://www.isek-online.org/standards.asp
3. Madeira MC. Anatomia da face (1997). Sarvier.
4. Madeira MC. Anatomia da face (2004). Sarvier.
5. Maldonado DC, et. al. (2005) Registro eletromiográfico para ilustrar as aulas de fisiologia neuromuscular. ConScientiae Saúde, São Paulo, v. 4, p. 79-86
6. Mitre SM. Metodologias ativas de ensino-aprendizagem na formação profissional em saúde: debates atuais.(2007). Revista Ciência & Saúde Coletiva da Associação Brasileira de Pós-Graduação em Saúde Coletiva.
7. Drake, et al. Gray`s Anatomia para estudantes (2005), Elsevier
8. Moore K, Dailey Anatomia orientada a clinica (2007) Guanabara Koogan

58 UNILATERAL AND BILATERAL POSTERIOR TIBIAL NERVE STIMULATION EFFECTS ON VOIDING FREQUENCY IN WOMEN WITH OVERACTIVE BLADDER SYNDROME

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INTRODUCTION

The Overactive Bladder (OAB) is a syndrome of the lower urinary tract that causes sudden urge to urinate and often leads to the urinary incontinence, frequency and nocturia (more than eight voids in 24 hours) (Hashim and Abrams, 2007). To reduce the psychological and social impact of symptoms, physiotherapy presents the posterior tibial nerve stimulation (PTNM) as a conservative treatment option, but this is a technique that requires further studies on the application form. Thus, the objective of this study was to evaluate the effect of unilateral and bilateral PTNS on the urinary frequency in women with OAB.

METHODS

Thirty female subjects, with a medical diagnosis OAB participated in this study. They were divided into three groups of 10 subjects: control group (CG) (56.9 ± 12.56 years), unilateral group (UG) (58.5 ± 12.37 years) and the bilateral group (BG) (54.6 ± 13.25 years). In this randomized double-blind study, the CG has received no intervention, the UG was treated unilaterally (in one member) and BG was treated bilaterally (both members). Exclusion criteria were considered as urinary tract infection in the past six months, any medication that could impair the function of the urinary tract, pregnancy, decompensated diabetes, neurological disorders and individuals who have received or performing any form of therapy for overactive bladder. Intervention with transcutaneous electrical nerve stimulation (TENS) in posterior tibial nerve was performed with an equipment model Physiotonus Four ® (BIOSET) and a depolarized symmetric current (T = 200 µs, f = 10 Hz) was used with a protocol based on proposed by Amarenco et al. (2003). Two silicon dioxide electrodes (3 x 5 cm) were fixed at the ankle, one behind the medial malleolus and the other 10 cm above. The intensity was kept just below the motor threshold for 30 minutes. This electrical stimulation was performed twice a week, totaling 10 sessions. Before and after the proposed intervention, the subjects were instructed to complete a 3-day voiding diary (daily record of the routine bladder activity). Analyzing the 3-day frequencies, an average was calculated. Statistical analysis was initially applied the Shapiro-Wilk test to verify that the data were normal. Because the data had normal distribution were analyzed with a parametric test: repeated measures ANOVA F with Tukey's post hoc. For all calculations the level of significance was set at 5% (p <0.05).

RESULTS and DISCUSSION

The voids/day means obtained by 3-day voiding diary before and after treatment was: CG (10.29 ± 1.29 and 10.39 ± 1.42), GU (9.95 ± 1.41 and 7.62 ± 1.41) and BG (10.05 ± 1.6 and 7.72 ± 1.23). There was a significant decrease in voids/day after therapy for the UG (p <0.0001) and for the GB (p <0.001). The CG did not change significantly (p=0.308). There were significant differences in comparison CG with the UG (p = 0.031) and in comparison GC with the BG (p = 0.045). Comparing the results of two interventions, no significant difference on frequency of micturion between UG and BG was found (p> 0.05) (Figure 1). The decrease in voiding frequency in this study was also identified by other authors, but with different methodologies. Van Balken, Vandoninck and Gisolf (2001) proposed a PTNS with needle electrodes, bilaterally placed three fingers above the medial malleolus, using a current of 9 V, 200 µs, f = 20 Hz and maximum intensity 10 mA, for 30 minutes. Using the voiding diary, a positive response in voiding frequency was seen in 60% of 37 women with OAB evaluated.

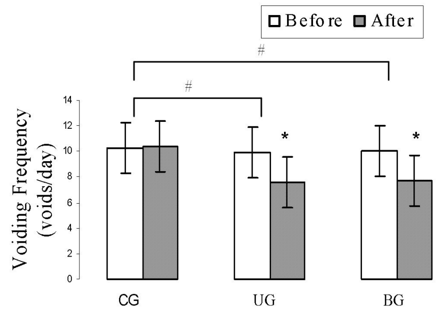

Figure 1. Mean ± sd voiding frequency of the volunteers of the study, before and after 10 PTNS sessions, n = 30. *p<0,05 when compared to post intervention; #p<0,05 treated group compared to the control group.

Amarenco et al. (2003) have shown the neurophysiological PTNS effects by urodynamic test, identifying the reduction and delay of the detrusor contractions with consequent increase in maximum cystometric capacity. These authors used unilateral stimulation. In the current study, the voiding frequency decreased significantly after PTNS in both UG and in BG. The comparison between the treated groups showed no statistical difference between them. These results demonstrate that both forms of stimulation were effective in reducing voiding frequency and that the bilateral PTNS did not provide more effective than unilateral PTNS. The PTNS effects identified in this study can be clarified by analyzing the neurophysiological mechanisms for urine storage. Considering the origin of the posterior tibial nerve in the sacral micturition center, the application of electrical stimuli in the posterior tibial nerve interferes in the activity bladder, inhibit it indirectly (Vandoninck et al., 2004). The posterior tibial nerve stimulations proposal, either unilateral or bilateral, were effective in reducing urinary frequency of the volunteers studied, and no technique was more effective than the other regarding the effects evaluated. In this case, stimuli applied at low frequencies (maximum 10 Hz) stimulate contraction of the muscles of the urethra and promote detrusor relaxation through the lower urinary tract sympathetic innervation (Chancellor and Yoshimura, 2004). The lack of difference between the results obtained with unilateral and bilateral stimulation suggest that depolarization of sympathetic afferent fibers and the detrusor muscle have a maximum threshold of stimulation and bilateral stimulation did not potentiate the effects of unilateral placement possibly because this maximum is already reached with unilateral stimulation. Thus, we can infer that the two forms of PTNM studied are effective in reducing voiding frequency and it can be used in the clinic as an additional form of conventional treatment for OAB, without discomfort or embarrassment.

CONCLUSIONS

The two forms of PTNM studied, either unilateral or bilateral, have been effective in reducing voiding frequency women with OAB treated, and no technique was more effective than the other regarding the effects evaluated.

REFERENCES

1. Amarenco G, Sheik IS, et al. (2003). J Urol. 169, 2210-2215.
2. Chancellor MB, Yoshimura N. (2004). Reviews in Urology. 6, 19-28.
3. Hashim H, Abrams P. (2007). Current Opinion in Urology. 17, 231-6.
4. Van Balken MR, Vandoninck V, et al. (2001). J Urol., 166, 914-918.
5. Vandoninck V, Van Balken MR, et al. (2004). Neurolol and Urodyn. 23, 246-251.

59 ELETROMYOGRAPHYC STUDY OF THE DEVELOPMENT OF HEAD CONTROL IN FULL TERM BABIES

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INTRODUCTION

Electromyography has long been an instrument used to investigate posture activities in full-term (Hedberg et al., 2005) and pre-term (Fallang and Hadders-Algra, 2004) newborns, including those with cerebral palsy (Van der Heide et al., 2004). The control of head movements is not complete at birth and it must be established until the fourth month of life, since it is essential for the newborn's neuro-motor development. Such a postural control occurs when the posterior-superior muscles of the trunk are set in motion.

This study was aimed to compare the recruitment of posterior-superior muscles of the trunk by means of surface electromyography, measuring seated and prone postures in full term newborns aged between 15-90 days old.

METHODS

Twenty healthy term newborns of both genders aged 30-90 days old took part of this research study. Pre-term newborns as well as those with diagnosis of genetic anomalies, congenital malformations, neurological sequelae, infections or any other inborn condition resulting in motor alteration were excluded from the study. The newborns were divided into three groups: Group 1 consisting of 12 children aged 30 days old; Group 2 consisting of 5 children aged 60 days old, and Group 3 consisting of 3 children aged 90 days old. Participation in the groups required upper and lower limits of 5 days in relation to the established age. This work was approved by the Unifenas Human Research Ethics Committee. Procedures were performed according to recommendations from the project SENIAM (surface electromyography for non-invasive assessment of muscles). Surface electrodes were placed perpendicularly to spinous processes from T2 to T4 to assess muscular activity of the trunk posterior-superior region. Data on right and left sides were gathered simultaneously during 20 seconds and repeated three times for seated and prone postures. Child was positioned on a thin mattress regardless of the posture, then receiving audiovisual stimulus at 30cm distance to stimulate extension movement of the head. Data were analysed using the Kruskal-Wallis non-parametric test and Mann-Whitney test at $p < 0.05$.

RESULTS and DISCUSSION

Three groups of two postures each were evaluated. Significant difference was observed only for seated posture on the right side of the trunk. The group of 30 day old children was different from the groups of 60 day old and 90 day old ones. However, no significant difference was observed between these latter groups. In the studies by Hedberg et al. (2005) in which neck extensor muscles were evaluated through EMG for seated posture with anterior and posterior displacements of the body, no difference in the recruitment of such muscles was observed. This finding is in accordance with our study in terms of prone posture, but it is different for seated posture despite the lack of body displacement.

CONCLUSION

This study showed restrictions regarding the number of newborns evaluated. Nevertheless, one can observe that neuro-motor recruitment is different for seated posture, perhaps because the task demand is greater for such a position. For seated posture, the breadth of neuro-motor recruitment was not enough to demonstrate statistical difference.

Table 1 - Median comparison among different groups in the different postures and range

Group	Prone - Right (μv)	Prone - Left (μv)	Sit - Right (μv)	Sit - Left(μv)
1	14.7 (15.5)	9.8 (18.6)	11 (12.5)*A*B	11.5 (18)
2	18.3 (7.9)	16.5 (14.5)	21.3 (10.6)*A	19.1 (14.2)
3	24 (15.4)	30.5 (24.6)	22.8 (12.9)*B	18.8 (22.8)
p-value	0.074	0.094	0.006*	0.192

*p<0.05 significant difference
*A group 1 different from group 2
*B group 1 different from group 3

60 PATTERNS OF GAIT IN SEDENTARY ELDERLY WOMEN UNDERGOING ACTIVE REGULAR DANCE CLASSES

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INTRODUCTION

Aging is a natural process influenced by genetic, nutritional, lifestyle, lifestyle, among others. It is known that physical inactivity is a major contributor to the decline in physical capacity of the elderly. Besides the benefit of metabolic activities for the elderly, physical activity provides a mental well being. Dancing provides a socializing activity, capable of reducing the limitations of age, as it also stimulates the action of muscles, improving mobility and movement, and the balance of the elderly. You can then say that the dance has a character of biopsychosocial contribution (TRIBESS e VIRTUOSO, 2005). An evaluation tools able to verify the improvement of physical activity in these individuals is the kinematic analysis of gait, as there is a change in gait with age, as the decrease in stride velocity and slowness of the pitch. This study sought to characterize the gait of sedentary elderly women who underwent regular dance classes.

METHODS

The research was a cross-sectional, having been approved by the ethics committee of the State University of Paraíba (UEPB). Participants women 60 years or older were recruited the city of Campina Grande - PB. Inclusion criteria were: age 60 years or more and not engaging in regular physical activity for at least 02 months. Exclusion criteria were the same for both groups: history or case of myocardial infarction, angina pectoris and / or heart failure, diabetes mellitus type 1, insulin-dependent; problems myo-osteo-articular impeding movement, and use regular medications that interfere with balance. To assess the level of physical activity of participants used the Modified Baecke Questionnaire for Elderly (FLORINDO e LATORRE, 2003). The participants performed 40 days of classes, with three weekly sessions lasting one hour each, which were emphasized motor coordination, aerobic capacity and body balance.
Gait assessment, each participant walked walking a distance of 8 meters. Participants walked at their preferred speed, until the end of the runway in 5 attempts.
Rest breaks were provided whenever requested by the participants. Eight passive markers, made of reflective tape film 15 mm in diameter, were attached the following anatomical sites: a) greater trochanter of the femur, b) lateral condyle of tibia c) right fibular malleolus d) left tibial malleolus e) side of the right calcaneus, f) medial calcaneal left g) lateral head of the 5th metatarsal right; h) of the medial head of the 1st metatarsal left. A digital camcorder (Samsung ®, SDC173U) was positioned perpendicular to the distance traveled to film the right sagittal plane of the participants in order to view all labels and record one last intermediate-term of the right lower limb. The frequency of image acquisition was 60 Hz .
The images were analyzed with the program through the Digital Video for Windows – Dvideow.
The dependent variables of gait in the present study were: stride length (m), stride length (m), length of stride (s), stride velocity (m / s), cadence (pass / s) and duration of the phases single support, double support and swing in the past (%). For the analysis of variables was used Matlab 6.5.

RESULTS and DISCUSSION

Table 1

This Reasearch	
Velocity of footstep (m/s)	Length of footstep (cm)
0.98 ± 0.11	46.6± 0.27

Table 2

Oberg e cols.	
Velocity of footstep (m/s)	Length of footstep (cm)
1.15±0.16	55.3 ± 4.2

Table 3

Castro e cols..	
Velocity of footstep (m/s)	Length of footstep (cm)
1.05 ± 0.14	42.53 ± 1.1

The adult population has an average of 1.41 m male and female of 1.28 m in step length . This research points to the lower values reported for an individual adult, which was expected (Table 1), although proven to be even lower than the normative value described by Oberg e cols. (Table 2). It is worth noting that the height of the participants could explain the discrepancy found, as the Brazilian population is lower, which may determine a shorter step and walking slower.

CONCLUSIONS

According to the values found in the general elderly population, this study showed that regular dance classes for 40 days did not increase the performance vaiáveis gait of elderly participants in the evaluated parameters, although it has shown next to a research conducted by Castro cols. (2000) (Table 3). Although more research is needed with a time of greater application of the protocol to ascertain the effectiveness of this type of exercise.

REFERENCES

1. Castro CLN, Santos JACB, Leifeld PS, et al (2000). Estudo da marcha em idosos – resultados preliminares. Acta Fisiátrica; 7(3): 103-107.
2. Florindo AA, Latorre MRDO (2003). Validação e reprodutibilidade do questionário de Baecke de avaliação de atividade física habitual e em homens adultos. Rev. Bras. Med.; 9(3): 121-128.
3. Oberg T, Karsznia A, Oberg K (1993). Basic gait parameters:reference data for normal subjects. 10-79 years of age. J Rehabil Res Dev; 30(2): 210-31.
4. Tribess S, Virtuoso Jr. JS (2005). Prescrição de exercícios físicos para idosos. Rev.Saúde.Com; 1(2): 163-172.

61 KINEMATIC ANALYSIS OF GAIT IN ELDERLY SEDENTARY SUBJECT TO REGULAR WORKOUT CLASSES

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INTRODUCTION

Human aging is responsible for the progressive decline in all physiological processes. Around 60 years ago a reduction of the maximum muscle strength between 30 and 40%. Also highlighting the loss of bone mass leading to osteoporosis. Physical inactivity is seen as a major responsible for these and other functional limitations in the elderly, such as decreased flexibility, joint mobility, balance and coordination. A Physical activity may delay or limit the installation of a malfunction occurring sedentary lifestyle (JACOB FILHO, 2006). The exercises aimed at preserving the functional activities of daily living, providing a longer time of independence of elderly people for tasks that require strength, balance and coordination. This study aimed to analyze the gait of elderly sedentary were subjected to regular fitness classes.

METHODS

The research was a cross-sectional, having been approved by the ethics committee of the State University of Paraíba (UEPB). Participants 7 women 60 years or older were recruited the city of Campina Grande - PB. Inclusion criteria were: age 60 years or more and not engaging in regular physical activity for at least 40 days. Exclusion criteria were the same for both groups: history or case of myocardial infarction, angina pectoris and / or heart failure, diabetes mellitus type 1, insulin-dependent; problems myo-osteo-articular impeding movement, and regular use of drugs that interfere with balance. To assess the level of physical activity of participants used the Modified Baecke Questionnaire for Elderly (FLORINDO and LATORRE, 2003). All participants performed two months of weight training activities, with three weekly sessions lasting one hour each, which consisted of: active exercises free, active resistance exercises and stretching to the upper and lower limbs. Gait assessment, each participant walked walking a distance of 8 meters. Participants walked at their preferred speed, until the end of the runway in 5 attempts. Rest breaks were provided whenever requested by the participants. Eight passive markers, made of reflective tape film 15 mm in diameter, were attached the following anatomical sites: a) greater trochanter of the femur, b) lateral condyle of tibia c) right fibular malleolus d) left tibial malleolus e) side of the right calcaneus, f) medial calcaneal left g) lateral head of the 5th metatarsal right; h) of the medial head of the 1st metatarsal left. A digital camcorder (Samsung ®, SDC173U) was positioned perpendicular to the distance traveled to film the right sagittal plane of the participants in order to view all labels and record one last intermediate-term of the right lower limb. The frequency of image acquisition was 60 Hz . The images were analyzed with the program through the Digital Video for Windows - Dvideow.

The dependent variables of gait in the present study were: stride length (m), stride length (m), length of stride (s), stride velocity (m / s), cadence (pass / s) and duration of the phases single support, double support and swing in the past (%). For the analysis of variables was used Matlab 6.5.

RESULTS and DISCUSSION

Table 1

This Reasearch	
Velocity of footstep (m/s)	**Length of footstep (cm)**
0.96 ± 0.135	0.46± 0.04

Table 2

Oberg e cols.	
Velocity of footstep (m/s)	**Length of footstep (cm)**
1.15 ± 0.16	55.3 ± 4.2

Table 3

Castro e cols..	
Velocity of footstep (m/s)	**Length of footstep (cm)**
1.05 ± 0,14	42.53 ± 1.1

Eight to nineteen percent of the elderly have difficulty in walking, increasing over the years, its main determinants sine length step and cadence. The adult population has an average of 1.41 m male and female of 1.28 m in length step. The double support step is inversely proportional to the increase in speed, increasing significantly with age. JUDGE et al (1993) observed significant improvements of gait after 12 weeks of moderate strength training and balance in elderly suggesting a relationship between walking speed free speed, balance and strength activities (Table 1). Compared with the normative data of Oberg e cols. (1994) (Table 2), the sample had decreased values of stride velocity and stride length, although its results close to those found in Castro cols. (Table 3).

CONCLUSIONS

According to the values found in the general elderly population, this study showed that a weight training protocol of 40 days did not increase the performance vaiáveis gait of elderly participants in the parameters. Although more research is needed with a time of greater application of the protocol to ascertain the effectiveness of this type of exercise.

REFERENCES

1. Jacob Filho, W (2006). Atividade física e envelhecimento saudável. Rev. bras. Educ. Fís. Esp.; 20 (5): 73-77.
2. Florindo AA, Latorre MRDO (2003). Validação e reprodutibilidade do questionário de Baecke de avaliação de atividade física habitual e em homens adultos. Rev. Bras. Med.; 9(3): 121-128.
3. Judge JO, Underwood M, Gennosa, J (1993). Exercise to improve gait velocity in older persons. Arch. Phys. Med. Rehabil.; 74: 400-406.
4. Oberg T, Karsznia A, Oberg K (1993). Basic gait parameters:reference data for normal subjects. 10-79 years of age. J. Rehabil. Res. Dev.;30(2): 210-31.
5. Castro CLN, Santos Jacob, Leifeld PS et al (2000). Estudo da marcha em idosos – resultados preliminares. Acta Fisiátrica; 7(3): 103-107.

62 COMPARISONS BETWEEN ELECTROMYOGRAPHIC ACTIVITIES OBTAINED BY VOLUNTARY CONTRACTION AND IRRADIATION OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION

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INTRODUCTION

The proprioceptive neuromuscular facilitation (PNF) offers specific techniques as the irradiation (Adler, 2000), whose therapeutic effect are described for different neuromotor problems (Wang et al, 1994, Meningroni et al, 2009). However, the voluntary recruitment muscular obtained with FNP patterns and that one evoked indirectly through the irradiation had been not yet confronted. Thus, the aim of the present study was to compare the upper limbs muscular activity produced by direct and voluntary form (during a FNP pattern in upper limbs), and indirect (when the irradiation technique was applied in lower limbs).

METHODS

Sixteen dexterous, healthy individuals had participated of the study (8 men and 9 women), with 18 the 24 years (21± 1.61). Electrodes of surface bipolar Delsys® had been used settled bilaterally in the muscles anterior deltoid (OF), posterior deltoid (DP), pectoral greater (PT), external oblique (OE) and an electrode of reference fixed in the lateral of the trunk. The data collection had lasted 3 seconds and the sampling frequency was of 1000 Hz. The data collection conditions included: (1) rest (r) with upper limbs in neutral position; (2) free diagonal (DL) of extension-aduction- internal rotation in right upper limb; (3) isometric contraction during the diagonal of left lower limb in flexion, aduction and external rotation (IRR) with the upper limbs in rest. Signals EMG had been gotten in millivolts (mV) and normalized by the maximum voluntary contraction (MVC) carried through in the test position. The Root Mean Square (RMS) was gotten and used for analysis of the data by means of the programs Microsoft Excel and Kaleida Graph. For the analysis statistics the Statistics program (version 5.0) was used and applied test t of Student for dependent samples.

RESULTS

It had difference in EMG activities between the conditions tested for the majority of the muscles (Table 1). EMG activities obtained in IRR was higher than DL.

Table 1. Result of test t of Student in the conditions of R (rest), DL (free diagonal) and IRR (irradiation of the lower limb for the upper limb).

	Conditions	R x DL	DL x IRR
Muscles t-value (p-value)	DA	-4.39 (0.0005)*	-0.09 (0.92)
	DP	-2.91 (0.01)*	-0.51 (0.61)
	PT	-3.92 (0.001)*	2.87 (0.01)*
	OE	0.98 (0.34)	-4.77 (0.0002)*
	DA_E	-4.19 (0.0007)*	-2.39 (0.03)*
	DP_E	-1.56 (0.13)	-2.99 (0.009)*
	PT_E	-1.12 (027)	-1.05 (0.30)
	OE_E	-1.64 (0.12)	-4.35 (0.0005)*

DISCUSSION

The irradiation between the upper limbs was studied by Pink (1981) while in the present study, the approach was investigate the phenomenon of the lower member for the upper limb. With respect to the adopted method, it has similarities in the tool of register and the position of test. The pattern chosen differs, as well as the monitored muscles. However, the results point in one same direction: the overflow of the emg activity for segments not exercised.

The proper mechanics and corporal position seem to be involved in the activation biggest of certain muscles, as Shimura and Kasai (2001) had suggested. Condition IRR supposedly generated isometric contraction of iliopsoas, the most powerful muscle of the diagonal in vogue. Iliopsoas exerts an action on the lumbar column that can result in increase of lordose due to its origin and insertion. To counterbalance such action, the abdominal muscles activation must occur to maintain lordose and to stabilize the trunk. In similar way, the ipsilateral posterior deltoid also was activated during condition IRR in order to assist in the stability. Therefore, in accordance with Gribble et al (1998), posterior deltoid activation intensifies when the rotation of the trunk is ipsilateral to the movement.

CONCLUSIONS

It is possible to obtain muscular activation of indirect form using the irradiation and the magnitude of this recruitment can surpass that one obtained by direct form.

REFERENCES

1. Adler SS, Beckers D, Buck M. PNF in practice – an illustrated guide. (2000) Springer Verlag.
2. Wang RY. (1994).The effect of proprioceptive neuromuscular facilitation in case of patients with hemiplegia of long and short duration. Phys. Ther. 12, 25-32.
3. Pink M. (1981).Contralateral Effects of Upper Extremity Proprioceptive Neuromuscular Facilitation Patterns. Phys. Ther. 61(8): 1158-1162..
4. Shimura K, Kasai T. (2002). Effects of proprioceptive neuromuscular facilitation on the initiation of voluntary movement and motor evoked potentials in upper limb muscles. Hum. Mov. Sci.. 21, 1, 101-113,.
5. Gribble PL, Mullin LI, Cothros N, Mattar A. (2003). Role of Cocontraction in Arm Movement Accuracy. J. Neurophysiol. 89: 2396-2405.

63 COCONTRACTION INDEX COMPARISON OF MUSCLES BICEPS BRAQUIALIS AND TRICEPS BRAQUIALIS DURING THE PERFORMANCE OF A PUSH UP EXERCISE ON THE FLOOR

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INTRODUCTION

Muscle cocontraction is defined as the contraction of several muscles around the same joint, and is associated to motor learning, joint protection and body stability (Fonseca et al. 2001). Besides being associated to the body dynamic adjust, co-contraction may occur when the subject is beginning the practice of physical exercise. Because of the non familiarization with the movement a lack of neural and muscle systems adaptation happens, generating a possible recruitment of agonist muscles as well as antagonist of the desired movement (Hakkinen, 1994). During the process of familiarization to the movement a gradual decrease of cocontraction occurs, which may be evaluated using electromyography (EMG). Thus, this study aimed to compare the muscle co-contraction index of agonist and antagonist muscles of forearm extension of the elbow joint during push-up exercise on the floor, performed by two different groups: practitioners (P) and not-practitioners (NP) of regular physical exercise.

METHODS

Sample: twenty male students of the university where the study took place, with means of 23.5±13 years, 177±13 cm height, 75.6±27.8 kg of body mass. Participants were divided between practitioners (10) and not practitioners (10) of regular physical activities. Selection criteria's were: (1) be or not practicing physical exercise for a minimum of three months, (2) regular practitioners were only subjects with a minimum frequency of twice a week.

Evaluation Protocol: (1) two 9 seconds maximum isometric voluntary contraction (MIVC), of muscles biceps braquialis (BB) and triceps braquialis (TB), bilaterally, with 5 minutes interval between MIVC; (2) performance of 10 repetitions of the push up exercise (EA) on the floor. Execution velocity of EA was guided by an audible feedback (4 s).

Data acquisition: During all protocol steps bilateral neuromuscular activity of TB and BB was evaluated. EMG data acquisition was performed using surface electrodes on bipolar configuration. EMG signal was collected using a four channel Miotool electromyography (Miotec Equipamentos Biomédicos, Porto Alegre, Brasil), through software Miograph 2.0, using sample frequency of 2000 Hz per channel. During EA images were collected using a webcam, which were used for dividing the phases of the movement.

Signal processing: EMG signal was processed using Data Acquisition System SAD [(2002) (www.ufgrs.br/lmm)]. A 3rd order Butterworth digital filter ((20-500 Hz) was used. EMG signal was analyzed on time domain, from RMS envelop calculus, using 0.05s hamming window. EMG normalization was performed using the highest value of RMS envelop obtained on both MIVC's.

Data analysis: cocontraction index of muscles BB and TB during EA was determined using a routine on software MATLAB®. The procedures adopted for the co-contraction index were: (1) determination of curve covering the common area of the normalized curves of BB and TB; (2) determination of the area under the normalized curves of TB and BB muscles; (3) determining the common area between TB and BB muscle curves; and (4) calculating the cocontraction index equation 1, according to Candotti et al., (2009).

Equation 1:

$$\%COCON = 2 \times \frac{AC}{AANT + AAG} \times 100\%$$

Where:
%COCON = cocontraction index;
AC = common area between TB and BB muscles curves;
AANT = Area under BB muscle curve;
AAG = Area under TB muscle curve.

Cocontraction index was calculated during forearm extension (phase 1) and flexion (phase 2) phases on 10 repetitions of EA movement on the floor. Statistical treatment was performed on software SPSS 17.0. Co-contraction index differences and inter groups differences in each phase of the movement were verified using a One-Way ANOVA ($p<0.05$).

RESULTS and DISCUSSION

Results show that during the EA there is a higher cocontraction index on the NP group of subjects during forearm extension phase (table 1).

Table 1 – cocontraction index of groups P and NP.

	Phase 1	Phase 2
P	18.66 ± 5.96 %	22.51 ± 7.95 %
NP	22.32 ± 10.51 %	23.33 ± 9.80 %
P value	0.001*	0.367

* $p<0.05$

It is speculated that the difference found between groups on phase 01 is from a higher familiarization of the movement form subjects on group P. A movement's practice generates a motor learning which is related to subject's performance improvement due to the consequent improve on the coordination between nervous central system and muscle system. Corroborating to the present study, Sale (1988), states that simultaneous contraction of the agonist muscle and its antagonist may be evidenced when the subject is not trained or apt to the task, which occurred with group NP.

CONCLUSIONS

The lack of familiarity with a particular gesture generates a higher IC which is designed to provide greater stability. Although the calculation of the index of cocontraction can assist in the evaluation of neuromuscular coordination.

REFERENCES

1. Fonseca ST, et al. (2001). Análise de um método eletromiográfico para quantificação da co-contração muscular. Rev. Bras. Ciên. e Mov. 9.3, 23-30.
2. Hakkinen K. (1994). Neuromuscular adaptation during Strength training, Aging, Detraining, and Immobilization. Clinic Review Physiology Rehabilitation Medicine. 6.3,161-198.
3. Moritani T, Devries HA. (1979). Neural factors versus hypertrophy in the time course of muscle strength gain. American J. Phys Med, 58, 115-30.
4. Sale DG. (1988). Neural Adaptation to Resistance Training. Medicine Science Sports Exercise. 20.5, S135-S45.
5. Candotti CT, et al. (2009). Cocontraction and economy of triathletes and cyclists at different cadences during cycling motion. Journal of Electromyography and Kinesiology.19, 915-921.

64 COMPARISON OF COCONTRACTION INDEX OF TRUNK MUSCLES IN TWO LIFTING TECHNIQUES OF OBJECT FROM THE GROUND

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INTRODUCTION

Neuromuscular activity of the flexor muscles of the spine has been consistently observed during symmetric lifting tasks (LT) of objects from the ground. However this fact is contradictory, because activity of antagonistic muscles generates an opposite flexor moment to the extensor moment required to perform the LT (van Dieën et al., 2003). Spine function of stabilization and stiffness gain generated by antagonist cocontraction is one possible explanation for this fact. Yet this cocontraction increases compressive loads on the spine (Vera-Garcia et al., 2006). Thus, in order to understand the role of cocontraction during LT and to assist the production of biomechanical models to calculate internal forces in the spine, the goal of this study was to compare the agonistic and antagonist muscles cocontraction index (CI) on spine extension during the course of the LT in two different techniques.

METHODS

Sample: 30 volunteers, male, no history of spine pathologies, 28.4 ± 7 years, 173 ± 7 cm in height and 71.8 ± 8.1 kg body weight.
Assessment protocol: (1) two maximal voluntary isometric contractions (MVIC) of the muscles rectus abdominal (RA), external oblique (EO), iliocostalis (I) and longuissimus dorsi (LD), lasting 7s and 3 min interval between each MVIC. (2) 8 repetitions of the LT of an object with equivalent mass of 20% of body (weight) mass measured on two techniques: stoop and squat. The speed of the LT was paced by an audible feedback (16 s).
Data acquisition: during the course of the LT the muscles RA, EO, I and LD on the right side were assessed. EMG data acquisition was performed with 4 pairs of surface electrodes in bipolar configuration. Skin´s preparation and electrodes position followed the norms established by ISEK/SENIAN (Merletti, 1999). EMG signal was acquired with an electromyograph Miotool (Miotec Biomedical Equipment, Porto Alegre, Brazil), through the software Miograph 2.0, with a sampling frequency of 2000 Hz. During the LT, images were acquired from a Webcam, which were used for a division of the LT in 4s four phases: (Phase 1) trunk flexion without the object, (Phase 2) trunk extension with the object, (Phase 3) trunk strength with the object and (Phase 4) extension without the object returning to initial standing position.
Processing of signals: EMG signals were processed through the data acquisition system SAD [(2002) (www.ufgrs.br / lmm)]. It was used a 3rd order Butterworth filter (20-500 Hz). The EMG signal was analyzed in the time domain from the calculation of the RMS envelope, with hamming windowing of 0.5 s. Normalization of the EMG signal was carried from the higher value of RMS envelope obtained in two MVIC´s.
Data analysis: (1) determination of the weighted average for the cross-sectional area of the flexor muscles (RA and EO) and trunk extensors (IL and LT). (2) the calculation of the CR of the flexors and extensors of the trunk during the LT was determined using equation (1), according to Candotti et al. (2009).

Equação 1:

$$\%COCON = 2 \times \frac{AC}{AANT + AAG} \times 100\%$$

Whereby:
COCON%= index of co-contraction;
AC = Common area between the curves of the flexor and extensor muscles of the trunk;
AANT = Area under the curve of the flexor muscles of the trunk;
AAG = Area under the curve of the extensor muscles of the trunk;

The CR was calculated only for Phases 2 and 3 of the LT. The differences between the CR lifting techniques (KB and KE) in the stages of movement with the presence of external load (the object) were taken through a One-Way ANOVA ($p < 0.05$).

RESULTS and DISCUSSION

The results show that during the implementation of the LT Phase 3 showed no difference between the CR of the survey techniques used. Since Phase 2, which corresponds to trunk extension with the object, showed a higher CR in the LT with KB (Table 1).

Table 1 – Index of co-contraction of TL.

	Fase 2	Fase 3
JE	22.5 ± 7.9 %	28.9 ± 16.5 %
JF	23.3 ± 9.8 %	28.4 ± 19.9 %
P	0.02*	0.84

* p<0.05.

Based on the results it was possible to observe the occurrence of neuromuscular activity of the flexor group independent of the technique used to perform the LT. According to Van Dieën et al. (2003) co-contraction of trunk muscles during a LT is modulated in response to the occurrence of a mechanical perturbation. This antagonist cocontraction increases the stability of the spine and allows smoother motion. Granatta and Marras (2000) found that in upright postures of the spine, as those in the LT with KB there is a greater antagonist co-contraction with the objective of providing greater spine stability. Already in positions of greater spine flexion, as in the LT with KE, there is a reduction in antagonistic cocontraction with the objective of reducing the compressive forces on the spine.

CONCLUSIONS

The lifting task with flexed knees presented a higher IC due to the need of stabilizing the CV, result of a higher antagonistic activity which may generate greater internal forces at CV.

REFERENCES

1. Candotti C, Loss J, Bagatini D, Soares D, Da Rocha, E, De Oliveira Á, Guimarães A. (2009) Cocontraction and economy of triathletes and cyclists at different cadences during cycling motion. Journal of Electromyography and Kinesiology, 19, 915-921.
2. Granata KPP, Marras WSP. (2000) Cost-Benefit of Muscle Cocontraction in Protecting Against Spinal Instability. Spine, 25, 1398-1404.
3. Merletti R. (1999) Standards for reporting EMG data. J Electromyogr Kinesiol, 9, 3-4.
4. Van Dieën JH, Kingma I, Van Der Bug JCE. (2003) Evidence for a role of antagonistic cocontraction in controlling trunk stiffness during lifting. Journal of Biomechanics, 36, 1829-1836.
5. Vera-Garcia FJ, Brown SHM, Gray JR, Mcgill SM. (2006) Effects of different levels of torso coactivation on trunk muscular and kinematic responses to posteriorly applied sudden loads. Clinical Biomechanics, 21, 443-455.

65 METHODOLOGICAL PROPOSAL FOR SURFACE ELECTRODES POSITIONING ON THE WRIST AND FINGERS MUSCLES THROUGH ANTHROPOMETRIC MEASUREMENTS OF FOREARM

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INTRODUCTION

Surface electromyography (SEMG) is an important noninvasive modality for the study of muscle function, observing the biomechanics and motor control of human body. Although there is an effort to standardize the use of this reaource, there is still a great variety of methodologies and equipment to formalize their use in assessment of forearm muscles due to their small belly and proximity to each other.

In view of this and following the recommendations of Hermens et al (2000), the aim of this study was to match up the motor points of different muscles of the forearm with anthropometric measurements of the forearm and hand to determine the placement of surface electrodes.

METHODS

The study included 10 subjects, 5 male and 5 female, aged between 18 and 30 years (mean 22.5 ± 3.37) with no history of joint or muscle injury in the upper limbs and no complaints of musculoskeletal pain during the evaluation. All participants signed a consent form approved by the Ethics in Human Research Committee of the Federal University of Triângulo Mineiro (UFTM).

Equipment for electro-stimulation with FES (Functional Electrical Stimulation) was used to locate the motor point of each muscle, using a pen-type active electrode and a dispersive electrode plate-type shaped, positioned over the anterior face of the homo-lateral arm. The muscles analyzed were: flexor carpi ulnaris (FUC); flexor carpi radialis (FRC); flexor digitorum (FD); extensor carpi ulnaris (EUC) and; extensor radialis brevis and longus (ERC). Initially, were carried out the location of motor points in only one volunteer and the points were marked on the forearm with a dermographic pencil. Then, two axes were marked on the forearm, being called as medial longitudinal axis (ELM) for the flexors and as lateral longitudinal axis (ELL) for the extenders. The two horizontal axes extend from each epicondyle of the humerus toward the distal end of the 3rd finger, with the forearm in neutral position. After these axes were marked, direct measurements were made along the axes till the marks of each motor point. At these points located perpendicular to the axis, were measured in circumference (Cir) of the forearm. Three measurements were performed, with the Cir 1 located for the FRC, the Cir 2 located for the FUC and the ERC and Cir 3 for EUC. The FD was located directly on the ELM without the need of a circumference to its location. Following, these measures were transformed into percentage of the length of the axes for the longitudinal measures and into percentage of the circumference of forearm to the perpendicular ones. For measurement of the axes and the circumferences were used a retractable metal tape measure.

Subsequently, measurements were made in 10 volunteers, about the two longitudinal axes and measures of the 3 circles in the forearm and the points located in relation to them. To confirm these points located by anthropometry, was performed electro-stimulation with FES on the set point and confirmed by specific muscle contraction performed due to electrical stimulation. The marking and electro-stimulation were performed bilaterally, aggregating 20 samples.

RESULTS and DISCUSSION

For validation of each point, was determined to display a visible or palpable contraction of the muscle belly of each muscle when subjected to the electrical stimulation. Using pen-type electrode, were accepted a variation of no more than 1cm ² around the point, since this distance does not interfere with the collection of the electromyographic signal.

The position of motor-points about the percentage of the longitudinal and circumferences are shown for the extensor muscles in Figure 1 and for the flexors in Figure 2.

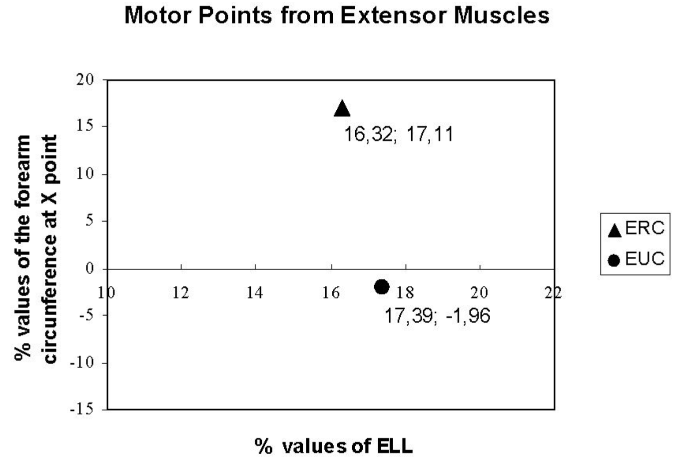

Figure 1 - Location of extensor mm. starting from the lateral epicondyle of the humerus (EL). Percentile values reported in the distance from the ELL to the X axis and percentile of the circumference of the forearm just distal to the markings to the axis Y.

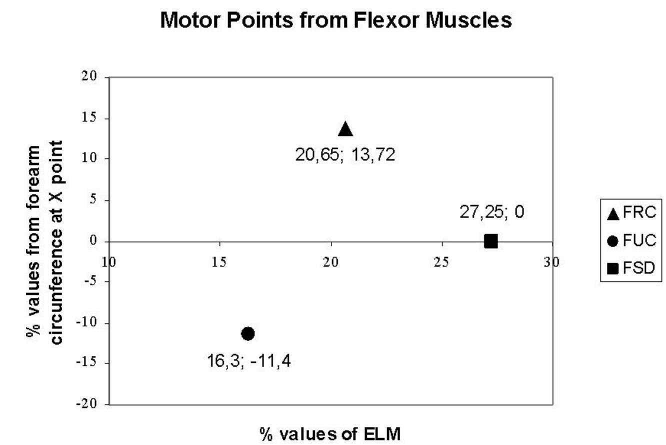

Figure 2 - Location of Flexor mm. starting from the medial epicondyle of the humerus (MS). Percentile values reported in the distance from the ELM to the X axis and percentile of the circumference of the forearm just distal to the markings to the axis Y.

CONCLUSIONS

It was possible to locate the motor points of the wrist flexors, wrist extensors and finger flexors by using percentage of anthropometric measurements of the upper limb (length and circumference). Thus, it is possible to use these markings to reliably SEMG samples and following the routines percentages for measures in accordance with the proposition of SENIAM (Surface Electromyography for Non-Invasive Assessment of Muscles) (SENIAM PROJECT, 2010) similarly as used for placement of electrodes on the big muscles.

REFERENCES

1. Hermens HJ, Freiks B, Disselhorst-Klug C, Rau G. (2000). Development of recommendations for SEMG sensors and sensor placement procedures, 10, 361-374.
2. Seniam Project. [Homepage at Internet]. [Enschede, The Netherlands]: The Seniam Project; c1996-2010 [acess on 2010 Feb 20]. Disponible at: Http//www.seniam.org/.

66 ANALYSIS OF ELECTROMYOGRAPHIC ACTIVITY OF THE WRIST AND FINGERS MUSCLES DURING THE CARRYING OUT OF ISOMETRIC STRENGTH OF GRIPPING TASK

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INTRODUCTION

Just a few studies over surface electromyography (SEMG) of the forearm muscles single-handedly are made due to difficulty in placing the electrodes. The muscles are numerous and some are overlapping, which makes it hard to locate. Another problem is regarding the use of SEMG as an indirect measure of muscle strength (Oliveira et al., 2008).

Therefore, the purpose of this study was to examine the electromyographic activity of the wrist and fingers muscles single-handedly for the gripping task and check the correlation between the electromyographic signal of the forearm muscle and its strength on grip task held on a hydraulic dynamometer.

METHODS

The study included 18 subjects, 10 males and 8 females, aged between 18 and 30 years (mean 21.95 ± 3.03) with no history of joint or muscle injury in the upper limbs and no complaints of musculoskeletal pain. All participants signed a consent form approved by the Ethics in Human Research Committee of the Federal University of Triângulo Mineiro (UFTM).

All evaluations were performed only on the dominant side, and 2 volunteers, one female and one male, were left-handed.

For signal acquisition was used electromyography (EMG® System do Brasil Ltda) 8-channel, band pass from 20 to 500 Hz with common mode rejection> 120 dB, input impedance> 10 MΩ and gain of 100 times in the conditioner and 20 times in the bipolar active-electrode, totaling 2000 times. Electrodes Ag/AgCl, disc-shaped self-adhesive with gel, 1cm of diameter, 2cm apart center-to-center were used, after shaving and cleaning the skin area with 70% alcohol.

Software WinDaq (Dataq Instruments®) was used for data acquisition, which were scanned by A/D converser board of 16-bit resolution and sampling frequency of 1 KHz for each channel. All precautions were taken during the compilation and processing of data as recommended by the International Society of Electrophysiology and Kinesiology (ISEK). (Marchetti & Duarte, 2006)

The electrodes were placed on the muscles flexor carpi radialis (FRC), flexor carpi ulnaris (FUC), flexor digitorum (FD), extensor carpi radialis (ERC) and extensor carpi ulnaris (EUC) after the location of its motor points applying excito-motor current and measuring their locations following anthropometric measurements of forearm and hand.

Participants were seated on a chair with forearm support to maintain an angle of 90° between the arm and forearm. The forearm was maintained in neutral. The electromyographic signal was collected in 3 repetitions of maximal voluntary isometric contraction (MVIC) in the hand grip dynamometer and recorded the maximum isometric strength during the MVIC.

To normalize the signal, it was collected during the manual muscle strength test (TFMM) for each muscle separately. The duration of contraction for both the 3 repetitions of MVIC and to TFMM of each muscle was 3 seconds with 1 minute interval between each collection to prevent possible muscle fatigue.

RESULTS and DISCUSSION

The values of the amplitude of the signal are represented in the root mean square (RMS). The electromyographic values concerning the 3 replications of MVIC used to calculate the EMG-force were normalized by the ratio between the average value of RMS obtained in three repetitions of the MVIC and the RMS value obtained in TFMM of each muscle.

To calculate the estimated strength, this study was based on the research of Oliveira et al., 2008. It was considered the electromyographic activity of the total sum of normalized RMS values of all muscles (EMG total), the electromyographic activity of the wrist flexors as the RMS sum of FUC and FRC (EMG_FP), the activity of the wrist extensors as the sum RMS EUC and ERC (EMG_EP) and activity of the finger flexors RMS value obtained in these one (EMG_FD). The calculation of the estimated strength of extensors (feEP), the wrist flexors (FeFP) and finger flexors (FeFD) was performed, respectively, by the following equations: 1) EMG of wrist flexors X maximum force on the dynamometer / EMG total; 2) EMG of wrist extensors X maximum force on the dynamometer / EMG total, 3) EMG of finger flexor X maximum force on the dynamometer / EMG total. Thus, it was possible to estimate the force exerted by the muscles of the wrist and fingers during the MVIC in the dynamometer. To calculate the percentage of the estimated strength for each muscle group was used the equation: estimated strength X 100 / maximum force. Mean values and standard deviations are presented in Table 1.

Table 1 - Mean values and standard deviations of the estimated strength and % of the estimated strength.

FPP [Kgf]	FeFP	% FeFP	FeEP	% FeEP	FeFd	% FeFD
37.74 ±12.6	13.81 ±4.72	36.96 ±5.57	14.32 ±5.01	38.19 ±6.05	9.60 ±4.72	24.84 ±7.12

The average total grip strength was 37.74 Kgf (± 12.6 Kgf), and this, 36.96% (SD ± 5.57%) corresponds to the estimated strength of wrist flexors (FUC + FRC), 38.19% (SD ± 6.05) estimated the strength of wrist extensors (EUC + ERC) and 24.84% (SD ± 7.12) estimated the strength of the flexors of fingers.

Correlation of the sum of the normalized RMS (EMG total) with the values of maximum force on the dynamometer was performed. The values of correlation for the EUC, ERC, FUC, FRC and FD were 0.02, -0.22, 0.19, -0.36 and 0.13, respectively. These values show no significant correlation between the electromyographic activity of the wrist and fingers muscles and the overall strength of grip, according to Pearson correlation.

CONCLUSIONS

According to the results and according to the methodology employed, can't be said that there is a significant correlation between electromyographic activity of the muscles of the forearm and grip strength on maximal voluntary isometric contraction.

REFERENCES

1. Disselhorst-Klug C, Schmitz-Rode T, Rau G. (2009). Surface electromyography and muscle force: Limits in sEMG-force relationship and new approaches for applications, 24, 225-235.
2. Marchetti PH, Duarte M. (2006). Instrumentação em eletromiografia.
3. Oliveira AC, et al. (2008). Influência da posição do braço na relação EMG-força em músculos do braço, 15, 222-227.

67 CHARACTERIZATION OF ELDERLY'S GAIT SUBJECT TO REGULAR PROGRAM GYMNASTIC

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INTRODUCTION

With age there is a series of physiological and biomechanical changes in the individual. One such change concerns the strength that decreases approximately 15% from 50 years in addition to reduced muscle mass, which leads to decrease in walking speed. The reduction in the balance, present in the aging process, also contributes to a lower speed in walking, creating uncertainty in the afternoon, slowing the steps. Physical inactivity is responsible for some of these declines in the elderly. It has been shown physical activity as a tool for slowing the decline biopsychosocial faced in the process of aging. Gymnastics, when well targeted, provides the individual with the physical activity you need in order to develop their physical, mental and social individual, contributing biopsychosocial. This study sought to characterize the march through the kinematic analysis of sedentary elderly women subjected to a regular fitness program.

METHODS

The research was a cross-sectional, having been approved by the ethics committee of the State University of Paraíba (UEPB). Participants women 60 years or older were recruited intentionally in physical activity programs systematically in Campina
Grande - PB. Inclusion criteria were: age 60 years or more and not engaging in regular physical activity for at least 02 months. Exclusion criteria were the same for both groups: history or case of myocardial infarction, angina pectoris and/or heart failure, diabetes mellitus type 1, insulin-dependent; problems myo-osteo-articular impeding movement, and use regular medications that interfere with balance. To assess the level of physical activity of participants used the Modified Baecke Questionnaire for Elderly (FLORINDO e LATORRE, 2003). All participants performed two months of gym activities, three weekly sessions lasting one hour each, which consisted of strength training (free active exercises with and without the ball, resistance exercises, exercises with the use of medicine-ball) balance (leg support with and without visual control, with and without support of hands) and coordination.
Gait assessment, each participant walked walking a distance of 8 meters. Participants walked at their preferred speed, until the end of the runway in 5 attempts. Rest breaks were provided whenever requested by the participants. Eight passive markers, made of reflective tape film 15 mm in diameter, were attached the following anatomical sites: a) greater trochanter of the femur, b) lateral condyle of tibia c) right fibular malleolus d) left tibial malleolus e) side of the right calcaneus, f) medial calcaneal left g) lateral head of the 5th metatarsal right; h) of the medial head of the 1st metatarsal left. A digital camcorder (Samsung ®, SDC173U) was positioned perpendicular to the distance traveled to film the right sagittal plane of the participants in order to view all labels and record one last intermediate-term of the right lower limb. The frequency of image acquisition was 60 Hz
The images were analyzed with the program through the Digital Video for Windows - Dvideow (Instrumentation Laboratory in Biomechanics - Unicamp, BARROS et. Al., 1999). The dependent variables of gait in the present study were: stride length (m), stride length (m), length of stride (s), stride velocity (m / s), cadence (pass / s) and duration of the phases single support, double support and swing in the past (%). For the analysis of variables was used Matlab 6.5.

RESULTS and DISCUSSION

The Table 1 shows the characteristics of the gait of the research sample.

Table 1: Description analyses of gymnastic group

	Avarege	Deviation	Variance	Median
Stepfoot length (m)	0.48	0.03	0.002	0.47
Step length (m)	1.03	0.06	0.004	1.01
Step's Time (s)	1.02	0.09	0.010	1.00
Step Velocity (m/s)	1.03	0.13	0.019	1.06
Cadence (pass/s)	0.99	0.09	0.008	1.00
Time SSP*(s)	40.44	1.36	1.86	39.98
Balance (%)	41.22	3.93	15.51	41.10
Double SS**(%)	18.60	2.59	6.722	17.40

* Simple Support Phase, ** Step Support

The results show that the parameters of gait in elderly women participating in a program of regular exercise typically have a stride length greater than a group of healthy elderly (0.48 m vs 0.46 m), however the values of the cadence (0, 99 pass / s vs 2.2 paas / s) and stride velocity (1.03 m / s vs. 1.07 m / s) are lower than the general population of elderly people (Castro, Santos and LEIFELD et al. 2000). Compared with the adult population, the stride length has decreased (1.03 m vs. 1.28 m), such as a linear decrease in gait velocity and no dependency on the rhythm developed (MASHIMA and CAROMANO, 2002).

CONCLUSIONS

The study shows that a protocol of regular fitness activities in general 40 days did not alter the variables of performance the progress of the elderly participants to levels higher than the elderly population in general. However, it is still necessary studies with a duration of action longer in order to verify the effectiveness of this type of physical activity.

REFERENCES

1. Castro CLN, Santos JÁ, Leifeld OS, et al (2000). Estudo da Marcha do Idoso: resultados preliminares. Acta Fisiátrica, 7, 103-107.
2. Florindo AA, Latorre MRDO (2003). Validação e reprodutibilidade do questionário de Baecke de avaliação de atividade física habitual e em homens adultos. Rev. Bras. Med.; 9(3): 121-128.
3. Mashimoto AM, Caromano FA. (2002). A Marcha em Idosos Saudáveis. Arq. Ciênc. Saúde Unipar, 6, 117-121.

68 COMPARATIVE STUDY OF THE OPERATING PARAMETERS OF ELDERLY UNDER THREE DIFFERENT PROGRAMS OF FITNESS

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INTRODUCTION

Kinematics is the geometry of movement in relation to the forces that cause, representing a change of position in space that can be linear or angular. In the linear kinematics, describes the movement around the speed and acceleration, while the angle around the arc. For the analysis techniques are used in cameras and camcorders to calculate the position and orientation of the body part that you want to analyze in order to reconstruct the movements that occur, may be measured in two or three dimensions. This method provides the researcher the opportunity to analyze the motion in detail, and provides a permanent record. (MAGANHOTO e TORRO, 2005). The assessment of gait and the reassessment of the therapeutic method used, has been of fundamental importance to the achievement of good conduct. The recommended physical activity in the well being of the body, capable of mediating a balance musculoskeletal. For this to occur we must balance the normalization of muscle tone, articulation and sound intact neural coordination. In view of this, this study was aimed to verify, through the kinematic analysis of gait, compare characteristics of three distinct group of group of sedentary elderly women subjected to three programs of regular exercise.

METHODS

The study was a cross-sectional, having been approved by the ethics committee of the University State of Paraíba (UEPB). Participants women 60 years or older were recruited the city of Campina Grande - PB. Inclusion criteria were: age 60 years or more and not engaging in regular physical activity for at least 02 months. Exclusion criteria were the same for both groups: history or case of myocardial infarction, angina pectoris and / or heart failure, diabetes mellitus type 1, insulin-dependent; problems myo-osteo-articular impeding movement, and use regular medications that interfere with balance. To assess the level of physical activity of participants used the Modified Baecke Questionnaire for Elderly (QBMI - Voorrips, 1991). All participants performed 40 days of activities, weight training, gymnastics and dance, with three weekly sessions lasting one hour each, which consisted of: active exercises free, active resistance exercises and stretching to the upper and lower (weightlifting), strength training (free active exercises with and without the ball, resistance exercises, exercises with the use of medicine-ball), balance (leg support with and without visual control, with and without support of hands) and ordination (gymnastics), motor coordination, aerobic capacity and body balance (dance). Gait assessment, each participant walked walking a distance of 8 meters. Participants walked at their preferred speed, until the end of the runway in 5 attempts. Rest breaks were provided whenever requested by the participants. Eight passive markers, made of reflective tape film 15 mm in diameter, were attached the following anatomical sites: a) greater trochanter of the femur, b) lateral condyle of tibia c) right fibular malleolus d) left tibial malleolus e) side of the right calcaneus, f) medial calcaneal left g) lateral head of the 5th metatarsal right; h) of the medial head of the 1st metatarsal left. A digital camcorder (Samsung ®, SDC173U) was positioned perpendicular to the distance traveled to film the right sagittal plane of the participants in order to view all labels and record one last intermediate-term of the right lower limb. The frequency of image acquisition was 60 Hz.

The images were analyzed with the program through the Digital Video for Windows - Dvideow (Instrumentation Laboratory in Biomechanics - Unicamp, BARROS et. Al., 1999).

The dependent variables of gait in the present study were: stride length (m), stride length (m), length of stride (s), stride velocity (m / s), cadence (pass / s) and duration of the phases single support, double support and swing in the past (%). For the analysis of variables was used Matlab 6.5.

RESULTS and DISCUSSION

The research findings are deposed in Table 1. The values of gait parameters of the groups studied were similar to variably,

But they were not significant ($p> 0.05$) and taking the measurements of stride length and duration values are more distinct.

The results of gain in muscle performance and consequentimente in functional skills, like walking, occurs after a period of more than two months (KISNER and COLB, 2005) and this may have been a factor in the absence of differences between groups and shows the interference of the emphasis placed by them.

CONCLUSIONS

The quantitative analysis of the performance parameters of gait in elderly women subjected to a fitness program showed no statistically significant difference between the modalities Conditioners studied. However, because of the reduced sample used, it is necessary to study a larger scale to confirm this finding.

REFERENCES

1. Florindo AA, Latorre MRDO (2003). Validação e reprodutibilidade do questionário de Baecke de avaliação de atividade física habitual e em homens adultos. Rev. Bras. Med. ; 9(3): 121-128.
2. Kisner C, Colby L (2005). A. Exercícios Terapêuticos: Princípios e Técnicas. Ed. Manole.
3. Maganhoto TF, Torro TEC, et al.____
4. Perry J. Análise de Marcha (2005). Ed. Manole, v. 1.

Table 1: Description analyse and variation of groups researches.

	Significance Level	Average of Workout and deviation	Average of Gymnastic and desviation	Average of Dance and deviation
Footstep Length (m)	p = 0.6852	x = 0.461; s = 0.043	x = 0.48; s = 0.039	x = 0.466; s = 0.027
Step Length (m)	p = 0.3391	x = 1.000; s = 0.077	x = 1.032; s = 0.063	x = 0.980; s = 0.035
Step's Time (s)	p = 0.7797	x = 1.045; s = 0.082	x = 1.025; s = 0.099	x = 1.020; s = 0.088
Step Velocity (m/s)	p = 0.3408	x = 0.966; s = 0.135	x = 1.035; s = 0.136	x = 0.954; s = 0.117
Cadency (step/s)	p = 0.5162	x = 0.960; s = 0.071	x = 0.992; s = 0.092	x = 0.976; s = 0.084
Time SSP* (s)	p = 0.9801	x = 40.646; s = 2.353	x = 40.448; s = 1.364	x = 40.280; s = 1.645
Balance (%)	p = 0.4848	x = 41.034; s = 1.583	x = 41.221; s = 3.938	x = 40.130; s = 1.390
Double SS** (%)	p = 0.7628	x = 18.315; s = 2.964	x = 18.608; s = 2.593	x = 19.060; s = 2.987

*Single support phase; **Support step.

69 THE EFFECT OF THE RESTRICTED SIT-TO-STAND TASK ON JOINT TORQUES IN SUBJECTS WITH AND WITHOUT PARKINSON'S DISEASE

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INTRODUCTION

Rising from a seated position is a basic functional task, but standing up from sitting is a complex task, especially when there are motor dysfunctions, like Parkinson's disease (PD). During sit-to-stand, the subjects with PD who move slowly demonstrate a large proportion of co-contraction because they move slower [Bishop, et al. 2005]. The slowness could be due to the incapacity to change the torque direction [Mak, et al. 2003]. However, if the trunk is restricted in the sagittal plane, the ankle and knee joint torques would reveal different behavior during sit-to-stand, specially requiring greater leg-extensor strength [Hughes, et al. 1996]. This could help for new insights for evaluation and treatment of subjects with PD. The primary aim of this study was to compare the torques produced at the ankle, knee and the hip joints in subjects with and without PD.

METHODS

Fifteen subjects voluntarily participated in the study. These included 7 healthy subjects (NN group) and 8 subjects with Parkinson's disease with a mean age of 63.7 (±4.9) years and 63.9 (±10.2) years respectively. For the subjects with Parkinson's disease, the mean duration of disease was 7.6 (±3.7) years. All the subjects with PD showed bilateral involvement and were classified as stage II in the Hoehn and Yahr scale. All the PD subjects were medicated and undergoing physiotherapeutic treatment.

All subjects with PD were tested after 12 hours of medication withdrawal. The sit-to-stand task was done using a chair with adjustable height, with initial position of the 70° of hip flexion and 60° of knee flexion. The shoulders were kept at 90 degrees of flexion to restrict trunk movements in the sagittal plane [Dionisio et al. 2008]. The subjects were instructed to perform the sit-to-stand movement as fast as possible after verbal command. The angular displacements of the hip, knee and ankle joints, and the linear displacements of the shoulder, hip, knee and ankle were registered by LED (*light emission diodes*) markers placed at greater trochanter, lateral epicondyle of the femur, lateral malleolus, and the lateral aspect of the acromion) and over the calcaneus, fifth metatarsal head and the posterior corner of the force plate. The LED emissions were captured at a frequency of 100 Hz using a three-dimensional optical system (OPTOTRAK® 3020, Northern Digital Inc., Waterloo, Ontario, CA). The force plate (*AMTI OR6-5, Watertown, MA, USA*) was used to record the ground reaction forces, at a sampling frequency of 1000 Hz. The Kinematic (angular and linear displacement) and Kinetic (torques and center of pressure) were processed using a Matlab® software. The anthropometric data was obtained based on weight and sex of each subject using Zatsiorsky's model modified by Paolo de Leva [Dionisio et al. 2008]. The joint torque of the hip, knee and ankle was normalized to each subject's weight. The mean of the COP and joint torques were calculated in 4 phases of the movement.

RESULTS and DISCUSSION

Subjects with PD showed more flexion at the ankle, knee and hip joints and increased ankle, knee and hip joint torques in comparison to healthy subjects in the final position. However, this joint torques can be explained by the differences in kinematic data. Also, the hip, knee and ankle joint torques were not in the acceleration phase. The slowness could be compensated by the stiffness, characteristics of the PD people. Also, the interaction torques could be lead in the similarities of torques.

CONCLUSIONS

Compared with the healthy subjects, subjects with PD with moderate involvement used a similar pattern to perform the sit to stand transition, include the joint torques, but the velocity of movement was affected by their bradykinesia. So, the use of a sit-to-stand task with a restriction for subjects with PD would allow the generation of joint torques values similar to healthy subjects, which would reduce the difficult in the task performance.

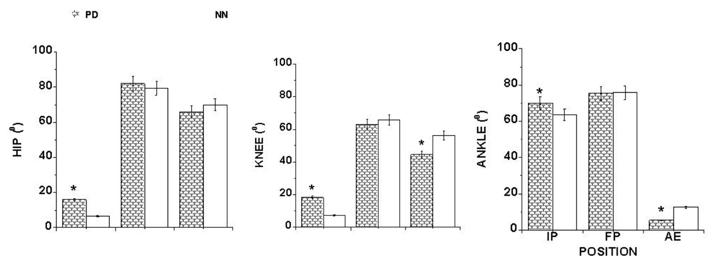

Figure 1. Angular positions (initial, IP and final, FP) and angular excursion (AE) measured in degrees of hip (A), knee (B) and ankle (C) during sit-to-stand. The data represents means and standard error of all healthy (NN, open squares) and subjects with PD (PD, closed squares).

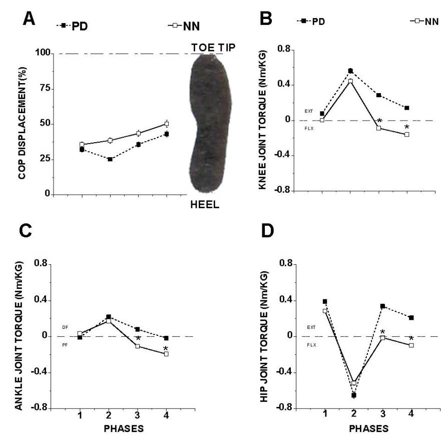

Figure 2. This figure depicts the average of the COP (A); knee (B), ankle (C) and hip (D) joint torques (Nm/kg) during the four phases of sit-to-stand movement across all subjects. (NN, open squares; PD, closed squares). EXT= extension; FLX= flexion; DF= dorsiflexion; PF= plantar flexion.

REFERENCES

1. Bishop M, Brunt D, Pathare N, Ko M, Marjama-Lyons J. Changes in distal muscle timing may contribute to slowness during sit to stand in Parkinsons disease. Clin Biomech. 2005; 20(1): 112-7.
2. Mak MK, Levin O, Mizrahi J, Hui-Chan CW. Joint torques during sit-to-stand in healthy subjects and people with Parkinson's disease. Clin Biomech. 2003; 18(3):197-06.
3. Dionisio VC, Almeida GL, Duarte M, Hirata RP. Kinetic and EMG Patterns during Downward Squatting. J Electromyogr Kinesiol 2008;18:134-43.
4. Hughes MA, Myers BS, Schenkman ML. The role of strength in rising from a chair in the functionally impaired elderly. J Biomech 1996; 29: 1509-13.

70 THE EFFECT OF AGE IN HABITUAL CHEWING

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INTRODUCTION

Chewing is one of the most important functions of the stomatognathic system.
Masticatory mechanisms are flexible and, when disabled, are easily compensated (Piancino et al., 2005). This can explain the considerable variation in the magnitude, duration and time of masticatory cycles in healthy subjects (Vitti et al., 2007). The aim of this study was to analyze the electromyographic activity of left and right masseter and temporal muscles, in 177 individuals from 7 to 80 years, divided in five groups: I=7-12, II=13-20, III=2-40, IV=41-60 and V=6-80 years to compare the habitual chewing in children, adolescents, young adults, adults and elderly, all nasal breathers, Angle's Class I, without parafunctional habits and symptoms of temporomandibular disorder.

METHODS

Surface electromyography was performed using five channels of the Myosystem-Br1 apparatus (DataHominis Ltd.), with simultaneous acquisition and common grounding to all channels. sEMG data were collected using surface differential electrodes (two Ag–AgCl bars, 10 × 2 × 1 mm, with 10 mm interelectrode distance, gain of 20, input impedance of 10 GO and common mode rejection ratio of 130 dB – Myosystem, São Paulo, Brazil). EMG signals were sampled by a 12-bit A/D converter board with afrequency of 2 kHz, and band-pass filtered at 0.01–1.5 kHz. The habitual chewing was verified through the electromyographic signal obtained during chewing of five peanuts and five raisins. The electromyographic signals of all the masticatory cycles were collected in three replicates of ten seconds, intercalated by two minutes of rest and, after this process, it was used the mean value. The masticatory efficiency of cycles between individuals was evaluated by the ensemble average of the electromyographic signal, and this value was obtained in microvolts/second, during the time. The values of ensemble average were normalized by the value of the electromyographic signal of maximum dental clenching, harvested by four seconds. The electromyographic means were tabulated and subjected to statistical analysis using ANOVA (SPSS 17.0).

RESULTS

There was significance ($p < 0.05$) for chewing with raisins and peanuts respectively: MD=[(I = 0.47 ± 0.03), (II=0.32 ± 0001), (III=0.44 ± 0.03), (IV=0.46 ± 0.03), (V=0.48 ± 0.07)]; ME=[(I=0.45 ± 0.02), (II=0.38 ± 0.05), (III=0.43 ± 0.37), (IV= 0.53 ± 0.06), (V=0.68 ± 0.08)] , TE=[(I = 0.54 ± 0.04), (II=0.45 ± 0.03), (III=0.50 ± 0.04), (IV=0.63 ± 0.05), (V=0.68 ± 0.13)]; MD=[(I=0.81 ± 0.06), (II=0.55 ± 0.03), (III=0.81 ± 0 , 07), (IV=0.69 ± 0.05), (V=0.64 ± 0.06)].

CONCLUSIONS

It was concluded that changes occurred in the patterns of activation of the masticatory muscles as times goes by, and the elderly individuals need a higher number of masticatory cycles to obtain the same masticatory performance of younger individuals.

ACKNOWLEDGEMENT

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REFERENCES

1. Piancino M.G., Farina D., Talpone F.,
2. Castroflorio T., Gassino G., Margarino V., Bracco P.(2005). *J Oral Rehabil*., Dec; 32 (12) :863-70.
3. Galo R., Vitti M, Mattos Mda G., Regalo S.C.(2007). *Gerodontology*, 244-248.

71 LEVODOPA INTAKE INFLUENCE ON NEUROMUSCULAR RECRUITMENT LEVEL DURING THE GAIT IN PARKINSON'S DISEASE PATIENTS: PILOT STUDY

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INTRODUCTION

Parkinson's disease (PD) is a neurodegenerative disorder characterized by the loss of the dopaminergic neurons located in the basal ganglia structure. As a consequence, these patients have difficulties to perform cyclic movements and show a premature activity of the muscles to compensate the slowness of movements (Nieuwboer et al., 2004). So, the capacity of walking independently decrease and this factor can increase the risk of falling (Morris, 2001). Some studies have been showing that the spatial-temporal parameters of the gait improved after levodopa intake (Moore et al., 2008). However, it's not known the effect of this intake on the EMG activity level during gait in PD patients. So, the aim of this study was to characterize the effect of the levodopa therapy in the neuromuscular activity level during gait in PD patients.

METHODS

This study was approved by the Local Ethics Committee (Protocol # 2635). Two PD patients participated in this pilot study (65.5 ± 3.5 years); Patient 1 – Stage 2 in the Hoehn & Yahr (HY) scale, Medications – Parkidopa/Carbidopa and Pramipexole (375 mg/day); Patient 2 – Stage 1.5 in the HY, Medications – Levodopa/Benserazide (200 mg/day). Participants were asked to walk on a 8m pathway with a 1,4 m width. In the first phase of the data collection, the patients were wearing off medication at least 8 hours and in the second phase, one hour after the medication intake (on effect of medication), the same experimental protocol was applied. Three trials were performed for each phase of the data collection. During the gait, EMG signals were collected from the muscles Vastus Lateralis (VL), Biceps Femoris (BF), Tibialis Anterior (TA), Gastrocnemius Medialis (GM) and Lateralis (GL) with a sample rate of 2000 Hz using an biological conditioner. The signal acquisition followed the ISEK/SENIAM recommendations. The data were filtered using a Butterworth filter, 4 th order and a band pass filter (20-500 Hz) (Barela, Duarte, 2008). For the data analysis the central stride of the pathway was considered. The following events were evaluated: Heel strike (0-10%) and Terminal stance (30-60%) (Schmitz et al., 2009). The eletromyographic signal was normalized by the mean of each stride, calculating the RMS values. The RMS values were treated in a descriptive way, considering the mean and the standard deviation of the three trials for each condition for the two subjects.

RESULTS and DISCUSSION

The Table 1 presents the mean and standard deviation values of the RMS for each muscle. Generally, for the patient 1, in the heel strike, after the medication intake it was observed an increase in the muscular recruitment level for VL, VM, BF, TA, with a decreased in these values for GL and GM muscles. However, for the patient 2, this tendency was opposite and a decrease in the RMS values for the VL, VM, BF and TA muscles was observed with an increase for the GL and GM values. For the Terminal stance, this tendency was opposite for each subject. These results indicate that the muscular activation behavior is influenced by the levodopa intake. It was also possible to observe that these effects were greater for the patient 1. These preliminary results can be explained for the different stages of the disease for each patient. Therefore, the patient 1 was classified in a severe stage (bilateral impairment) when was compared with patient 2. Therefore, it's possible to affirm that in different stages of disease, the PD patients could perform different strategies to control the movements. However, it's necessary an evaluation with more subjects to elucidate this topic.

CONCLUSIONS

Based on these results, it was possible to conclude that the levodopa therapy induced changes in the muscular recruitment. However, these effects are dependents of the evolution disease stage of the patient.

REFERENCES

1. Barela AMF, Duarte M. (2008). J Electromyogr Kinesiol, 18, 446-454.
2. Moore ST, et al. (2008). Exp Brain Res, 184, 469-478.
3. Morris ME, et al. (2001). Clin Biomech, 16, 459-470.
4. Nieuwboer A, et al. (2004). Brain, 127, 1650-1660.
5. Schmitz A, et al. (2009). J Electromyogr Kinesiol, 19, 1085-1091.

Table 1: Mean and standard deviation of the eletromyographic profile (RMS) of the muscles VL, VM, BF, TA, GL and GM normalized for each phase of the strike for both PD patients.

Medication	Patients	HEEL STRIKE						TERMINAL STANCE					
		MUSCLES						MUSCLES					
		VL	VM	BF	TA	GL	GM	VL	VM	BF	TA	GL	GM
ON phase	1	1.56 (1.77)	1.47 (0.93)	1.37 (1.52)	0.71 (0.15)	1.59 (1.06)	1.47 (1.84)	0.90 (0.26)	1.38 (0.19)	1.43 (0.83)	0.52 (0.01)	0.89 (0.22)	1.56 (1.16)
	2	2.52 (1.24)	2.82 (0.90)	1.69 (1.67)	3.22 (0.09)	0.46 (0.07)	0.38 (0.27)	1.61 (1.67)	1.28 (1.04)	2.42 (0.98)	0.35 (0.09)	0.09 (0.01)	0.51 (0.80)
OFF phase	1	2.77 (0.61)	2.83 (0.37)	2.31 (0.23)	0.92 (0.39)	0.83 (0.31)	0.80 (0.60)	2.04 (0.61)	1.49 (0.53)	1.98 (0.36)	0.84 (0.24)	0.81 (0.24)	0.66 (0.14)
	2	1.89 (1.47)	2.10 (1.75)	1.61 (1.91)	1.93 (1.55)	0.93 (0.81)	0.91 (1.12)	1.62 (1.50)	1.44 (1.51)	1.77 (1.31)	1.23 (0.98)	0.18 (0.17)	0.08 (0.06)

72 COMPARISON OF ELECTROMYOGRAPHIC ACTIVITY OF THE ANKLE DURING THE PERFORMANCE OF DIFFERENT TASKS

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INTRODUCTION

The complex of the ankle-foot to meet the demands of stability through a stable base of support for the body in a variety of positions in the discharge weight without causing an undue muscular activity (NORKIN; LEVANGIE, 2001). Thus the surface electromyography (SEMG) is an important way for understanding the functioning of the neuromuscular system during activities that generate instability (SODERBERG, KNUTSON, 2000). It is a noninvasive method that records the electrical potentials of motor units derived from muscle fibers through electrodes placed on the skin (TUCCI, 2007). The aim of this study was to compare the electromyographic activity of the ankle while performing different tasks that generate instability in this joint.

METHODS

Ten volunteers participated in this study, five men and five women, aged 21 (±3.7) years old and 20 (± 1.8) years old respectively. All subjects were healthy with no history of joint injury or muscle in the lower limbs and no complaints of musculoskeletal pain. All participants signed a consent form, and the project was approved by the Ethics in Human Research of the Universidade Federal do Triângulo Mineiro.
The subjects performed three tasks. The task 1 (T1) supporting the right leg, the task 2 (T2) supporting the left and Task
3 (T3) to maintain the standing position on the board of proprioception spherical. During these tests was collected electromyographic signal for three seconds. To normalize the signal, this was collected during the test manual muscle strength (TMMS) for each muscle separately.
To collect the unipodal the subjects were instructed to flex the knee to 90 ° being parallel to the opposite knee and remain in that position for three seconds. Then, collection was performed on the board of proprioception spherical, in which individuals maintained a support base of fifteen centimeters. This value was measured with a tape measure.
The placement and positioning of surface electrodes followed the stipulations of the protocol SENIAM (Surface Electromyography for the Non-invasive Assessment of Muscles). These electrodes were placed on the tibialis anterior (TA) and peroneus longus (PL) and brevis (PB) from both legs and the ground electrode was placed in the sternal region. Before placing the electrodes the skin was shaved with a fine sandpaper was removed the layer of dead cells and then cleaned with alcohol 70% (HERMES & FRERIKS, 2000).
The electromyographic activity of muscles was recorded by electromyography (EMG System in Brasil® Ltda) eight-channel, passes from 20 to 500 Hz with common mode rejection > 120 dB, input impedance > 10MOHms and gain of 100x in conditioner signs and 20x in the bipolar electrode active totaling 2000x. Electrodes Ag / AgCl, in the form of self adhesive disc and diameter of 1 cm with gel.
We compared the values of RMS standard between men and women by ANOVA and there was no statistical difference, so the analysis was performed with 10 volunteers, without separation by gender. We used a oneway ANOVA and factorial ANOVA with a significance level of 5%.

RESULTS and DISCUSSION

The values of the amplitude of the electromyographic signal were represented in the root mean square (RMS). The EMG values were normalized by the ratio of the RMS value of each task and the RMS value obtained in TMMS of each muscle.
The mean values and standard deviations of RMS values of the standard are presented in Table 1.

	TA	PB	PL
Task 1	0.73 (± 0.76)	1.73 (± 0.93)	0.94 (± 0.65
Task 2	0.91 (± 0.78)	2.93 (± 0.78)	0.87 (± 0.43)
Task 3 R	0.23 (± 0.29)	0.28 (± 0.37)	0.18 (± 0.23)
Task 3 L	0.27 (± 0.29)	0.39 (± 0.80)	0.16 (± 0.13)

TA = tibialis anterior, PB = peroneus brevis e PL = peroneus longus

We observed a higher activity of the peroneus brevis muscle (PB) in all tasks.
Initially we carried out factorial ANOVA to determine whether there was interaction between muscle and task and has not been verified interaction ($p = 0.900$). Thus the tasks 1 and 2 were compared, without separating the muscles and there was no statistically significant difference ($p = 0.786$). The tasks were separated and the different muscles in each task were compared and statistical differences were found in Task 1 of the muscles TA and PB (Table 2).

Table 2 - Values of *p* for comparison between muscles for the tasks 1 and 2.

	TASK 1	TASK 2
TAxPB	0.022*	0.13 NS
TAxPL	0.816 NS	0.99 NS
PBxPL	0.085 NS	0.10 NS

* Significant at $p < 0.05$

In Task 3 the muscles were compared to the right and left and there was no difference ($p = 0.799$ for the right side and $p = 0.602$ for the left side). However when comparing the leftright sides there was significant difference ($p = 0.00005$).

CONCLUSIONS

It can be concluded that the activity of the peroneus brevis muscle was higher in all tasks, but this difference was significant only in task 1.

REFERENCES

1. Norkin CC, Levangie PK. Complexo do tornozelo- pé. In: Norkin CC, Levangie PK. Articulações Estruturas e Funções: Uma Abordagem Prática e Abrangente. 2. ed. Rio de Janeiro: Revinter, 2001. Cap. 12, p. 373-411.
2. Hermes HJ, Frerik B. Development of recommendations for semg sensors and sensor placement procedures. Journal Eletromyography kinesiology. New York v.10, n.5, p.361-74, 2000.
3. Tucci HT. Avaliação eletromiográfica de músculos da cintura escapular e braço durante a realização de exercícios com a extremidade distal do segmento fixa e carga axial controlada. [Dissertação de Mestrado da University from São Paulo]. Ribeirão Preto, 2007.

73 ELETROMYOGRAFIC ANALYSIS OF SEMITENDINEOUS AND RECTUS FEMORALIS MUSCLES IN KNEE MOVEMENTS

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INTRODUCTION

The quadriceps muscles of lower limb acts during knee joint movements. The rectus femoralis muscle is the one of the four quadriceps muscles that is involved in hip flexion and knee extension. In this way, the semitendineous muscle acts in knee flexion, demonstrating antagonist functions (Drake et al., 2004). This fact shows the importance of knowlegde of the actuation of each structure in knee joint movements.

The aim of this work was evaluated the eletromiographic activity of semitendineous and rectus femoralis, during knee extention, bilaterally.

METHODS

Six healthy volunteers (age mean 25.5 ± 3.72) were submitted to eletromyographic evaluation of semitendinous and rectus femoralis muscles, during an isometric contraction in the movement of extension of the knee, in standing position.

The skin was prepared and the surface electrodes were located following SENIAM (2009).

The *Root Mean Square* (RMS) was done and the mean of the three repetitions were obtained and normalizaded. The statistical analyses was performed by ANOVA ($p<0.05$).

RESULTS and DISCUSSION

The results didn't show statistically significant differences when compared the right with the left semitendinous muscles ($p = 0.0761$; $p = 0.01266$) and rectus femoralis ($p = 0.0513$), during the extension of right and left knee.

However, statistical significant different was observed when compared the right and left rectus femoralis ($p = 0.0018$) during extension of left knee.

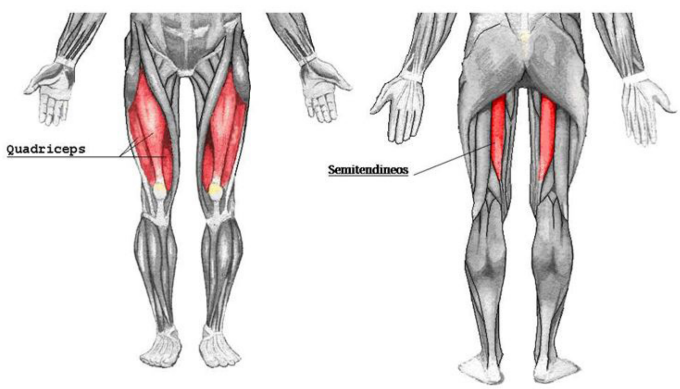

Figure 1: Quadriceps and semitendineous muscles

The muscular interference in knee joint movement has being focus of interest. A research was conducted to verify the electromyography response of antagonist muscles in the knee extension, showing importance in give orientations for training exercise (Bara Filho et al., 2008).

CONCLUSIONS

It can be concluded that the rectus femoralis is an important muscle in realize extension of the lower extremity and the semitendineous may contribute to maintenance of posture in standing position. Although, more research were necessary to verify the interference of different muscles during a knee joint movement.

REFERENCES

1. Drake RL, et al (2004). Gray's Anatomy for Students. Elsevier.
2. SENIAM, www.seniam.org, 2009.
3. Bara Filho M, et al. (2008). Rev Bras Biom. 9(16): 12-17.

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74 COMPARISON OF FREE AND ADAPTIVE WALKING BEFORE AND AFTER THE FATIGUE INDUCTION: PRELIMINARY RESULTS

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INTRODUCTION

The full walking analysis should consider the different environments where this movement pattern is performed (Patla, 2003). The walking patterns in regular environments presents a few adjustments (free walking - FW), however, to perform this pattern in irregular environments adaptive strategies and a more refined control is required than free walking (adaptive walking - AW). Several factors influencing the control of movement have been studied to understand the walking control, such as the fatigue influence study (Helbostad et al., 2007). Fatigue is still a potential factor to increase the risk of falling (Parijat and Lockhart, 2008; Bellew, Fenter, 2006). To keep the motor performance, new intrasegmentary organization in the presence of fatigue is required. However, there is a lack of knowledge about the fatigue effect on the walking, especially in the adaptive walking, in which the motor control requirement is higher (Pierucini-Faria et al., 2006). As a result, possible changes in muscle activation can occur. Thus, the aim of the study was to compare the electromyographic activity in free and adaptive walking of three young women before and after fatigue induction.

METHODS

Three healthy young females participated in this study (age - 22±3.4 years, body mass - 60.6±6.3 kg, height - 1.62±0.06 m). The study was approved by local Ethics Committee (Protocol 2055/2008). For analysis of free walking, each participant walked, in their preferred walking speed, a distance of 8m. In the adaptive walking, the participant walked the same distance, but an obstacle of 0.15 m in height (Pijnappels et al., 2008) was in the middle of this distance. Each subject performed 3 trials of this task before, immediately after and 5 minutes after fatigue. Fatigue was induced through the sitting and rising task. This task was performed from a chair without arms (Helbostad et al., 2007) with a 0.4Hz frequency, controlled by means of a metronome. Fatigue was determined by the volunteers inability to perform the proposed movement or to maintain the desired cadence. Electromyographic sinal of the vastus laterallis, biceps femoralis and medial gastrocnemius of both lower limbs was reordered during the free walking by an biological conditioner (sample rate - 2000Hz) with eight channels (EMG System do Brazil Ltda.). The signals acquisition followed the ISEK/SENIAM recommendations. The data were filtered with high pass Buttherworth 4th-order and bandpass filter 20-500Hz (Barela, Duarte, 2008). The two central strides were considered for the data analysis. In AW the stride before the obstacle and the step crossing the obstacle were analyzed. The following variables were determined for each condition: RMS of the entire cycle (one heel strike to the next of the same limb), peak EMG activity and muscle activation latency (time of onset of muscle activation to the peak). The Shapiro Wilk did not verify data normal distribution and therefore, Wilcoxon test was performed to verify the differences between FW and AW, before and after fatigue induction ($p < 0.05$).

RESULTS and DISCUSSION

Statistical analysis showed a significant difference before fatigue induction for muscle activation latency: a) biceps femoris of the leading limb in the stride before crossing the obstacle ($p = 0.01$) and in the stride crossing the obstacle ($p = 0.05$); b) biceps femoris of the support limb in the stride crossing the obstacle ($p = 0.002$) and c) gastrocnemius of the leading limb ($p = 0.001$) and of the support limb ($p = 0.005$) in the stride before crossing the obstacle. For the peak activation EMG were found differences before fatigue induction for biceps femoris of the support limb in the stride before crossing the obstacle ($p = 0.001$) and in the stride crossing the obstacle ($p = 0.002$). Concerning the RMS of the cycle before fatigue induction, were found differences for muscles: a) biceps femoris of the support limb for the stride before crossing the obstacle ($p = 0.003$) and in the stride crossing the obstacle ($p = 0.001$), and b) gastrocnemius of the support limb in the stride crossing the obstacle ($p = 0.01$). The muscle activation latency, the peak muscle activation and RMS of all cycle were higher in AW than FW. After fatigue induction, concerning latency, significant differences were found for muscles: a) biceps femoris of the support limb for the stride before crossing the obstacle ($p = 0.02$) and in the stride crossing the obstacle ($p = 0.02$), and b) biceps femoris of the leading limb in the stride crossing the obstacle ($p = 0.05$). The mean were higher for FW than AW. For absolute values of peak muscle activation, a significant difference was observed in the stride before crossing the obstacle ($p = 0.003$) and in the stride crossing the obstacle ($p = 0.002$). For the RMS of the cycle, it was found difference in the biceps femoris of the support limb in the stride before crossing the obstacle ($p = 0.001$) and in the stride crossing the obstacle ($p = 0.001$). The peak muscle activation and RMS of the cycle were higher for the AW condition. The results showed that muscle recruitment was modified according to the walking type of young women. The adaptive walk needs more muscle recruitment, both before and during the obstacle crossing The increase in recruitment level during the stride before crossing indicates modulations on the walking for the task with a higher demands, which is crossing the obstacle. Specifically for the muscle latency, the fatigue seems to interfere in the differences between the walking types. Before fatigue induction, AW showed greater delay in activation than FW, which seems to indicate a cautious strategy for crossing the obstacle. However, after fatigue induction the muscle latency was higher for the FW, indicating that fatigue reduces the ability to control movement.

CONCLUSIONS

It can be concluded, preliminarily, that the walking type, free or adaptive, interferes in the muscle recruitment and that fatigue modifies muscle activation latency between FW and AW.

REFERENCES

1. Barela AMF, Duarte M. (2008) J Electromyogr Kinesiol, 18, 446-454.
2. Bellew JW, Fenter PC. (2006) Arch Phys Med Rehabil, 87, 1486-1489.
3. Helbostad JL, et al. (2007) J Gerontol A Biol Sci Med, 62, 1010-1015.
4. Hunter SK, et al. (2005) Muscle Nerve, 31, 730-40.
5. Katsiaras A, et al. (2005) J Appl Physiol, 99, 210-216.
6. Parijat P, Lockhart TE. (2008a) Gait Post, 28, 568-573.
7. Parijat P, Lockhart TE. (2008b) Ergonomics, 51, 1873-1884.
8. Patla AE. (2003) IEEE Eng Med Biol Mag, 22, p. 48-52.
9. Pieruccini-Faria F, et al. (2006) Bras J Phys Ther; 10, 243–249.

75 EVALUATION OF ELETROMYOGRAPHIC ACTIVITY OF GASTROCNEMIUS MUSCLE DURING PLANTAR FLEXION

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INTRODUCTION

The muscles of lower limb are of the extremely importance in several movements of foot, including the human gastrocnemius muscle, important superficial muscle located in the back part of the lower leg and is involved in standing, walking, running and jumping (Drake et al., 2004).
Among their functions stands plantar flexion, component essential in several movements of daily life and fundamental in maintenance of balance in the standing position (Basmajian, 1976). In this way, an evaluation of electrical activity of gastrocnemius muscle in different foot positions becomes able to provide additional information about its work. The aim of this work was evaluate the electromyography of medial and lateral gastrocnemius muscles in different foot positions.

METHODS

In development of this work, six healthy volunteers (age mean 25.5 ± 3.72) were submitted to electromyography (EMG) of medial (MG) and lateral (LG) gastrocnemius muscle of right side, in three different foot positions:

- Neutral foot position (N)
- Foot turned to outside about 30º (O)
- Foot turned to inside about 30º (I)

The subjects performed isometric maximal voluntary plantar flexion contractions in situations describle above, in standing posture. The roles for EMG procedures were obtained in SENIAM (2009).
The individuals were performed three repetitions of each test during 05 seconds and the mean of Root Mean Square was obtained. The normalized values were used for data analyses and the statistical test was provide by ANOVA ($p<0,05$).

RESULTS and DISCUSSION

The data were compared between the neutral, outside and inside foot positions during plantar flexion, for medial gastrocnemius ($p = 0.73889$) and for lateral gastrocnemius ($p = 0.8179$).
The values of initial and final period of contraction also were analyzed for both muscles, medial ($p = 0.7244$) and lateral ($p = 0.8986$) gastrocnemius, to the right side.

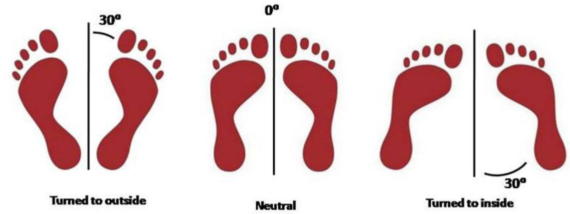

Figura 1: Foot positions for EMG data collecting

No statistical significant difference was observed in each comparison done. Has been shown that foot in neutral (N), internally-rotated (IR) and externally-rotated (ER) positions does alter relative muscle activation during heel raise exercise (LeFavi et al., 2009). However, in foot position analyses in this research, little have been studied.

CONCLUSIONS

It can conclude that the position of the foot doesn't interfere with the movement of plantar flexion but additional studies were necessary to clarify this subject.

REFERENCES

1. Basmajian J. (1976). Electro-fisiología de la acción muscular. Cambridge University Press.
2. Drake RL, et al. (2004). Gray's Anatomy for Students. Elsevier.
3. SENIAM, www.seniam.org, 2009.
4. LeFavi RG, et al. (2009). Medicine & Science in Sports & Exercise. 41(5): 137.

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76 ANALYSIS OF ELECTROMYOGRAPHIC MUSCLES ACTIVITY OF GAIT IN HEALTHY SUBJECTS WITH AND WITHOUT AFO DEVELOPED FOR PATIENTS WITH HEMIPARESIS

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INTRODUCTION

Gait is an extremely complex motor ability made up of a sequence of cyclical movements of the lower limbs for the locomotion of the body (Abreu 2008; De Vita et al. 2007)
The aim of the present study was to analyze and compare the electromyographic (EMG) signals of the rectus femoris (RF), vastus lateralis (VL), tibialis anterior (TA) and soleus (SO) muscles as well as spatial and temporal parameters (speed, step length, stride length, cadence) during gait in young healthy adults with and without the use of an experimental ankle-foot orthosis (AFO) designed for patients with hemiparesis

METHODS

Thirty-four individuals were recruited, but six did not complete the study. Thus, the sample was made up of twenty-eight healthy young adults (18 females and 10 males) between 18 and 30 years of age (mean age = 22 ± 3.63 years, height of 171.07 ± 0.08 cm and body mass of 69.57 ± 10.05 Kg)

Experimental AFO

The AFO in question was patented (patent no. 018090022818) and is a single piece that fits over the foot and 1/3 of the distal tibia (over the lateral and medial malleoli) and has a steel spring.

Figure 1 – Experimental ankle-foot orthosis (AFO)

A 16-channel electromyograph (EMG System do Brasil) with 20-500 Hz frequency band filter and amplifier (100x gain) and self-adhesive, disposable passive surface electrodes (Medtrace) coupled to a pre-amplifier (20x) were used to assess the EMG activity of the RF, VL, TA and SO muscles during gait with and without the AFO. The electrodes were placed over the motor point of the muscles, which was determined following SENIAM.
Two force plates (EMG System do Brasil) were used for capturing the ground reaction force curves to determine precisely the initial contact and impulse phases precisely. A footswitch (EMG System do Brasil) was placed in the heel region of the participant's shoe in order to have synchronism between the electromyography and force plates during the data collection.
A catwalk (5 meters long, 1.5 meters wide and 10 centimeters tall) containing the two force plates was used for the test. The participants walked along the catwalk six to 10 times – first without the AFO, then with it.

Statistical analysis

The paired Student's t-test was used for intra-group comparisons (pre and post). The level of significance was set at $p < 0.05$. Pearson's correlation analysis was employed to assess the relationships between the root mean squares of the muscles analyzed.

RESULTS and DISCUSSION

Kao & Ferris (2009) studied motor adaptations during dorsiflexion with the use of an AFO on 10 healthy individuals and found that ankle dorsiflexion increased substantially with the use of the AFO in comparison to its non-use, without altering EMG activity in the TA muscle. In contrast, the present study found an increase in EMG activity in the TA during the support phase when the participants were using the experimental AFO in comparison to its non-use, although this increase was non-significant. This may have occurred because the steel spring tends to retract during the end of the balance phase and beginning of the support phase.
The figure 2 shows the variation in RMS (root mean square) of EMG activity during initial contact.

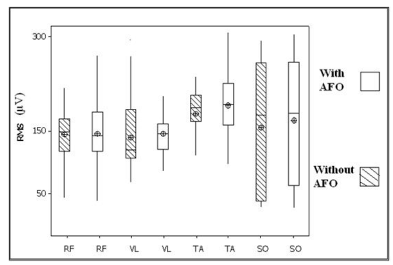

Figure 2 – Variation of EMG activity among muscles: RF, VL, SO and TA with and without AFO use during entire gait ($p>0.05$)

In the present study, there was a positive correlation between the EMG activity of the TA and SO muscles during the gait cycle. This likely occurred because the steel spring also offers resistance during the end of the support phase and beginning of the balance phase, making the plantar flexor muscles tend to increase their activity in order to overcome this resistance.

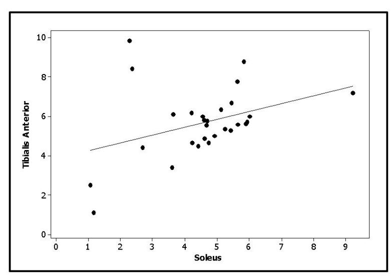

Figure 3 – Correlation between RMS (root mean square) of EMG activity of TA and SO muscles ($r = 0,37$) with and without AFO use throughout entire gait cycle ($p<0,05$).

CONCLUSIONS

The use of the experimental AFO by healthy young adults did not alter gait pattern. The increase in EMG activity of the TA during the support phase was expected, as one of the functions of this AFO is to assist dorsiflexion in patients with hemiparesis stemming from a stroke.

REFERENCES

1. Abreu SSE. (2008). Rev. bras. Fisioterapia 12(4): 15-21.
2. Kao PC, Ferris DP. (2009). Gait Posture 29: 230-236.
3. DeVita P, Heiseth J, Hortobagyi T. (2007) J. Exp. Biol. 210(19): 3361-3373

77 ANALYSIS OF THE MECHANISMS OF MOTOR CONTROL ADOPTED DURING THE MOVEMENT OF THE SHOULDER EXECUTED IN DEVICE REFORMER WITH DIFFERENT ELASTIC LOADS ACCORDING TO METHOD PILATES

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INTRODUCTION

The exercises of the Pilates Method can be carried through in the ground and equipment. In the equipment, the same ones are executed against the resistance of springs (elastic load), which impose an additional complexity to the execution and control of the movements. From a general way, during the gone movement of of an initial position until a target, the spring suffers a deformation and the external resistance offered by it increases gradually. The accumulated potential energy during the allonge of the spring is set free and the same one will tend to speed up the segment in return to the initial position. Although the abrangency of the use of the Pilates Method in the whitewashing, has few scientific studies that prove its effectiveness. This abrangency of the use of the method demonstrates, by itself, the necessity of a biomechanics description and motor control of the exercises, making possible a kinesiology agreement of the same ones. The objective of this work was to identify and to describe the kinematic strategies and of modulation of activity EMG of the main muscles during the execution of the movement of the shoulder with reversion carried through under the elastic load demand different in the Reformer equipment for not practicing individuals of the Pilates Method.

METHODS

Eight volunteers with band enter the 20 40 years, rights hand, without injury description muscle-esqueletic or neuromuscular they had participated of this study. The volunteers had been instructed according to carry through a task of extension and flexion of shoulder in the Reformer equipment Pilates method. Three levels (magnitudes) distinct had been used of springs (R1, R2 and R3). Five repetitions in each condition had been collected, totalizing fifteen movements. In the initial position, the volunteers had remained in dorsal decubitus, with the shoulders in flexion of 90° (perpendicular the stretcher of the equipment), the hands holding the handle of the device whereas the joints of the hip and knee remain in flexion of 90° (figure 1). From the initial position, the volunteers had been instructed to carry through a movement of 80° of extension of shoulder with the extended elbows, keeping the immovable trunk and inferior members. After this first phase of the movement, the volunteers had remained a time in the region of the target and, after that, they had returned to the initial position, while they carried through one second contraction of the abdominal muscle. The linear kinematics of the equipment were reconstructed through an optic system of three-dimensional analysis of movement (OPTOTRAK 3020) and the register of the muscular activities had followed the norms of the ISEK/SENIAM, through surface electrodes (DESLYS), composition for eight canals. Activity EMG of the following muscles had been collected: Previous deltoid (OF), Posterior Deltoid (DP), Pectoral Greater (PEC), Abdominal Rectum (FROG), Spinal Erector (EE), Femoral Rectum (RF), Isquitibial (IT). All kinematic data and EMG had been filtered and quantified using Matlab® software (Mathworks).

Figure 1.

RESULTS and DISCUSSION

Figure 2 sample that during a stage, the shoulder moves in extension from a flexion of 90º. In this phase, the spring suffers a stretching and the agonist muscle (DP) is activated, speeding up the member in direction to the target through a concentrical contraction. B stage is characterized by a substantial reduction of agonist activity EMG (DP) and antagonist (PEC) and a co-activation of this muscle through a isometric contraction. During c stage, the accumulated potential energy during the stretching of the spring is set free and the spring tends to move the member in return to the initial position. In this phase, muscle DP is activated of eccentric form to softly decelerate the movement in the initial position.
Figure 2: Linear displacement of coordinate X of the mark placed in the stand of the Reformer device (M2) and the three phases of the extension movement and flexion of the shoulder (A stages, B and C). Activity EMG of the pectoral greater (PEC) and posterior deltoid (DP) of the shoulder. Linear displacement is given in millimeters, activity EMG in Volts and time in seconds.

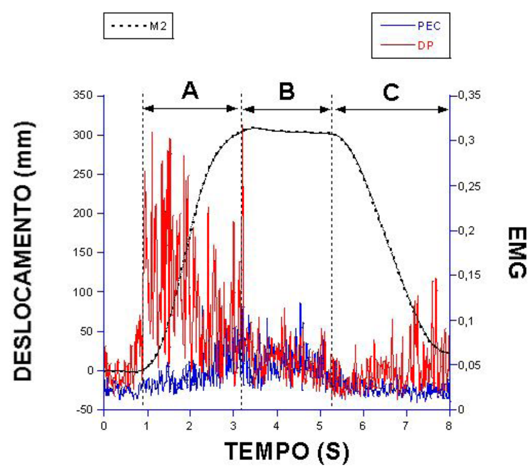

Figure 2: Linear displacement of coordinate X of the mark placed in the stand of the Reformer device (M2) and the three phases of the extension movement and flexion of the shoulder (A stages, B and C). Activity EMG of the pectoral greater (PEC) and posterior deltoid (DP) of the shoulder. Linear displacement is given in millimeters, activity EMG in Volts and time in seconds.

CONCLUSION

The elastic load effect in the strategies of motor control already was described for unidirectional movements. However, the movement analyzed here is characterized by a reversion in the direction. The results confirm our hypothesis from that the kinematic standard and muscular activity differs from the observed one in unidirectional movements and confirms found of previous studies of that the standard of activity EMG reflects the demand mechanics of a task.

REFERENCES

1. Gottlieb GL. (1996). J. Neurophysiol. 76 (3): 207-29
2. Sacco ICN, et al. (2005). R. Bras. Ci. e Mov. 13 (4): 65-78
3. Silva YO, et al. (2008). Rev. Bras. de Fisiot. 13 (1): 88-94

78 INFLUENCE OF CHANGES ON BREATHING ON EMG SIGNAL OF TRUNK FLEXORS DURING MAT PILATE'S ROLL-UP: A CASE STUDY

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INTRODUCTION

Pilates is a method of body conditioning that has as characteristic the core strengthening. Muscolino, Cipriani (2004) define the core as the region between the pelvic floor and the rib cage. One exercise for core strengthening in Pilates is *roll-up*, a classic exercise performed on the floor (*Mat*) (Latey, 2001). It is know that breathing and core strengthening are related and there are information on literature about activating patterns of the main trunk flexor muscles (Akuthota, Nadler, 2004; Urquhart, *et al*. 2005), however only few studies about breathing on Pilates were found in literature. Also, knowledge about core muscle's electric activation on different types of breathing may assist on the prescription end progression of the Pilates exercises (Silva et.al., 2009). Thus, this study aimed: a) measuring electric activation (EMG) of three core muscles: *upper rectus abdominis* (URA), *lower rectus abdominis* (LRA) and *external oblique* (EO) during flexion and extension phases of the exercise, b) comparing three types of breathing for executing the roll-up exercise.

METHODS

This research characterizes as a case study that analyzed one teacher (26 years of age and BMI of 19.5), practitioner of the method for three years. Data collection was performed in a single session, in which the individual performed 10 repetitions of the roll-up exercise, lying down, beginning at 0º of hip flexion up to 90º (upward phase) and reverse (down phase). The individual kept the shoulders at 90º flexion. Three breathing patters were analyzed: 1) breathing out during hip flexion and breathing in during extension (OFIE), 2) breathing in during flexion and breathing out during extension (IFOE), 3) breathing out during flexion and breathing out during extension (OFOE) breathing in only at 0o and 90o of trunk flexion. The exercises were perfomed in random order and velocity was monitored by metronome. EMG signals of RAS, RAI and OE muscles was collected on the right side. A Miotool 400 electromiograph (Miotec ®) and surface electrodes (Ag / AgCl with a diameter of 2.2 cm) were used. Sampling frequency was 2000 Hz per channel. All pertinent regulations of EMG signal collecting and electrodes location were respected according to recommendations of the International Society of Electromyography and Kinesiology (ISEK / SENIAM). Signal processing was made using system SAD32 (2.61.07mp, 2002), using a 3rd Buttherworth digital filter low pass, with 20 to 500 Hz cut frequencies. RMS values were determined and normalized by Voluntary Maximum Contraction (MVC). Normality and homogeneity were tested and a three factor ANOVA (muscle, exercise and phase) and for descriptive analysis mean and standard error were processed using MS Excel 2007 and SPSS 17.0.

Table 1: EMG activity (percentage of MVC) of on the three types of breathing (OFIE , IFOE, OFOE) during flexion and extension of trunk muscle URA, LRA and EO.* Represent significant difference ($p<0.05$) between the phases (flexion and extension).# Represent significant difference among the three breathing. ** Represent significant difference between the muscles.

Muscle	URA **			LRA**			EO**		
Breath	OFIE	IFOE	OFOE	OFIE	IFOE	OFOE	OFIE	IFOE	OFOE
Rise	86.9* (±2.5)%	66.7 (±2.5)%	62.2* (±1.4)%	49.0* (±1.7)%	55.9 (±1.6)%	55.0* (±0.5)%	66.9* (±1.6)%	53.0 (±1.6)%	61.9* (±0.9)%
Down	68.6* (±2.2)%	63.1 (±1.4)%	66.9* (±0.8)%	34.6* (±1.0)%	52.0 (±0.9)%	66.6* (±0.7)%	53.9* (±0.9)%	51.3 (±1.4)%	72.5* (±0.9)%

RESULTS and DISCUSSION

Interaction was found only in variable phase. Table 1 shows the differences between the three types of breathing (on both phases) for three analyzed muscles. It may be observed that activation during flexion is significantly higher than during extension in OFIE and OFOE for RAS, RAI and OE muscles. OFIE is the breathing used by the subject during her daily practice. When comparing Esid and Ised a lower activation may be observed during extension phase (excentric) when compared to the flexion phase (concentric) (Urquhart, et al. 2005) on the three muscles, this do not occur do Esed data. On Pilate Methos enphasis is given to breathing control and core (Latey, 2001), which may be verified on the flexion and extension phases' values. It is known that small alterations in a determined Pilates exercise may completely alter muscle strategy (Silva et al., 2009). Thus the focus on the core, throw breathing control, may emphasize dynamic stability of lumbar spine, motor control training of the involved muscles and prevent and treat squeletal muscle disorders (Akuthota and Nadler, 2004).
A higher EMG activation was observed for URA (69.0 ± 1.8)> EO (59.9 ± 1.2)> LRA (52.2 ± 1.1) regardless of phase or breathing type. These data corroborate partially to Urquhart et. al. (2005) which examined these and others muscles in different situations.
Depending the students objective and needs it is possible to choose among the analyzed breathing changes and demand more or less from one or other muscle. Thus, knowledge of these information may help on the prescription of an exercise program during Pilates classes.

CONCLUSIONS

For the analyzed subject, there has been differences on electric activation between the three breathing types for muscles URA, LRA and EO during roll up during the roll-up exercise.

REFERENCES

1. Akuthota V, Nadler S. (2004). Arch Phys Med Rehabil 85 (3 Suppl 1):S86-92.
2. Latey P. (2001). J Bodyw Mov Ther. 5(4): 275-82.
3. Muscolino J, Cipriani S. (2004). J Bodyw Mov Ther. 8(1): 15–24.
4. Silva YO, et al. (2009). Rev Bras Fisioter. 13(1): 82-88.
5. Urquhart D, et al. (2005). Man. Ther. 10: 144–153.

79 MYOFASCIAL TRIGGER POINT DEVELOPMENT – TWO HYPOTHESIS

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INTRODUCTION

The Myofascial Pain Syndrome has its source in a myofascial trigger point (MTP), which is defined as "one hyperirritable spot palpable in skeletal muscle associated with a hypersensitive palpable nodule in a taut band. The spot is painful on compression and can lead to the characteristics of referred pain, tenderness and to motor dysfunction and autonomic phenomena" (Simons et al, 1999).

The pathophysiology of MTP is incompletely understood. It is assumed that the MTP to be a result of physiological dysfunction within the neuromuscular junction and the surrounding connective tissue (Shah and Gilliams, 2008). In this paper we presented two hypotheses for the development of MTP: Integrated Hypothesis Trigger Point and Cinderella Hypothesis.

The Integrated Hypothesis maintains that the continuous and excessive release of acetylcholine (AC) in the synaptic cleft leads, through subsequent processes, the sustained contraction of the sarcomere, leading to an "energy crisis" that perpetuates the sustained contraction of muscle fibers near the endplate dysfunctional, further promoting the release of neuroactive substances responsible for sensitization in the region (Simons et al, 1999).

The Cinderella hypothesis acknowledges that the continuous activity of specific motor units during low-level contractions can become the "Cinderella fibers" overloaded, resulting in muscle pain (Zennaro et al, 2003) and may contribute to the formation of the MTP (Treaster et al, 2006).

METHODS

Initially a search was made of articles in the database PUBMED with the theme: "Trigger points myofascial development pathophysiology" limited to human, English and published in the last five years. This led to five papers, of which two were selected (Shah and Gilliams, 2008; Treaster et al, 2006). With the knowledge gained by reading those, two new surveys were carried out with the themes "The integrated trigger point hypothesis" and "The Cinderella Hypothesis", both with limits: humans, English and published in the last ten years. From the first research of the two results, one was selected (Gerwin et al, 2004), from the second three (Zennaro et al, 2003, Forsman et al, 2001, Kitahara et al, 2000) of the five results. The selections were due to greater relevance and / or completeness of the themes.

RESULTS and DISCUSSION

The Integrated Hypothesis describes a possible sequence of development of MTP: dysfunctional motor neuron terminal release continuous and excessive amounts of AC in the synaptic cleft producing sustained depolarization of the post-junctional membrane with a consequent increase in the tonic release of Ca^{+2} from the sarcoplasmic reticulum, leading then to a sustained contraction of the sarcomere (Simons et al 1999). This sustained contraction leads to increased metabolic demand and local compression of blood capillaries. With the reduction of blood flow and diminished sources of adenosine triphosphate (ATP), occur an "energy crisis", causing the muscle fibers remain contracted lack of energy to promote the return of Ca+2 to the sarcoplasmic reticulum and restore the polarized membrane potential (Shah and Gilliams, 2008). In a recent publication (Gerwim et al, 2004) the authors support and expand the Integrated Hypothesis adding important data such as: the Calcitonin Gene-related Peptide (CGRP) acts as a facilitator of depolarization promoted by the AC in the post-synaptic membrane, extending the average time of opening the channels of the acetylcholine receptor and inhibiting the activity of acetylcholinesterase (ACSE); the release of bradykinin, potassium (K^+), protons (H^+) and cytokines from injured muscle activates the muscle nociceptor receptors, causing pain.

The Cinderella hypothesis is based on the "size principle" of Henneman, whereby smaller muscle fibers type I are recruited first and "desrecrutadas" last during static exertions at a sub-maximal level with a low or moderate physical load. As a result, these "Cinderella man" are constantly activated and metabolically overloaded, while major motor units do not work "so hard" and spend less time continually activated. Sub-maximal exertions can lead to possible muscle damage and disturbance of Ca^{+2} homeostasis, features that may contribute to the pain of MTP (Gilliams and Shah, 2008). In recent studies (Kitahara et al, 2000, Forsman et al, 2001; Zennaro et al, 2003, Treaster et al, 2006) supported the hypothesis Cinderella, but they all agree on the need for further discussion and research in the area.

CONCLUSIONS

The integrated hypothesis has strong support in the formation of MTP, despite combining complex phenomena. The Cinderella hypothesis, although complementing the integrated hypothesis in specific situations and having relevance in studies of workplace ergonomics, is open to questions because of going against the replacement mechanism of motor units, which offset the effect of muscle fatigue.

REFERENCES

1. Forsman M, et al. Motor unit recruitment in the trapezius muscle with special reference to coarse arm moviments. J Electromyogr Kinesiol 2001 Jun; 11(3):207-16.
2. Gerwin RD, et al. An Expansion of Simons' Integrated Hypothesis of Trigger Point Formation. Curr pain Headache Rep 2004 Dec; 8(6):468-75.
3. Kitahara T, et al. Motor-unit activity in the trapezius muscle during rest, while imputting data, and during fast finger tapping. Eur J Appl Physiol 2000 Oct;83(2-3):181-9.
4. Shah JP, Gilliams EA. Uncovering the biochemical milieu of myofascial trigger points using in vivo microdialysis: An application of muscle pain concepts to myofascial pain syndrome. J Bodyw Mov Ther. 2008 Oct; 12(4):371-84.
5. Simons DG, et al. Myofascial Pain and Dysfunction: the Trigger point Manual, vol 1, edn 2. Baltimore: Williams and Wilkins; 1999.
6. Treaster D, et al. Myofascial trigger point development from visual and postural stressors during computer work. J Electromyogr Kinesiol 2006 Apr; 16(2):115-24.
7. Zennaro D, et al. Continuos, intermitted and sporadic motor unit activity in the trapezius muscle during prolonged computer work. J Electromyogr Kinesiol 2003 Apr; 13(2):113-24.

80 SURFACE EMG ACTIVITY PATTERNS (sEMG)OF MASTICATORY MUSCLES

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INTRODUCTION

This study evaluated the sEMG activity of the bilateral masseter and temporalis muscles in Brazilian children, youth, adults, and elderly people at rest and at different jaw postural conditions in order to establish normality standards for the sEMG activity of masticatory muscles in relation to age.

METHODS

250 individuals were evaluated and 177 were included in the final sample according to the inclusion criteria. All volunteers were fully dentate (except for Group I - mixed dentition, caucasian, aged 7 to 80 years, and divided into five groups: I (7-12 years), II (13-20 years), III (21-40 years), IV (41-60 years), and V (61-80 years). Except for Group V, which comprised nine women and eight men, all groups were equally divided in respect to gender (20 M/ 20 F). All subjects had normal occlusion, no parafunctional habits and had to be free of signs and symptoms of any dysfunction of the masticatory system.

Surface electromyography was performed using five channels of the Myosystem-Br1 apparatus (DataHominis Ltd.), with simultaneous acquisition and common grounding to all channels. sEMG data were collected using surface differential electrodes (two Ag–AgCl bars, 10 × 2 × 1 mm, with 10 mm interelectrode distance, gain of 20, input impedance of 10 GT and common mode rejection ratio of 130 dB – Myosystem, São Paulo, Brazil). EMG signals were sampled by a 12-bit A/D converter board with a frequency of 2 kHz, and band-pass filtered at 0.01–1.5 kHz. Raw sEMG data were digitally filtered at frequency bandwidth of 10–500 Hz and root mean squares (RMS) were calculated. Three maximal voluntary isometric dental contractions (MVCs) were performed for each muscle to normalize the sEMG data (4s). sEMG activity was recorded at rest, protrusion, left and right laterality, and maximal clenching in the intercuspal position, each recording lasted 10 seconds. Analyses of variance (ANOVA) were used to compare the groups' EMG recordings and the level of statistical significance was set at $p<0.05$ (Table 1).

RESULTS

The children group had higher EMG activity recordings for all clinical situations, while the young people group displayed lower muscular activity. As age increases from youth to adults and from adults to elderly, a clear decrease in EMG activity was observed, confirming that many changes occur in the stomatognathic system as a function of age.

CONCLUSIONS

Considerably different patterns of muscle activation were found across ages, with greater electromyographic activity in children and youth, and decreasing from adults to aged people.

ACKNOWLEDGEMENT

This study was supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP – process # 2006/60965-6).

Table 1. Normalized sEMG data of bilateral masseter and temporalis muscles for Groups I-V in the following clinical conditions: rest, right and left laterality, protrusion, and maximal clenching.

		Group					
Clinical Condition	Muscle	I	II	III	IV	V	Significance
Rest	RM	0.10 ± 0.01	0.04 ± 0.03	0.07 ± 0.009	0.06 ± 0.08	0.05 ± 0.08	*
	LM	0.10 ± 0.01	0.05± 0.05	0.08 ± 0.008	0.10 ± 0.01	0.06 ± 0.01	*
	RT	0.10 ± 0.01	0.05± 0.004	0.10 ± 0.01	0.11 ± 0.01	0.08 ± 0.01	*
	LT	0.10 ± 0.01	0.05± 0.004	0.11 ± 0.01	0.11 ± 0.01	0.08 ± 0.01	*
Right laterality	RM	0.15 ± 0.02	0.09 ± 0.007	0.13 ± 0.01	0.14 ± 0.01	0.16 ± 0.02	*
	LM	0.18 ± 0.01	0.10 ± 0.01	0.12 ± 0.01	0.14 ± 0.02	0.15 ± 0.02	*
	RT	0.15 ± 0.02	0.09 ± 0.007	0.13 ± 0.01	0.14 ± 0.01	0.16 ± 0.02	
	LT	0.11 ± 0.01	0.05 ± 0.005	0.11 ± 0.01	0.10 ± 0.01	0.08 ± 0.01	*
Left laterality	RM	0.18 ± 0.02	0.08± 0.01	0.11 ± 0.01	0.13 ± 0.02	0.14 ± 0.02	*
	LM	0.15 ± 0.03	0.06± 0.006	0.10 ± 0.01	0.10 ± 0.01	0.11 ± 0.02	*
	RT	0.11 ± 0.02	0.05± 0.005	0.11 ± 0.01	0.10 ± 0.01	0.07 ± 0.007	
	LT	0.14 ± 0.01	0.07± 0.01	0.14 ± 0.01	0.14 ± 0.02	0.11 ± 0.01	*
Protrusion	RM	0.27 ± 0.03	0.15 ± 0.02	0.16 ± 0.02	0.20 ± 0.03	0.17 ± 0.03	*
	LM	0.24 ± 0.02	0.14 ± 0.01	0.18 ± 0.02	0.18 ± 0.03	0.18 ± 0.02	
	RT	0.11 ± 0.01	0.07 ± 0.01	0.11 ± 0.01	0.10 ± 0.01	0.09 ± 0.02	
	LT	0.10 ± 0.01	0.06 ± 0.009	0.11 ± 0.01	0.12 ± 0.01	0.09 ± 0.01	*
Maximal clenching	RM	1.07 ± 0.08	0.78 ± 0.04	0.74 ± 0.04	0.67 ± 0.04	0.71 ± 0.06	*
	LM	0.99 ± 0.07	0.81 ± 0.04	0.84 ± 0.07	0.66 ± 0.04	0.79 ± 0.06	*
	RT	1.14 ± 0.09	0.93 ± 0.03	1.03 ± 0.08	0.84 ± 0.04	0.87 ± 0.05	*
	LT	1.23 ± 0.12	0.91 ± 0.04	0.95 ± 0.06	0.83 ± 0.05	0.80 ± 0.05	*

* significant for $p<0.05$

81 THE INFLUENCE OF THE POSITIONING OF THE SPRING IN THE MECHANISMS OF BIOMECHANIC MOTOR CONTROL AND DURING THE EXECUTION OF AN EXERCISE OF METHOD PILATES

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INTRODUCTION

Developed in the Europe and later spread out in the United States, the Pilates Method comes gaining adepts for the entire world. An increasing number of practitioners has adopted the technique with the objective to improve its general physical state and position. The exercises of the Pilates method can be carried through in the ground or specific equipment. One of these equipment is called Cadillac that consists of a species of stretcher with a metallic structure that has as characteristic main the presence of diverse vectors for the positioning of the springs. They are these springs that impose the elastic resistance for the execution of the exercises. In the initial phase of the exercise, the springs are prolongated, occurring an increase of the external resistance imposed by them. The accumulated potential energy during the allonge of the springs is set free and the same ones will tend to speed up the corporal segment in return to the initial position. At this moment, it is reasonable to imagine that an eccentric contraction of the muscle would be necessary to decelerate the movement of slow and soft form in the initial position. Simple rules of modulation of the electromyography standard (EMG) agonist and antagonistic during the execution of unidirectional and restricted movements to a joint, carried through under the elastic load imposition different already had been identified. However, these rules are not applied for movements more complex, characterized for a reversion in the direction and carried through under the imposition of different elastic load coefficients. The objective of this work is to describe of the kinematic point of view e EMG the exercise of flexion and extension of the trunk carried through in the Cadillac equipment in three distinct conditions.

METHODS

Eight volunteers with band of 20 the 40 years, without previous experience with the Pilates method, rights hand, without injury description muscle or neuromuscular had participated of this study. The volunteers had been instructed to carry through fifteen repetitions of a flexion task and extension of the trunk in the equipment Cadillac (D& D Pilates), in three distinct conditions (five repetitions in each condition). C1, without spring; C2, with spring (coeficient= 0. 030 Kgf/cm) and C3, with spring attending the movement. The initial position is presented in the figure 1A. During the first phase of the movement (of the initial position until the target), the volunteers had carried through a flexion of trunk until 60º while they carried through the flexion of the shoulders with the extended elbows, pushing the bar of the equipment for top (figure 1B). The second phase was characterized by a period of maintenance of the position (figure 1B). The third phase was characterized by the return to the initial position (figure 1A). Coordinates X and Y of the mark placed in the fixed bar of the Cadillac equipment, had been used to calculate the linear displacement and to above identify the three described phases of the movement. The activity of the main muscles (previous deltoid - OF, posterior deltoid - DP, previous serrátil SA, rhomboid - RO, abdominal rectum - FROG, internal oblique - OI, external oblique - OE) was collected with surface electrodes (Delsys Incorporation) in accordance with protocols established for the ISEK/SENIAM. All kinematic data and EMG had been filtered and quantified using Matlab® software (Mathworks).

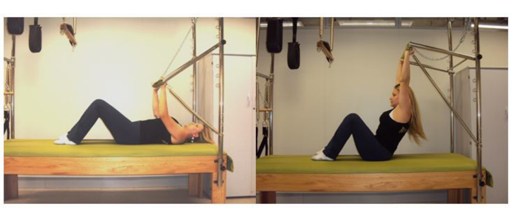
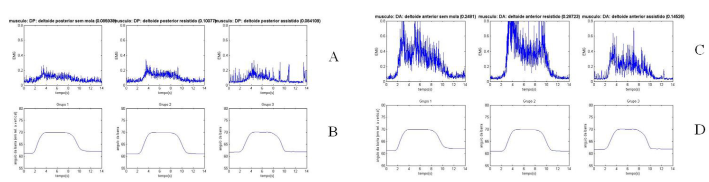
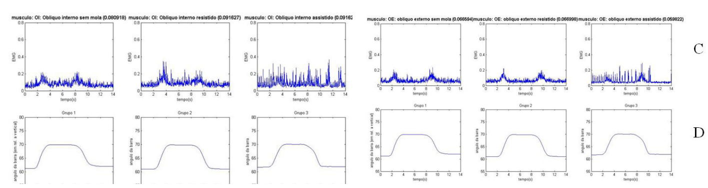


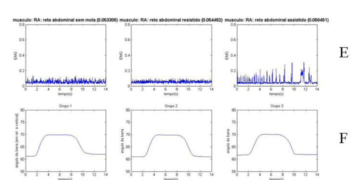
Figure1A Figure1B

RESULTS and DISCUSSION

Figure 2 illustrates standard EMG of the shoulder. The three phases of the movement clearly are defined (B and D). The columns of the left for right represent, respectively, the conditions C1, C2 and C3. While OF if they keep activated during the three phases of the movement (a), the activity of the DP occurs mainly during the second phase (c). Of the three conditions, C2 imposed a bigger demand in terms of amount EMG. Similar results had been demonstrated for and the RO. Figure 3 illustrates standard EMG of the trunk (C and E). Of the three abdominal muscles analyzed, the abdominal rectum it is what it presented a lesser activity EMG. The secular series are representative of the behaviors observed in all the volunteers. The activity of the one OF the one during the three phases of the movement had as functions, respectively, to speed up the member in the target (concentric contraction), to keep the member raised against the action of the gravity and to decelerate slowly the member in the final position (eccentric contraction). The observed muscular co-activation during the second phase of the movement helps to keep the arm raised against the action of the gravity. The positioning of the spring to resist or to attend the movement, influenced the amount of activity EMG directly. The movement of flexion of the trunk was carried through mainly by the activity of OI and OE that had been activated during the first one and the third phases of the movement.







CONCLUSIONS

The positioning of the spring in the Cadillac influenced the amount of activity EMG. Standard EMG took care of to the demand mechanics of the task.

REFERENCES

1. Silva YO, et al. (2008). Rev. Bras. de Fisiot. 13(1): 88-94
2. Sacco ICN, et al. (2005). R. Bras. Ci. e Mov. 13(4): 65-78
3. Gottlieb GL. (1996). J. Neurophysiol. 76(3): 207-29

82 THE STANDARDIZATION OF SURFACE ELECTROMYOGRAPHY TECHNIQUE

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INTRODUCTION

Electromyography (EMG) has been widely used to help in clinical diagnosis for over 40 years (MALTA et al., 2006). It's a technique that detects and analyzes the electrical signal from the contraction of skeletal muscle (TANK et al., 2009). This study had like an objective to investigate in literature information that may contribute to the standardization of surface electromyography technique.

METHODS

To produce this research, was performed a literature review more comprehensive and not a systematic search was done in different databases as SCIELO Brazil, MEDLINE, OLD MEDLINE and Pub Med. The terms used were: electromyography, electromyography AND standardization, surface electromyography, in Portuguese and English. To the authors' citation, chose to reference them by the ordination of clinical reasoning necessary to write each topic of this research, not by chronological order of their studies.

RESULTS and DISCUSSION

The literature search showed that the collection system of EMG consists electrodes, amplifiers, filters and a device records. These electrodes convert the electrical signal, resulted from the process of depolarization of muscle fibers, into an electrical signal can be processed into an amplifier and used for nerve conduction tests and kinetics investigations (TURK, 1993). The International Society of Electrophysiology and Kinesiology (ISEK) establishes standards for acquisition and processing of EMG signal, even with regard to surface electrodes placement which one is commonly used transducers (TANK et al., 2009). ISEK suggests that electrodes must be placed not more than 20mm center to center to minimize the effects of crosstalk (the electrical signal capture of adjacent muscles), since greater distances increase the probability that surface electromyography (sEMG) be contaminated by the activity of adjacent muscles (BECK et al., 2005). Literature argues that the electrodes must be placed at the midpoint of muscle belly, between the innervation zone and tendon region. Its orientation depends on muscle of interest and the direction of muscle fiber, muscle anatomy and conditions that minimize the electrical activity originated by other muscles (SCHWARTZ et al., 2007). In addition, the choice of kind and size of electrode also interfere in capture this sign because for small muscles, the literature recommends the smaller electrodes placement and cleans the skin surface to control the impedance (TÜRKER, 1993). Thus, literature points that it's better to capture the signal when the registers electrodes are placed along muscle fibers, in addition to placing the reference electrode in a neutral region to region collected, usually not on a muscle (TÜRKER, 1993).

CONCLUSIONS

At the end of this review, can see that the electromyographic signals are the action potentials records of muscle fibers. These signals are affected by the anatomical condition, physiological properties of muscles and the instrumentation used in data collection. Therefore, it's important to standardize the method of data collection about the electrodes placement position, distance between them to make the technique more reproducible as possible. So, more specific publications about EMG as the standardization of this collection are necessary.

REFERENCES

1. Malta J, et al. (2006). Eletromiografia aplicada aos músculos da mastigação. Acta Ortop Bras, 14(2):106-7.
2. Tank FF, et al. (2009). Influência da distância intereletrodos e da cadência de movimento no domínio da frequência do sinal de EMG de superfície. Rev Bras Med Esporte, jul-ago; 15(4):272-76.
3. Türquer KS. (1993). Eletromyography: some methodological problems and tissues. Phys Ther, 73(10):698-710.
4. Beck TW, et al. (2005) The effects of interelectrode distance on electromyographic amplitude and mean power frequency during isokinetic and isometric muscle actions of the biceps brachii. J Electromyogr Kinesiol,15:482-95.
5. Schwartz FP, et al. (2007). Análise de filtros espaciais em sinais de EMG de superfície nas condições do máximo volume de contração. IFMBE Proceedinhgs, 18:95-8.

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83 STRENGTH AND ELECTROMYOGRAPHIC EVALUATION OF UPPER LIMB MUSCLES IN MEN UNDERGOING CREATINE SUPPLEMENTATION

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INTRODUCTION

Surface electromyography is a potential tool for anatomic, clinic and kinesiologic studies of muscle electric activity and it has been employed to identify muscular activation levels associated with force and muscular fatigue (JAKOBI et al., 2001).
Creatine supplementation has been used to augment the strength and muscular efficiency as well to decrease the onset of muscular fatigue (JAKOBI et al, 2001; IZQUIERDO et al., 2002; HOFFMAN et al., 2005).
This study aimed to analyze the force and electromyographic activity of *biceps brachii* (BB), *brachioradialis* (BR) and *flexor carpi ulnaris* (FCU) muscles in subjects submitted to acute and chronic creatine supplementation.

METHODS

Twenty resistance-trained male volunteers, aged 18 to 35 years, were selected for this double-blind, controlled-placebo, randomized study. Volunteers were placed into two groups: creatine (5 g creatine and 5 g maltodextrine, n=10) and placebo (5 g cellulose and 5 g maltodextrine, n=10). Oral supplementation was given 4 times per day during the first 7 days and once a day in the 49 subsequent days.
Volunteers performed maximum isometric voluntary contraction (MIVC) of forearm flexion and with 30% and 60% MIVC (Figure 1), before and after 7 and 56 days of supplementation.
Electromyographic signs were captured using passive surface electrodes joined to a pre-amplifier and placed on the belly of BB, BR e FCU muscles (Figure 2). Recordings were made on computer-connected electromyography and analyzed by the Myosystem-Br1 software. A load cell was used to measure the maximum isometric strength during the tests (Figure 1).

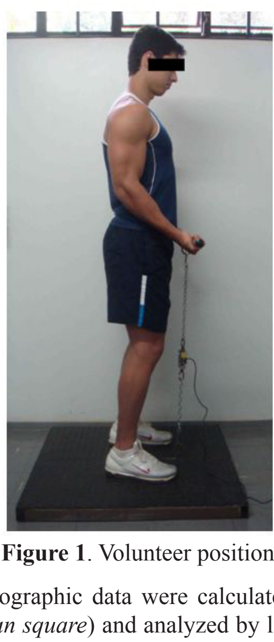

Figure 1. Volunteer position

Figure 2. Electrode placement

Electromyographic data were calculated by values of amplitude (RMS – *root mean square*) and analyzed by linear regression curve, generating RMS slopes that were considered muscular efficiency indices.

RESULTS and DISCUSSION

Results showed that creatine group exhibited an increase of strength only after 56 days of supplementation ($p < 0.05$), while no significant difference was found in placebo group (Figure 3). These data suggest that acute creatine supplementation (4-7 days) does not increase the isometric strength (JAKOBI et al., 2001), however, chronic creatine supplementation (> 42 days) induce augment of strength (BECQUE et al., 2000).

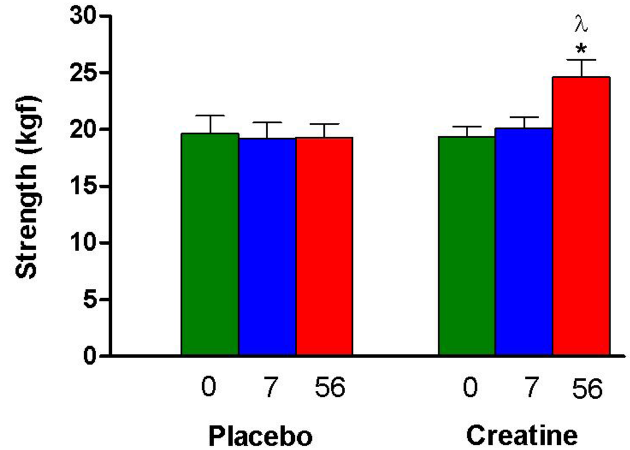

Figure 3. Strength values (kgf) of placebo and creatine groups after 0, 7 e 56 days of supplementation. Bars represent the mean and standard deviation of 10 volunteers. * Significantly different of 0 and 7 days, same group ($p < 0.05$); λ Significantly different of placebo, same supplementation day ($p < 0.05$).

Table 1 showed that BB and BR muscles showed a decrease of RMS slopes after 7 and 56 days of creatine supplementation with 60% MIVC ($p < 0.05$). No significant difference in the values of RMS slopes was found for FCU muscle between 0, 7 and 56 days of supplementation, in both loads and groups ($p > 0.05$).
These findings indicate that both acute and chronic creatine supplementation improve the BB and BR muscular efficiency only with high loads, possibly due to a higher energetic substrate availably as a result of the augment of skeletal muscle phosphocreatine (HOFFMAN et al., 2005; IZQUIERDO et al., 2002; SELSBY et al., 2004).

CONCLUSIONS

It can be concluded that the chronic creatine supplementation increases the isometric strength of forearm flexion. Also, both acute and chronic creatine supplementation improve the BB and BR muscular efficiency only with high loads.

REFERENCES

1. Becque MD, et al. (2000). Med Sci Sports Exerc. 32: 654-658.
2. Hoffman JR, et al. (2005). J Strength Cond Res. 19: 260-264, 2005.
3. Izquierdo M, et al. (2002). Med Sci Sports Exerc. 34: 332-343.
4. Jakobi JM, et al. (2001). Eur J Appl Physiol. 84: 321-328.
5. Selsby JT, et al. (2004). J Strength Cond Res. 18: 311-315.

84 EMG ACTIVITY OF BACK MUSCLES DURING PROLONGED CYCLING – A PRELIMINARY STUDY

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INTRODUCTION

The effects of fatigue on cycling performance have been documented (Nybo & Zecher, 2004; Sanderson & Black, 2003). Among the effects observed are increased pelvis rotation and lumbar spine flexion contributing to pelvis instability while seated on the bicycle saddle (Burnett et al., 2004). Concerning back and pelvis, few studies address EMG activity during cycling. Assessing EMG of low back while cycling could provide important information to prevention of low back pain commonly reported among cyclists. The aim of this preliminary study was to quantify the EMG of back muscles in one trained mountain bike (MTB) cyclist without history of back pain during a submáximal prolonged trial (SPT).

METHODS

A male MTB amateur trained cyclist was recruited for this study. He was 32 years old, weight of 75 kg, height of 1.88 m and never had experienced musculoskeletal injuries. The right body side was his preferred to perform motor actions such as writing and kicking a ball. The cyclist's bicycle (Trek MTB Fuel 100, EUA) was mounted on a cycle simulator (CompuTrainer Pro Lab3D, Racermate Inc, Seattle, EUA). Cyclist completed an incremental maximal test (IMT) to determine the maximal power output (MPO). After 5 minutes of warm up with a workload of 100W, increases of 30W were applied every minute until exhaustion. One week after the subjects performed a submaximal prolonged trial (SPT), surface electrodes were attached bilaterally according to SENIAM in the skin over *longissimus*, *iliocostalis* and *trapezius* descendents muscles for EMG analysis. From EMG signals RMS was calculated. Data were sampled at 2000 Hz after the subject rests in a seated position by 5 minutes, in the final stage of the first 10 min warm up with a workload of 100W, and then 20 seconds every 5 minutes during the SPT. SPT was maintained until exhaustion at target intensity between 70% e 80% of MPO. Exhaustion was defined when subject was not long able to maintain a pedaling cadence higher than 85 rpm. The heart rate (HR) was recorded throughout the IMT and SPT trials. The raw EMG data were submitted to a digital Butterworth filter of 5ª order (band-pass with cutoff frequency of 10-500 Hz). The RMS values were analyzed in windows of 40 ms (Neptune et al, 1997) using the software AqDAnalysis (*Lynx 1200 Tec. Eletrônica, Brazil*) and normalized by rest EMG. Descriptive statistics were applied to verity the magnitude of muscle activation and its behavior over time by means of analysis of linear regression considering the curve slope (angular coefficient). A significance level of 0.05 was considered for all data analysis.

RESULTS and DISCUSSION

The cyclist evaluated reached a maximal HR of 187 bpm, power output of 391 W, and pedaling cadence of 97 ± 3 rpm during the IMT. The duration of the SPT was 1h55min, including the warm up period. During SPT, mean and maximal HR were 143 ± 14 e 164 bpm, respectively. During SPT there was a general increase in RMS over time. It was expected due to mechanisms of fatigue, in which additional motor units are recruited in order to maintain the expected level of force (Miyashita et al, 1981). However, this behavior was more remarked for *trapezius descendens* and *Iliocostalis* muscles from left side of the body, whereas *longissimus* right side presented higher increases in EMG (Table 1). This asymmetric pattern of muscle activation may have relation with upper and lower leg asymmetry during pedaling, which should be further investigated as a factor determinant of pedaling asymmetries and low back pain.

CONCLUSIONS

Increased RMS of assessed muscles suggests fatigue process. Some of the differences between sides may have relation force asymmetry and occurrence of low back pain in symptomatic cyclists.

REFERENCES

1. Nybo L, Zecher NH. (2004). Progress in Neurobiology. 23, 223-261.
2. Sanderson DJ, Black A. (2003). Journal of Sports Sciences. 21, 191-199.
3. Burnett AF, et al. (2004). Manual Therapy. 9, 211-219.
4. Miyashita M, et al. (1981). Journal of Sports Medicine and Physical Fitness. 21, 209-217.
5. Neptune RR, et al. (1997). Journal of Biomechanics. 30, 1051-1058.

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Table 1: Angular, determination and correlation coefficients obtained from linear regression between RMS and total time of exercise for the *trapezius descendens* (*TD*), *longissimus* (*Long*) and *iliocostalis* (*Ilioc*) muscles in the right and left sides of the back. R: right, L: left.

Variable	TD R	TD L	Long R	Long L	Ilioc R	Ilioc L
Angular coef (dimensionless).	0.52	0.92	2.68	1.59	2.43	8.31
Determination coef (r^2)	0.11	0.21	0.73	0.33	0.56	0.69
Correlation coef (r)	0.33	0.46	0.86	0.58	0.75	0.83

85 CORRELATION BETWEEN TORQUE AND THE FUNCTIONAL HOP TESTS IN SUBJECT WITH RECONSTRUCTION OF ACL

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INTRODUCTION

In the last years has been researched on the consequences after lesion and restoration following by surgical reconstruction of ACL (Kapreli and Athanasopoulos, 2006), using, mainly, isokinetic tests to evaluate the muscular force of the knee and hop tests as indicators of the articular function (Jong et al., 2007). This way, our objective was to correlate the knee extensor and flexor torque with the functional hop tests, between the limbs, of subject with reconstruction of ACL.

METHODS

Sixteen subjects with unilateral reconstruction of ACL (30.6 ± 9.3 years; 78.1 ± 12.1 kg; 1.75 ± 0.1 m; IMC of 25.5 ± 3.0 kg/m2; time of lesion = 50.4 ± 34.9 months; time of surgery = 27.0 ± 23.7 months) were analysed. The knee torques were appraised in the modes: 1) isometric; 2) concentric to 30 and 120º/s; and 3) eccentric to 30 and 120º/s, in isokinetic dynamometer (*Biodex Multi-Joint System 3, Inc., Shirley, NY*), after warm-up and stretching of the lower limbs.
The functional tests consisted of 4 trials of horizontal hops accomplished in the following order: 1) simple; 2) triple; 3) cross-over; and 4) Figure in 8. In the simple and triple hops were considered the reached distances and for the cross-over and Figure in 8 hops were considered the time in seconds (s) to cover the course and registered the averages of 3 attempts for each hop (Figure 1).

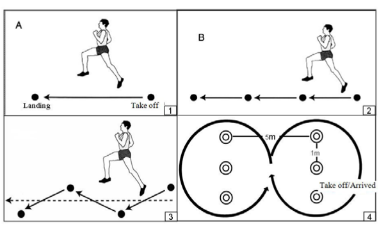

Figure 1 – Hop functional tests: 1) simple, 2) triple, 3) cross-over and 4) figure in 8.

RESULTS

The Table 1 display that there was significant deficit of the extensor torque in the attacked limb (AL) for the manners: isometric (14%, p <0.01), concentric to 30º/s (19%, p <0.01), concentric to 120º/s (14%, p <0.05) and eccentric to 30º/s (10%, p <0.01), however no deficit was found for the flexor torque.

Table 1: Mean of PT (Nm) of AL and NAL in subject with reconstruction of ACL

Contraction Modes	Peak Torque (PT)			
	AL	NAL	Diff.	t test
Extensors				
Isometric	229.7±60.6	268.4±66.2	-14	<0.01
Con. 30º/s	192.6±52.2	238.5±47.5	-19	<0.01
Con. 120º/s	149.6±39.2	173.4±44.2	-14	<0.05
Exc. 30º/s	253.0±66.0	281.9±74.2	-10	<0.01
Exc. 120º/s	234.8±79.8	253.2±93.3	-7	0.22
Flexors				
Isometric	140.6±30.3	146.2±30.7	-4	0.39
Con. 30º/s	121.3±26.7	128.3±25.1	-5	0.14
Con. 120º/s	107.6±31.7	101.6±20.7	5	0.40
Exc. 30º/s	133.6±26.2	137.9±32.7	-3	0.33
Exc. 120º/s	139.9±26.5	138.1±30.9	1	0.68

Legend: Nm = Newton.meter; AL = attacked limb; NAL = non attacked limb; Conc. = concentric; Ecc. = eccentric; Diff = difference (%).

In agreement with the Table 2, of the 4 hop tests, in the comparison inter-limbs there were significant differences for the simple hop (p <0.01), triple (p <0.01) and Figure in 8 (p <0.05) respectively. The distances reached by NAL were larger in the simple and triple jumps, while it was registered a smaller time in the acting of the Figure in 8.

Tabela 2: Mean of the hop functional tests in subjects with ACL reconstruction

Hop Tests	AL	NAL	t test
Simple hop (m)	1.71±0.29	1.90±0.20	<0.01
Triple hop (m)	5.36±0.81	5.83±0.63	<0.01
Cross-over hop (s)	2.61±0.59	2.44±0.48	0.06
Figure in 8 (s)	7.49±0.73	7.16±0.50	<0.05

In general, the correlations between PT and the functional tests were shown weak (r<0.5) in the two analyzed limbs (AL and NAL), both the extensors and flexors of the knee. However, it showed moderate (0.5 <r 0.75) for the extensors ones, in the following situations: Concentric PT to 30º/s *versus* simple hop (r=0.57), concentric PT to 120º/s *versus* simple hop (r=0.66), concentric PT to 120º/s *versus* triple hop (r=0.51), just for AL. For the flexors, between eccentric PT to 30º/s *versus* Figure in 8 (r=0.56), in NAL.

DISCUSSION

Corroborating with the results of this study, Keays et al. (2000) also found differences (28 and 22%) just in the extensor torques between AL and NAL, before and, with larger significance, after 6 months pos-surgery, when tested in the speeds of 60 and 120º/s.
In agreement with some authors, the hop functional tests are the more used in the return to sport for to measure the power of the lower limb and to reflect the effect of the integrity of the neuromuscular control, capacity of force generation and confidence in the limb.
The literature is still conflicted about which muscular group is more involved in the functional activities of the knee. Li et al. (1996) found correlation the forces of flexors with the functional ability, while Järvela et al. (2002), verified that correlation just for the extensors ones, however, they were classified of weak the moderate (r = 0.25 to 0.62).
For Keays et al., (2000), the maximal isokinetic force tests are defective to quantify the knee functionality. This affirmative can explain, partly, the weak and moderate correlations between the isokinetic PT and the functional tests found in our study.

CONCLUSIONS

In spite of the functional tests they have not shown a good correlation with PT of the extensors ones and the knee flexors, they are still the elect tests as parameters to determine the return to the practice of the sport.

REFERENCES

1. Jong SN, et al. (2007). Functional assessment and muscle strength before and after reconstruction of chronic anterior cruciate ligament lesions. Arthrosc. 23, 1:21-28.
2. Kapreli E, Athanasopoulos S. (2006). The anterior cruciate ligament deficiency as a model of brain plasticity. Med Hypoth. 67, 645–650.
3. Keays SL, et al. (2000). Strength and function before and after anterior cruciate ligament reconstruction. Clin Orthop. 373, 174-183.
4. Li RC, et al. (1996). Isokinetic strength of the quadríceps and hamstrings and functional ability of anterior cruciate ligament deficient knees in recreational athletes. Br J Sports Med. 30, 161-164.
5. Järvela T, et al. (2002). Simple measurements in assessing muscle performance after an ACL reconstruction. Int J Sports Med. 23, 196-201.

86 ELECTROMYOGRAPHIC ANALYSES OF THE MASTICATORY MUSCLES IN PATIENTS WITH ORAL PROSTHETIC REHABILITATION

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INTRODUCTION

Stomatognathic system is a physiological and functional entity comprising a set of organs and tissues, whose biology and pathophysiology are absolutely interdependent (Fernandes Neto, Neves 2003). In order to have the rehabilitation of the stomatognathic system in individuals with partial tooth loss and / or complete, important factors should be considered, as the prosthetic and muscular rehabilitation. Considering the important influence of muscle in the rehabilitation of the stomatognathic system, we attempted to evaluate the behavior of the masticatory muscles against different prosthetic rehabilitation, analyzing the electromyographic activity of the right masseter (MD), left masseter (ME) , right temporal (TD) and left temporal (TE). We analyzed 50 individuals aged between 35 and 70 years, rehabilitated with osseointegrated implants and ingle crowns, upper complete denture and lower two-implant-supported overdenture, upper and lower removable partial denture and a control group of dentate subjects without symptoms of temporomandibular disorders.

METHODS

This study was approved by the Ethics Committee on Research in the School of Dentistry of Ribeirão Preto, University of São Paulo-USP, Ribeirão Preto, Brazil. EMG Myosytem Br1 was used to analyze the masseter and temporal muscles in rest, opening and closing mouth, right and left laterality, protrusion, habitual chewing and maximum voluntary contraction

RESULTS and DISCUSSION

Statistical analysis (ANOVA - SPSS program) was performed with the normalized data by maximum voluntary contraction and the EMG results showed a statistically significant difference of muscle activity at rest (TD = 0.04, TE = 0.02), braces (MD = 0.006; ME = 0.03, TD = 0.001), right lateral (TE = 0.000), left laterality (MD = 0.02, TE = 0.000) and protrusion (TE = 0.000). Assessment of myoelectrical activity of masticatory muscles become increasingly useful to the dentist, contributing to the knowledge of the performance of these muscles at mandibular rest, n the movements of regulatory reflexes and changes in the muscle pattern. In addition, the electromyographic analysis currently represents a means not only evaluation but also for monitoring treatment (Regalo et al., 2003; Santos, 2005). In this study the difference between the groups can be explained by the different types of prosthetic rehabilitation evaluated and can be seen that the rehabilitations more functionally stable, as those conducted on osseointegrated implants are closer to activity levels observed in the dentate.

CONCLUSIONS

The data show the great influence of different types of prosthetic rehabilitation in the electromyographic activity of jaw muscle.

REFERENCES

1. Fernandes Neto AJ, Neves FD. Harmonia oclusal para a promoção de saúde. In: Promoção de Saúde Bucal: Paradigma, Ciência e Humanização 3ª Edição. Porto Alegre: Artes Médicas; 2003. p. 341-369
2. Regalo SCH, Vitti M, Hallak JEC et al. EMG analysis of the upper and lower fascicles of the orbicularis oris muscle in deaf individuals. Electromyography and Clinical Neurophysiology. 2003; 43(6):367-72.
3. Santos CM. Efeitos do uso de overdenture sobre implantes e de próteses totais na atividade eletromiográfica da musculatura da mastigação [Dissertação de Mestrado]. Ribeirão Preto: University from São Paulo, Faculdade de Odontologia, Departamento de Materiais Dentários e Prótese; 2005.

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87 EVALUATION OF ELECTRICAL ACTIVITY OF MASSETER MUSCLE DURING DEGLUTITION: PROPOSAL OF PROTOCOL

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INTRODUCTION

The masseter is a large, thick and rectangular muscle located on either side of face and its main function is to elevate the mandible (GRABOWSKI; TORTORA, 2002). To the deglutition's physiology, the masseter muscle helps to stabilize the mandible, acting in conjunction with the suprahyoid muscles (HIRAOKA, 2004). One way to evaluate the behavior of this muscle is by surface electromyographic, defined as the registration method of changes in muscles electrical activity during its contraction[4-6]. Evaluates the physiological and pathological conditions of muscle, provides information about muscle function[4] and can contribute to diagnosis (RODRIGUES; BÉRZIN; SIQUEIRA, 2006). The objective of this study is to present a proposal for a protocol of electromyography evaluation of masseter muscle during deglutition.

METHODS

The protocol was elaborated since a group of Brazilian speech therapists researchers who conclude that would be important to review the evaluation protocols previous published, as well as those used daily in clinical practice. Based on the researches experience and scientific literature, the protocol considered the electrodes placement positioning, the deglutition tasks to be performed and parameters to be extracted from the electromyographic signal.

RESULTS and DISCUSSION

The procedures that have proved most suitable for obtaining the recordings of masseter electromyographic in deglutition were:
The electrodes placement position, palpating the masseter muscle belly during dental clenching for 3s, bilaterally, to signal stabilization through clenching repetition. After, three tasks were done: liquid deglutition with comfortably volume, liquid deglutition with uncomfortably volume and training deglutition. The first two taks were repeated for 3 times with intervals of 10s between them and the last task was done once. The signal analysis is performed considering the highest peak of electromyographic activity during the task of natural deglutition (100%) in each channel. All other signals are analyzed in maximum percentage value (DING et al., 2002). From the first two tasks, the average is calculated one of each 3 repetitions and calculated the final average to be compared with the maximum value in each channel. In training deglutition, the average is compared with the maximum value in each channel, considering the time and number of deglutitions.

CONCLUSIONS

This protocol for electromyographic evaluation of masseter muscle during deglutition proposes a more efficient systematization of therapeutic plan allowing more reproducible and uniform results in future research and Speech, Language and Hearing Sciences clinic.

REFERENCES

1. Ding R, et al. (2002) Surface electromyography and electroglottographic studiesin normal subjects under two swallow conditions: normal and during the Mendelson maneuver. Dysphagia, 17: 1-12.
2. Grabowski SR, Tortora GJ. (2002) Princípios de Anatomia e Fisiologia, 9ª ed. Rio de Janeiro: Guanabara Koogan.
3. Hiraoka K. (2004) Changes in masseter muscle activity associated with swallowing. Journal of Oral Rehabil, 31(10), 963 – 967.
4. Rodrigues AMM, Bérzin F, Siqueira VCV. (2006). Análise eletromiográfica dos músculos masseter e temporal na correção da mordida cruzada posterior. Rev Dent Press Ortodon Ortop Facial,11(3), 55-62.
5. Vaiman M, Eviatar E, Segal S. (2004). Evaluation of normal deglutition with the help of rectified surface electromyography records. Dysphagia.; 19,125-32.

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Table 1 - Procedures for evaluation of masseter muscle in deglutition.

Stage 1	**Preparation for the test:** Volunteer comfortably seating in a chair with back support and no support for the head, hands on thighs, the feet soles on the ground, head erect and look forward, based on Frankfurt plan. The volunteer will not see the computer screen to avoid the visual feedback and commitment evaluation. Before each experiment, will have training with each volunteer, with all necessary instructions and information. The skin must be clean with gauze and alcohol 70º.
Stage 2	**Electrodes placement position:** It begins by placing the reference electrode, used to minimize interference from external electrical noise. It's placed, conditionally, in ulnar styloid process of the right arm of volunteer, far from the points of muscles evaluated. The other electrodes are positioned bilaterally in a bipolar configuration, in the masseter muscle belly, arranged along the muscle fibers. To locate the region where the first electrode is fixed, the volunteer will stay three seconds performing the dental clenching, visualizing and palpating the midline of masseter muscle belly. The second electrode is positioned 1.5cm below the first, also arranged along the muscle fiber. Proof of two channels in electromyographic.
Stage 3	**Signal stabilization:** Signal stabilization through repetition of clenching for 3s once. Wait a minute to start the next stage.
Stage 4	**Deglutition tasks** (adapted from Vaiman, Eviatar & Segal, 2004): **1. Liquid deglutition with comfortably volume:** water deglutition at room temperature in a single sip of 16,5ml in volunteers aged between 18 and 40; 14,5 ml in volunteers aged between 41 and 70 and 12 ml for individuals over 70 years. The individual will be instructed to place the sip in mouth, hold for three seconds and swallow when the evaluator says. Repeat three times, with intervals of 10s between each deglutition. **2. Liquid deglutition with uncomfortably volume:** water deglutition at room temperature in a single sip of 20 ml (test to evaluate the ability of adaptation of volunteers, using a large volume of water). The individual will be instructed to place the sip in mouth, hold for three seconds and swallow when the evaluator says. Repeat three times, with intervals of 10s between each deglutition. **3. Training deglutition:** The individual will be instructed by evaluator to water deglutition of 100ml, continuously and habitual, once.

88 HOW THE BRAZILIAN JOURNALS IN SPEECH, LANGUAGE AND HEARING SCIENCES PORTRAY THE SURFACE ELECTROMYOGRAPHY?

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INTRODUCTION

Surface electromyography (EMG) evaluates the physiological and pathological conditions of muscle and provides information about principles that regulates muscle function (RODRIGUES; BÉRZIN SIQUEIRA, 2006). In Speech, Language and Hearing Sciences clinic, electromyography helps diagnosis, treatment and prognosis (NAGAE; BÉRZIN, 2004). The variability of EMGs' implementation in Speech, Language and Hearing Sciences can be endorsed by a number of studies involving individuals with facial paralysis, for example (RAHAL; GOFFI-GOMEZ, 2007), temporomandibular dysfunction (SAMPAIO, 2003) or individuals using dental prosthesis (BERRÉTIN-FÉLIX et al., 2008), among others. Nevertheless, few studies were performed at the area of Speech, Language and Hearing Sciences. So, it's important to know if this subject has in national journals specialized in this kind of science and understand what it's necessary to be explored. The objective of this study was to characterize the national journals in Speech, Language and Hearing Sciences in relation to the surface electromyography in articles published from January 2000 to December 2008.

METHODS

A search in LILACS database which includes five journals specializing in Speech, Language and Hearing Sciences. The journals were called A, B, C, D and E. Were analyzed all articles published between the years 2000 and 2008, considering as criteria for search the term "electromyography". The number of publications per year, per journal, per article type, by area and theme were considered. The data were analyzed descriptively with tables and graphs.

RESULTS and DISCUSSION

Of the 954 articles published in these journals during the study, 10 are related to electromyography. Of these, 2 were published in 2002, 1 in 2004, 1 in 2006, 2 in 2007 and 4 in 2008. The journals C had the largest number of publications (7), while the journal and did not submit any articles on the subject. All articles are original and were concentrated in the areas of orofacial myology (5), Language (4) and Audiology (1). The subject studied was more stuttering (4), and mastication (2), facial paralysis (1), suction in babies (1), vestibular disorders (1) and evaluation of a clinical tool (1). The results show a low number of publications, with most concentrated in a single journal, with little variety of topics.

CONCLUSIONS

There is a scarcity of studies with surface electromyography published in national journals in speech therapy. It's suggesting a necessity to develop this subject and diversify the topics of Speech, Language and Hearing Sciences interest.

REFERENCES

1. Berretin-Félix G, et al. Electromyograpic evaluation of mastication and swallowing in eldery individuals with mandibular fixed implant-supported prosthesis. J Appl Oral Sci. 2008; 16(2):116-2.
2. Nagae M, Bérzin F. Electromyography: applied in phonoaudiolgy clinic. Braz J Oral Sci. 2004; 3(10):506-9.
3. Rahal A, Goffi-Gomez MVS. Avaliação eletromiográfica do músculo masseter em pessoas com paralisia facial periférica de longa duração. Rev. CEFAC. 2007; 9(2):207-12.
4. Rodrigues AMM, Bérzin F, Siqueira VCV. Análise eletromiográfica dos músculos masseter e temporal na correção da mordida cruzada posterior. Rev Dent Press Ortodon Ortop Facial. 2006; 11(3):55-62.
5. Sampaio CRA. Avaliação eletromiográfica dos músculos masseter e temporal anterior após o uso da placa de Hawley modificada em pacientes com DTM [dissertação]: Federal University of Pernambuco; 2003.
6. Tartaglia GM, Barozzi S, Marin F, Cesarani A, Ferrario VF. Electromyographic activity of sternocleidomastoid and masticatory muscles in patients with vestibular lesions. J Appl Oral Sci. 2008; 16(6):391-6.

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89 ELECTROMYOGRAPHIC STUDY OF TENNIS RELATED MUSCLES

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INTRODUCTION

The objective of this study was to electromyographically analyze the basic movements of the court tennis, classified in backhand, forehand and serve, in the muscles deltoid (upper portion) and brachial biceps in three phases: beginning, acceleration and end. The muscle deltoid (upper portion) has as main function the extension of the arm being of extreme importance in the backhand movement (Weineck, 1991). The muscle brachial biceps has as function the flexing of the anti-arm requested in the forehand movement and serve.

METHODS

The sample consisted of twenty right-handed male volunteers (10 tennis players and 10 non tennis players), with age range between 20 and 30 years, with index of body mass from 15 to 29%. The muscular activity was evaluated through an electromyograph (VIKING II) of 4 channels, connected through mini-electrodes of surface type Beckman. A metronome was used to indicate the exact time of the three phases of each movement accurately. The software SISDIN was used for the numeric data of the electromyografic activity in RMS (Root Mean Square), expressed in microvolts (µV).

RESULTS and DISCUSSION

The results showed that regardless of the movements and of the phases, the tennis players presented larger electric activity than the non tennis players (Silva et all, 2006) in the muscles deltoid (upper portion) and brachial biceps, with no statistically significant differences among the tennis players and non tennis players in the muscle deltoid (upper portion). The electric activity of the movements forehand, backhand and serve, varied according to the studied muscle without a standardization of the results.

The largest electric activity presented by the tennis players in relation to the non tennis players can be explained by the adaptation and larger applied intensity to the accomplished movements.

Table 1: Muscle deltoid (upper portion) and muscle brachial biceps.

Muscle	Total Activity	
	Tennis players	Non Ten-nis players
Deltoid (upper portion)	50.06	27.01
Brachial biceps	51.06	42.07

There was significant difference of total electric activity between the group tennis players (EMG = 50.06 µV) and the group non tennis players (EMG=37.01 µV). There was also significant difference of electric activity between the group tennis players (EMG=51.06 µv) and non tennis players (EMG=42.07 µv) (Seeley, 2008).

In addition, there was an interaction between the type of movement and the phase, with the averages between tennis players and non tennis players considered as representative of the statistical results.

CONCLUSIONS

There were statistically significant differences between tennis players and non tennis players, regardless of the movement and of the phase.

The electric activity varied according to the studied muscle, without standardization of the results.

REFERENCES

1. Weineck J. (1991). Anatomia aplicada ao esporte. 3ª ed. São Paulo: Manole, 65-69.
2. Silva RT, Gracitelli GC, Saccol MF, Laurino CF, Silva AC, Braga-Silva JL.(2006). Shoulder strength profile in elite junior ten-nis players: horizontal adduction and abduc-tion isokinetic evaluation. Br J Sports Med 40:513-7.
3. Seeley MK, Uhl TL, McCrory J, McGinn P, Kibler WB, Shapiro R. (2008). A comparison of muscle activations during traditional and abbreviated tennis serves. Sports Biomech. 7(2):248-59.

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The authors would like to thank CAPES for supporting this study.

90 ELETROMYOGRAPHY IN MASTICATION EVALUATION IN CHILDREN WITH GASTROESOPHAGEAL REFLUX DISEASE

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INTRODUCTION

To evaluate the activity of the masticatory muscles, systems and equipment have been implemented that allow measuring and analyzing the muscle electrical activity (PELAEZ, GALLEGO, JIMÉNEZ, 2006).
Some studies regarding electromyographic analysis of masticatory muscles in the literature are derived from a sample of pre-adolescents, young adults or elderly with few studies involving children. (PREETI AGGARWAL; HARBANDA; RASHMI MATHUR;ITU DUGGAL; PARKASH, 1999). An electromyographic evaluation of masseter muscle is important to characterize the masticatory preference right or left side(ONCINS; FREIRE; MARCHESAN, 2006). Mastication is the initial of mastication and digestion phases and this can interfere in other phases of this process. Therefore, a quick and/or inadequate mastication leads of a poor grinding and spraying the food. So, the food will be swallowed in pieces and undergoes little enzymatic activity, increasing the probability of a Gastroesophageal Reflux Disease (GERD), defined as a chronic disease caused by gastroesophageal reflux (GER), characterized as the passage of gastric contents into the esophagus.

METHODS

Was performed a clinical evaluation of mastication through the shooting where was observed the side of masticatory prevalence and was analyzed the electromyographic activity of masseter muscle at rest, in maximum voluntary contraction and during mastication. Were evaluated 3 children with 4, 6 and 12 years respectively, with chronic GERD treated at the Hospital of Clínicas of Universidade Federal.

RESULTS

CASE 1: presented a unilateral mastication on right side, predominantly. In electromyography of masseter, was observed that the right side had greater activity compared with the left, in the maximum contraction (24.9%), in rest (50.1%) and during mastication (20.2 %).

CASE 2: presented an alternate bilateral mastication, predominantly. In electromyography of masseter, showed that the right side had greater activity compared with the left in the maximum contraction (39.8%) and during mastication (1.3%), while the left side had an increased activity at rest at 4.8%.

CASE 3: presented a unilateral mastication on right side, predominantly. In electromyography of masseter, the right side had greater activity compared with the left in the maximum contraction (6.2%), at rest (9.35%) and during mastication (6.6 %). In all cases there was a correlation of electromyographic findings with the Speech, Language and Hearing Sciencesclinical evaluation of mastication.

CONCLUSIONS

According to the results of this research, the children who showed unilateral masticatory predominantly also suggested that the electrical activity on that preference side was higher at rest, at maximum voluntary contraction and during mastication when compared to the other side. It's important the electromyography evaluation in Speech, Language and Hearing Sciences practice.

REFERENCES

1. PELÁEZ A, GALLEGO G, JIMÉNEZ ID. (2006). CES Odontol. 19, 2, 25-29.
2. PREETI AGGARWAL, O.P. KHARBANDA, RASHMI MATHUR, RITU DUGGAL, H. PARKASH. (1999). *American Journal of Orthodontics & Dentofacial Orthopedics* , 116, 4, 405-414.
3. ONCINS, M.C.; FREIRE, R.M.A.C.; MARCHESAN, I.Q. (2006). *Revista Distúrbios da Comunicação, São Paulo*,18, 2, p. 155 -156.
4. CATTONI, D.M. (2004). *Tratado de Fonoaudiologia*, 277- 283.

ACKNOWLEDGEMENTS

The authors thank the National Council of Technological and Scientific Development (CNPq), which had a financial support with Universal Edictal MCT/ CNPq14/2009

91 CORRELATION BETWEEN RATING OF PERCEIVED EXERTION AND PHYSIOLOGICAL VARIABLES DURING THE EXECUTION OF STATIONARY RUNNING IN WATER AT DIFFERENT CADENCES

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INTRODUCTION

The subjective sensation of exertion can be defined as the relative tension that occurs in the muscle-skeletal, cardiovascular and pulmonary systems during physical exercise (DOHERTY et al., 2001).
Although the rating of perceived exertion (RPE) response has an important participation of the tension on the neuromuscular system, no approaches were found in the literature that undertakes this analysis in water aerobics. The purpose of the present study was to correlate the rating of perceived exertion with cardiorespiratory and neuromuscular variables during the execution of stationary running in water at different cadences.

METHODS

The sample consisted of 12 apparently healthy women (age: 22.33±0.57 years). All the members of the sample signed a free informed consent document approved by the ethics committee for research in humans of the UFRGS (2006566). An initial session was held with the collection of body mass data and oxygen consumption (VO2) and heart rate (HR) maximal. The latter two were obtained through the performance of a maximum test on a treadmill. During the assessment session, the subjects executed the following protocol: performance of maximal voluntary contraction (MVC) on land and execution of the water-based exercise protocol. The exercise protocol consisted of the performance of stationary running exercise during 4 min at three randomized submaximal cadences (60, 80 and 100 bpm) with a 5 min interval between each situation. HR, VO2, ventilation (Ve) and EMG were measured during the exercise and the overall body RPE, immediately following the end.
Electrodes were placed on the belly of vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF) and semitendinosus (ST) muscles, with a 3-cm center-to-center spacing. Transparent dressings were used to insulate electrodes for the water condition trials. The EMG signals were registered with a 4-channel EMG system (Miotool400 USB, Brazil), with a common mode rejection ratio >110 dB and a sampling rate of 2000 Hz by channel. The filtering of the raw EMG signal was performed with a 5th order Butterworth band-pass with cutoff frequencies of 25-500 Hz. The EMG data of each muscle were normalized by maximal voluntary isometric contraction (MVC).
Pearson's Linear Correlation and Multiple Linear Regression were used. P<0.05 was adopted for all statistical tests (SPSS vs. 13.0).

RESULTS and DISCUSSION

The analyses demonstrate high and significant relationships between RPE and all the cardiorespiratory variables, with the r values varying from 0.60 to 0.77 and
$p \leq 0.001$, as can be seen in figure 1. This results are in agreement with those found by Shono et al. (2000) which observed a highly significant relationship between HR and RPE ($r=0.996$, $p<0.01$) in an underwater treadmill. However, though the RPE is greatly influenced by the muscleskeletal system during physical exercise (DOHERTY et al., 2001), there was no relationship between the RPE and the EMGs of the VL, BF, RF and ST muscles, as can be seen in table 1. With regard of the regression, the model was significant ($p<0.001$) with an $r^2=0.79$, while the variables that explained better the RPE were $\%VO_{2max}$ and Ve (table 2).

CONCLUSIONS

The results of the present study suggest that the RPE can be used as an indicator of the aerobic intensity during the execution of the stationary running exercise in water for young women at cadences widely used in water-based sessions. The use of the Borg scale of RPE can offer professionals a simple, low cost, fast and particularly, reliable instrument for measuring intensity.

REFERENCES

1. Doherty, M. et al. Rating of perceived exertion during high- intensity treadmill running. (2001). *Med. Sci. Sports Exerc*. **33(11)**: 1953-1958.
2. Shono, T. et al. Physiological responses and RPE during underwater treadmill walking in women of middle and advanced age. (2000). *J. Physiol. Anthropol. Appl. Human Sci*. **19(4)**: 195- 200.

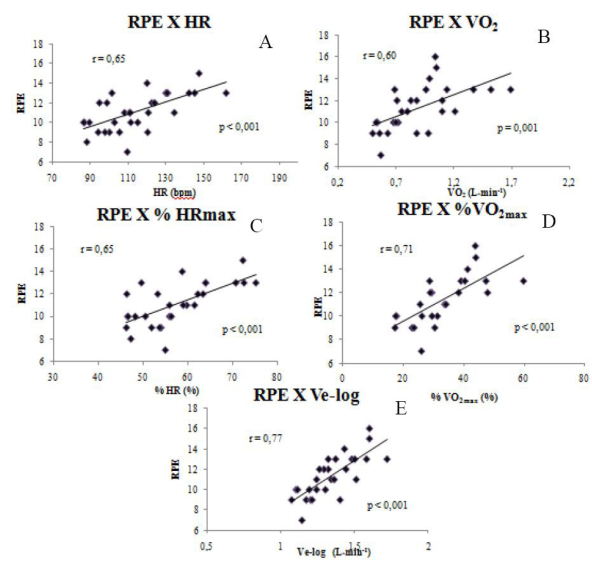

Figure 1 - Graphics with the results of the relationship between RPE and HR (A), RPE and VO_2 (B), RPE and %HRmax (C), RPE and $\%VO_{2max}$ (D), RPE and Ve-log (E).
Note: $\%HR_{max}$ – corresponding values for the percent of maximum HR; $\%VO_{2max}$ – corresponding values for the percent of maximum VO_2; Ve-log – ventilation values after logarithmic transformation.

Table 1 - The r and p values for relationship between EMG from the vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF) and semitendinosus (ST) muscles with rating of perceived exertion (RPE).

	r	p
VL-RPE	-0.046	0.810
BF-RPE	-0.036	0.844
RF-RPE	-0.026	0.892
ST-RPE	-0.175	0.403

Table 2 - Coefficient beta (β) and p values for the variables that entered in the model to explain the rating of perceived exertion.
Note: $\%VO_{2max}$ – corresponding values for the percent of maximum VO_2; Ve-log – ventilation values after logarithmic transformation.

	β	p
Constant	-8.582	0.007
$\%VO_{2max}$	-0.092	0.064
Ve-log	17.476	<0.001

92 ACTIVATION RATIO DURING A 40 KM TIME TRIAL IN TRIATHLETES

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INTRODUCTION

The ratio of muscle activation provides evidence of motor control of antagonist muscles during cycling. Candotti et al. (2008) observed an increase of the activation of the flexors and extensors of the knee joint muscles of triathletes, which is related to reduced pedaling technique for cyclists. Similar results were found by Chapman et al. (2008), for the flexors and extensors muscles of the ankle. Therefore, the lower activation ratio during time trial (TT) events may improve performance, postponing the premature fatigue. With focus on addressing this issue, the aim of the present study was to investigate the influence of TT 40 km in the ratio of muscle activation.

METHODS

Eight triathletes with age: 31.7 ± 5.2 years, mass: 76.9 ± 6.7 kg, maximum power output: 414 ± 39 W, and competitive experience: 5.18 ± 3.79 years participated in this study. The subjects performed a 40 km TT, using their own bicycles positioned in a ciclosimulator (Cateye CS1000, Cateye Co., Osaka, Japan) in the shortest time possible. The electrical activity of muscle was measured at 3°, 10°, 20°, 30 and 38 km. A switch reed switch was attached to the bike as a reference of the cycle ride. Surface electromyography (EMG) was used to measure the activity of the *tibialis anterior* (TA), *gastrocnemius medialis* (GM), *biceps femoris* (BF), *rectus femoris* (RF) and *vastus lateralis* (VL) of the left leg. Pairs of Ag/AgCl (bipolar configuration), with 22 mm of interelectrodes distance were placed on the skin following the norms of the International Society of Electrophysiology and Kinesiology (De Luca, 1997). The EMG signals were filtered with a pass band filter and a 10-500 Hz Butterworth of order 5. The EMG signal was collected using a system of eight-channel (Bortec Electronics Inc., Calgary, Canada), with sampling rate of 2000 Hz per channel (MATLAB® 7.3 (MathWorks Inc., USA). We calculated the mean and standard deviation and coefficient of variation of ten cycles of cycling signal Root mean square (RMS envelope) represented on average 40 ms for each muscle normalized by 3 km (Neptune et al. 1997). The activation ratio was calculated for the following flexors and extensors muscles: TA-GM, BF-RF and BF-VL. Tests of Shapiro-Wilk, Mauchly with correction factor (Greenhouse-Geisser) and ANOVA for repeated measures (post-hoc Bonferroni) were used in statistical analysis (SPSS 12.0, significance level $p < 0.05$).

RESULTS and DISCUSSION

The results showed a reduction in the activation ratio of the BF-VL pair at the 30th km compared to 10th km ($p = 0.02$), and a reduction at the 38th km compared to the 10th and the 20th km ($p = 0.04$ $p < 0.01$, respectively), which are shown in Figure 1. The no significant differences in the final km compared to the 3rd is due to the higher variability of data at the 3rd km (23%), compared to the 10th (14%), 20th (17%), 30th (19 %) and 38th km (15%). Based on these results we can suggest two hypotheses: (1) an increased activation of the VL muscle and (2) a reduced activation of the BF over the TT 40 km in triathletes. Evidence have lead toward the greater variability in muscle activation may be related to the lower technique of triathletes compared to cyclists (Chapman et al., 2007, 2008). Candotti et al. (2008) also reported that triathletes have a higher level of co-activation between the knee joint muscles. These results may indicate an attempt to avoid premature fatigue, based on managing muscle activation and energy expenditure for performance optimization (Bini et al., 2008).

CONCLUSIONS

Changes of the activation ratio may be related to increased activation of the mono-articular extensors.

REFERENCES

1. Candotti CT, et al. (2008). Journal of Electromyography and Kinesiology. In press.
2. Chapman AR, et al. (2008). Journal of Electromyography and Kinesiology. 18(3), 359-71.
3. De Luca CJ. (1997). Journal of Applied Biomechanics. 13(2), 135-63.
4. Neptune RR, et al. (1997). Journal of Biomechanics. 30, 1051-8.
5. Bini RR, et al. (2008). Journal of Science and Medicine in Sport. 11(4), 363-70.
6. Chapman AR, et al. (2007). Experimental Brain Research. 181(3), 503-18.

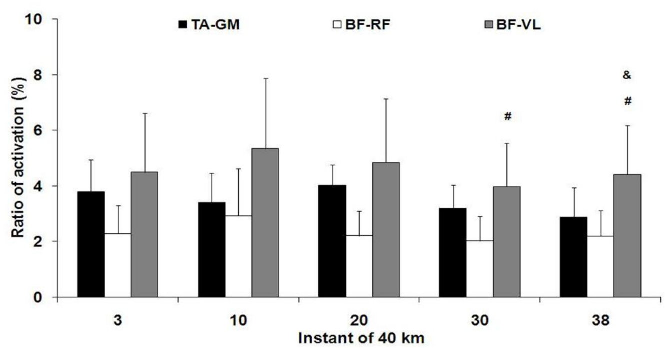

Figure 1: Activation ratio between muscle flexor-extensors. #Significant difference for the 10th km and &significant difference for the 20th km ($p < 0.05$).

93 CORRELATION BETWEEN RATING OF PERCEIVED EXERTION AND PHYSIOLOGICAL VARIABLES DURING A WATER AEROBIC EXERCISE PERFORMED WITH WATER-FLOATING EQUIPMENT

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INTRODUCTION

Recently, the popularity of water aerobics exercises has become growing (D'Acquisto et al., 2001). However, little research exists regarding both the cardiorespiratory and neuromuscular responses associated with the rating of perceived exertion during water aerobics exercises (Alberton et al., 2010). The purpose of this study was to correlate the rating of perceived exertion overall (RPE-overall) with cardiorespiratory and neuromuscular variables during the stationary running with the elbow flexion/extension performed with water-floating equipment. In addition, the correlation between the rating of perceived exertion for the arms (RPE-A) and for the legs (RPE-L) only with neuromuscular variables during the exercise was assessed.

METHODS

The sample consisted of eleven young women familiar with the aquatic environment (age: 23.09 ± 2.07 years). The study was approved by the Research Ethics Committee of the UFRGS (2007905).
The bipolar electrodes were placed on the belly of biceps brachii (BB), triceps brachii (TB), rectus femoris (RF) and biceps femoris (BF) muscles. Insulation was done with adhesive waterproof over the electrodes.
The maximal voluntary isometric contraction (MVC) was collected and was used to calculate the percentage of MVC (%MVC) of the collected EMG signal. The raw EMG signal was filtered using a 5th order Butterworth band-pass filter with cutoff frequencies of 20-500 Hz and was collected by a 4-channel EMG system (Miotool400, Brazil), with a common mode rejection ratio >110 dB and a sampling rate of 2000 Hz by channel.
The subjects performed the exercise with water-floating equipment in upper and lower limbs at two cadences (80 and 100 bpm). The exercise was performed during 4 min in each submaximal cadence, with a 10-min interval between them. During the exercise, cardiorespiratory and neuromuscular data were acquired as from the third minute. Immediately following the end of the exercise the RPE-overall, RPE-A and RPE-L were collected.
Pearson Linear product-moment Correlation test was used to check the level of relationship between the cardiorespiratory and neuromuscular variables with the rating of perceived exertion. An alpha level of 0.05 was adopted for statistical test (SPSS vs. 15.0).

RESULTS and DISCUSSION

High and significant relationships were showed between the REP-overall and all the cardiorespiratory variables, with the r values ranging from 0.60 to 0.70. Between the REP-overall and %MVC BB and %MVC BF variables moderate and significant relationship was found (Figure 1).
The RPE-A showed no correlation with the %MVC BB and %MVC TB. The same data was demonstrated between the correlation of the RPE-L with %MVC RF and %MVC BF.

CONCLUSIONS

The present study showed significant relationships between RPE-overall and all cardiorespiratory variables analyzed. Therefore, the importance of these data can be noted because the rating of perceived exertion is widely used in the prescription of water aerobics exercises.

REFERENCES

1. Alberton CL, Antunes AH, Pinto SS, Tartaruga MP, Silva EM, Cadore EL, Kruel LFM. (2010). Correlation between rating of perceived exertion and physiological variables during the execution of stationary running in water at different cadences. J. Strength Cond. Res. Fitness In press.
2. D'Acquisto L, D'Acquisto D, Renne D. (2001). Metabolic and cardiovascular responses in older women during shallow-water exercise. J. Strength Cond. Res. 15(1):12-19.

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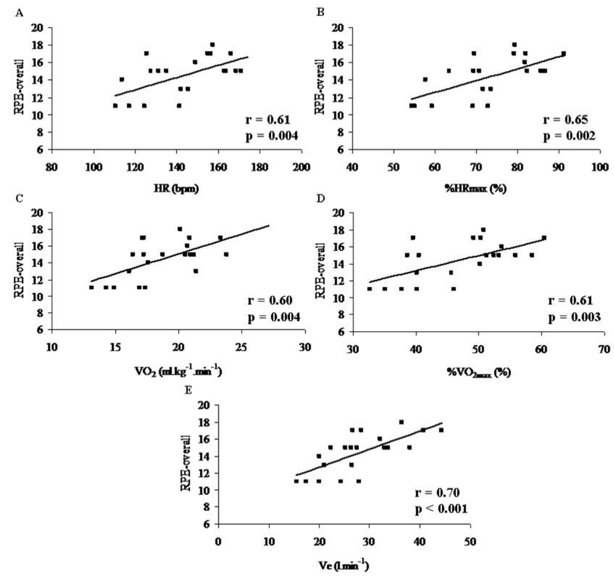

Figure 1 - (A) Correlation between RPE-overall and heart rate (HR), (B) RPE-overall and percentage of maximal HR (%HR_{max}), (C) RPE-overall and oxygen uptake (VO_2), (D) RPE-overall and percentage of maximal VO_2 (%VO_{2max}) and (E) RPE-overall and ventilation (Ve).

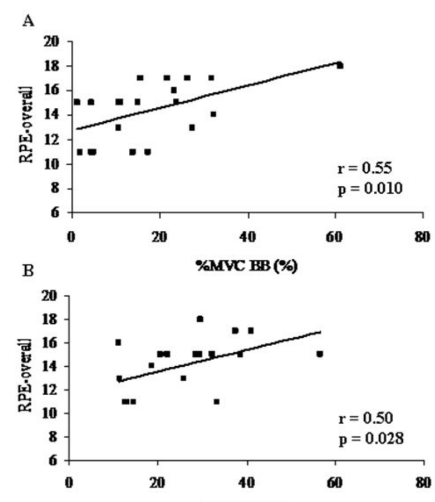

Figure 2 - Correlation between (A) RPE-overall and percentage of the maximal voluntary isometric contraction for biceps brachii (%MVC BB) and (B) RPE-overall and percentage of the maximal voluntary isometric contraction for biceps femoris (%MVC BF).

94 EMG ACTIVITY OF THE SUPERFICIAL QUADRICEPS MUSCLES DURING CONSTANT LOAD SUPRAMAXIMAL CYCLING EXERCISE

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INTRODUCTION

Information about a physiological perspective in laboratory conditions, in the field and at the competitions are commonly found (Bini et al., 2008; Hautier et al., 2000). However, information about the neuromuscular behavior of the main muscles involved in the action of pedaling in high intensity exercise is not well established (Fernandez-Garcia et al., 2000; Padilla et al., 2000). The purpose of the present study was to analyze the muscular activation pattern of the Vastus Lateralis (VL), Vastus Medialis (VM) and Rectus Femoris (RF) of the Quadriceps Femoris (QF), seeking to identify the relative contributions of each muscle during constant load cycling exercise.

METHODS

We evaluated the peak oxygen consumption (VO_{2peak}) and the Maximal Accumulated Oxygen Deficit (MAOD), according to the protocol proposed by MedbØ et al.. (1988), of 10 trained cyclists (27.5 ± 4.1 years; 71.0 ± 10.3 kg; 173.4 ± 6.6 cm; mean VO_{2peak} 56.7 ± 4.4 mL.kg-1.min-1; mean MAOD 5.7 ± 1.1 L) that performed the tests in a cyclosimulator model CompuTrainer DYNAFIT™ (RacerMate®, Seattle, WA, USA). The muscle activity (EMG signals) was recorded during the constant supramaximal load test (MAOD) and expressed by the *root-mean square* (RMS).

The EMG signals were recorded according to the ISEK guidelines. The active bipolar electrodes (TSD 150™, Biopac System®, USA), with inter-electrode distance of two cm, were placed over the superficial muscles of the quadriceps (QF), vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF), and QF integrated (VL + VM + RF / 3). The electrodes were positioned according to SENIAM recommendations.

The EMG activity was recorded by a 16-channel electromyograph model MP150™ (Biopac System®, USA) with a sampling frequency of 2000 Hz and common-mode rejection ratio of 95 dB. The raw EMG signals were filtered (band-pass filter of 20 Hz and 500 Hz), rectified and smoothed.

The distribution of the data was verified by the Shapiro-Wilk's test, followed by one-way ANOVA for repeated measures, with the Scheffé's *post-hoc* ($P<0.05$).

RESULTS and DISCUSSION

The RMS of the EMG signal from the QF, VL and VM muscles was significantly higher at 75% of exercise duration than at the beginning of the exercise, while in the RF muscle this was observed after 50% or exercise duration (Fig. 1) ($P<0.05$).

CONCLUSIONS

We conclude that RF may play an important role limiting performance during severe cycling exercise.

REFERENCES

1. Bini RR, et al. J Sci Med Sport 11: 363-370, 2008.
2. Hautier CA, et al. Med Sci Sports Exerc 32: 839-843, 2000.
3. Medbø JI, et al. J Appl Physiol, v.64, n.1, p.50-60. 1988.
4. Fernandez-Garcia B, et al. Med Sci Sports Exerc 32: 1002-1006, 2000.
5. Padilla S, et al. Med Sci Sports Exerc 32: 850-856, 2000.

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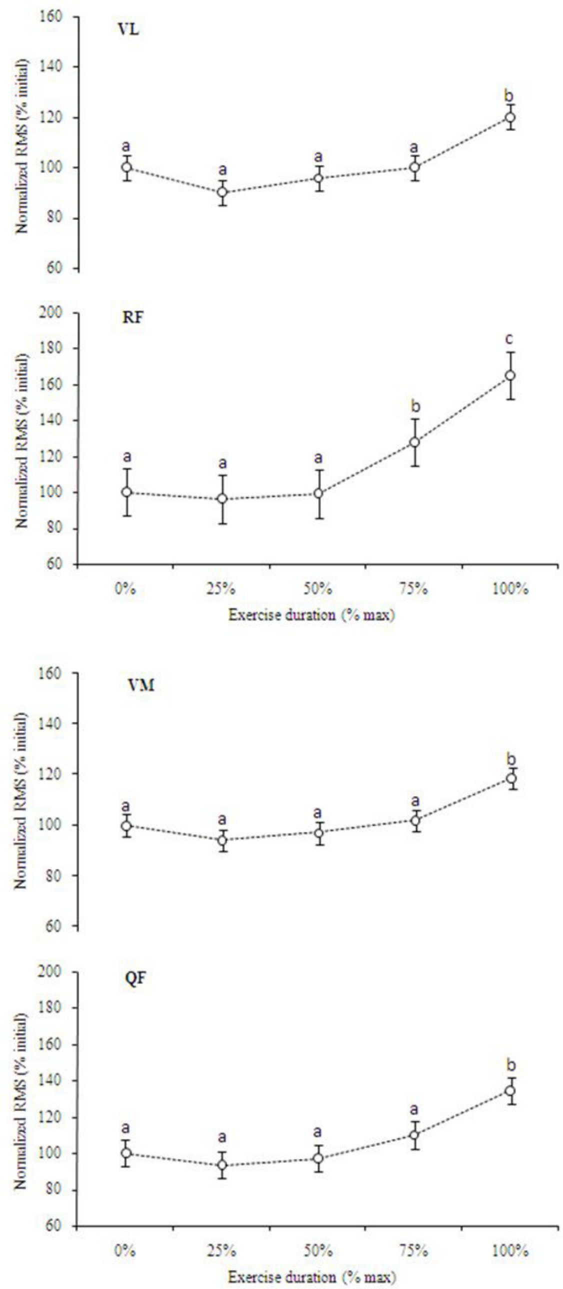

Fig. 1: Values (mean ± standard error) of EMG activity of the VL, VM, RF and QF muscles, normalized by initial RMS (5 s) and exercise duration (% max) (n = 10). Same letters = no significant differences of normalized EMG activity between exercise duration (% max) ($P>0.05$). Different letters = significant differences of normalized EMG activity between exercise duration (% max) ($P<0.05$).

95 ANAEROBIC PERFORMANCE OF BEGINNER ATHLETES WITH EMG BIOFEEDBACK TRAINING

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INTRODUCTION

Biofeedback (BFB) is a training program in which a person is given information about physiological processes that is not normaliy available with the goal of gaining conscious control of them, and uses visual and hearing inputs. As a part of the method, electromiographic BFB (EMG) is able to record the electric potential of working muscle fibers, and can be used in sport medicine as a tool for athletic improvement. In this sense, the goal of this work was to test EMG biofeedback training for volleyball players during anaerobic exertion.

METHODS

EMG measurements were taken from the M. *quadriceps femoris* of 10 female teenagers (13-15 years old) properly divided in control and test groups (n=5/group). EMG signals were acquired with Ag/AgCl Meditrace surface electrodes connected to Neuroeducador III® instrument. All subjects performed a knee flexion program in closed chain way with weight discharge during 20 s during the experiment. The test group (n=5), followed a training line as visual stimulus using the EMG biofeedback apparatus. After the fifth day of training, the subjects of both groups were instructed do not training during 15 days, aiming to evaluate the maintenance of electromiographic profiles. After this period, the subjects were allowed for more 15 days of training. Control group (n=5) done the same work at Alfenas Tennis Club, Minas Gerais. A 90 s-sprint running was also allowed for both groups before and after training. The results were analysed as mean ± SEM. Differences between groups were evaluated through Kruskal-Wallis and Mann-Whitney tests ($p<0.05$).

RESULTS and DISCUSSION

The test group increased EMG signals around 30 ± 1.8% up to the 3rd day of training, and 80 ± 1.4 % (279 - 501 uV) after 30 days of the training (fig 1).

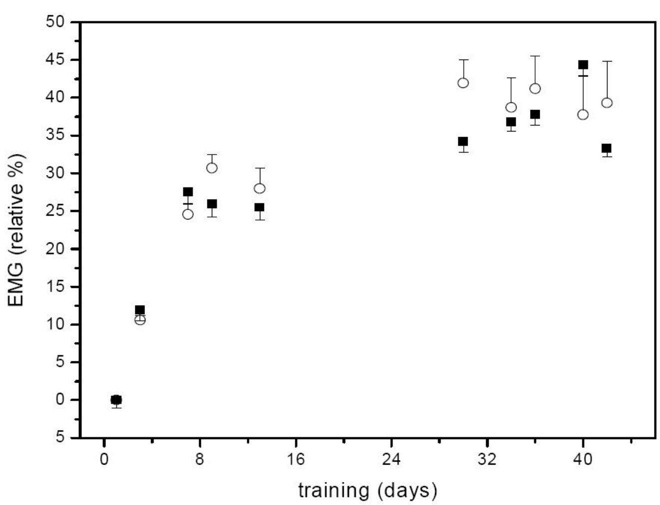

Figure 1. Relative EMG changes during EMG biofeedback training for the tested group. Data represented the relative percentual of EMG signals obtained for left (○) and right (■) legs of the subjects after the first training day. Values are expressed by mean ± SEM.

At the end of the training, the test group also showed a better anaerobic threshold, as verified by the runned distances for both groups. (fig 2). Cummings *et al* (1984) verified similar pronounced effects in stretching and flexibility exercises of group received biofeedback training for mental control, althought these results had vanished after training. On investigating the effect of EMG biofeedback in power gain and control of quadriceps in two volunteers groups of trained and untrained subjects, Crove (1986) found significative increases in torsion peak and electromiographic values of the muscle, as compared to the untrained group.

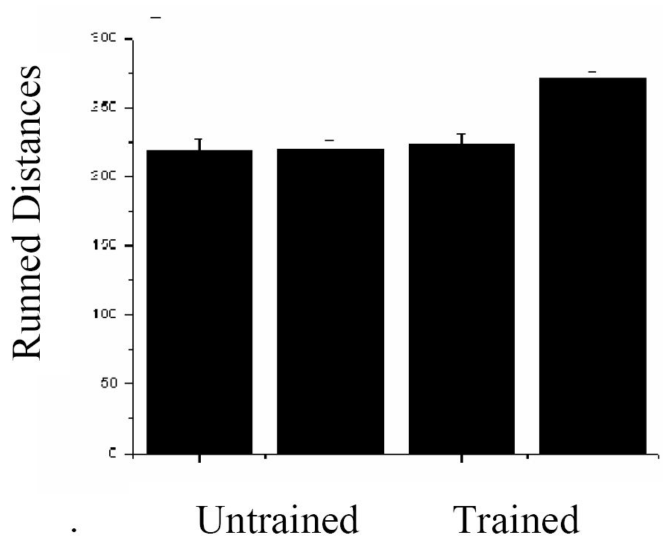

Figure 2. Relative changes in test running for trained group

CONCLUSIONS

EMG biofeedback can be considerably indicated for both training and performing assistance increasing anaerobic threshold potential, needed for initiation of fast muscle efforts in athletic performances.

REFERENCES

1. Association for Applied Psycophysiology and Biofeedback. (2003). *Associaton for Applied Psycophysiology and Biofeedback*.**1 - 26**.
2. Basmajian, J.V., *et al*. (1975). *Archives of Physical Medicine and Rehabilitation*, **231-236, 56**.
3. Caird *et al. (1999). Medicine and Science in Sports and Exercise*. **31, 717- 722, 5**.
4. Cummings, M. *et al. (1984). Biofeedback Self Regulation*.**9, 395-405**.

96 UNDER-20 SOCCER PLAYERS ISOKINETIC PROFILE

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INTRODUCTION

Lower extremity's muscle strength, power and work are biomechanical variables that have great influence over soccer players' performance. These parameters can be obtained through isokinetic evaluation, using pre determined angles and velocities (Terreri et al, 2000). The present study aimed at determining the isokinetic profile (peak torque, maximal power and total muscle work) of under 20 professional soccer players, before and after a fatigue protocol.

METHODS

Twenty one male athletes under 20 years of age of a Brazilian professional soccer team participated in the study. Their ages ranged from 16 to 19 years (17.7± 1.5 years). Isokinetic measurements were performed on quadriceps and hamstrings muscles from the dominant leg using an isokinetic dynamometer (*Biodex System 3 Pro*; Biodex Medical Systems, Shirley, New York). Maximal power (MP) and total work (TW) were obtained in the angular velocity of 300°/s, whereas isometric peak torque (PT) was obtained at the joint angle of 60°. These parameters were evaluated before and after an isokinetic fatigue protocol consisting of 10 bouts of 10 maximal voluntary isokinetic contractions at an angular velocity of 90°/s (Byrne et al, 2001). The GraphPad Prism 5.0 software was used to analyze data. The student t test was used to compare differences in the variables between pre- and post-fatigue, with a level of significance for $p<0.05$.

RESULTS and DISCUSSION

There was a significant reduction in PT and TW from pre-fatigue to post-fatigue ($p<0.05$). Knee extensor PT decreased from 289.7± 41.4N pre-fatigue to 228.4 ± 41.5N post-fatigue, whereas knee flexor PT decreased from 173.4 ± 31.5N to 142.7 ± 50.8N (Figure 1).

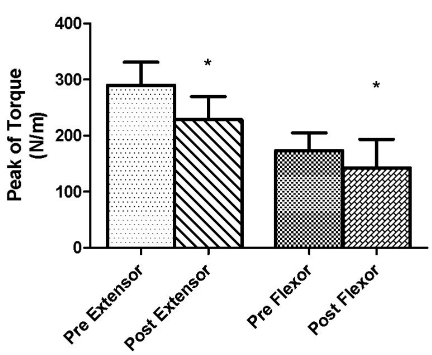

Figure 1 – Peak torque comparison in the quadriceps and hamstrings muscles before and after the fatigue protocol. * = $p<0.05$.

Knee extensor TW decreased from 386.4 ± 76.9J before the fatigue test to 280.6 ± 102.3 J after the test, whereas it decreased from 302.2 ± 97.4J to 280.5 ± 80.2J after the fatigue protocol (Figure 2).
However, MP did not decrease ($p>0.05$) from pre-fatigue to after-fatigue. Initial values for knee extensors were 252.2 ± 66.1W and 189.3 ± 63.4W for knee flexors, whereas after the fatigue test MP values were 245.9 ± 59.8W for knee extensors and 168.9 ± 42.6W for knee flexors.
These results show that the 21 athletes were unable to maintain torque and work at the same level after fatigue compared to pre-fatigue values. Similar results are observed during soccer games, when there is a decrease in performance throughout the game. Fonseca et al. (2007) characterized muscle performance in professional soccer players using isokinetic assessment. These authors evaluated peak torque, power and work, and observed a significant bilateral difference for some variables.
Our work results obtained before the fatigue protocol were higher than the results presented by Fonseca et al. (2007), either in extensor or knee flexors. We could not compare our results for peak torque and power, since we used different velocities than these authors. Borges and Vaz (2000) have found that soccer players' strength is always higher than strength produced by sedentary individuals. Moreover, differences in these variables can be found among athletes in the same sport modality.
We were unable to find in the literature studies that investigated the effects of fatigue on the above parameters. These data are important, as PT, TW and PM are biomechanical variables that allow for the determination of sports performance. Understand fatigue mechanisms and their effects over sports performance are important, as it allows coaches to better define training programs leading to a good physical fitness of their athletes, which will allow for a good performance. Moreover, these results may allow for the understanding of one of the main physiological phenomenon limiting sports performance: skeletal muscle fatigue.

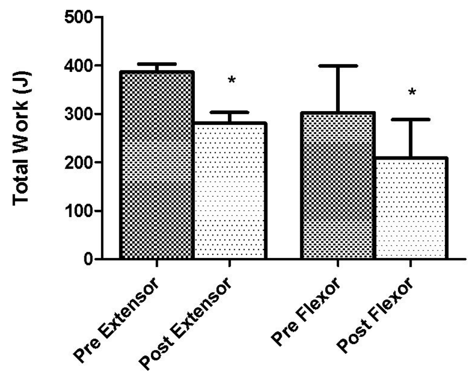

Figure 2 – Total work comparison between pre and post-fatigue for knee extensors and knee flexors. * = $p<0.05$.

CONCLUSIONS

Athletes showed a decrease in PT and MW as a consequence of the fatigue protocol. This decrease can influence performance in a negative way during a soccer match. New studies, however, are necessary in order to establish what the decrease in PT and TW is after a match and/or a training session in these athletes.

REFERENCES

1. Byrne C, Eston RG, Edwards RH. Characteristics of isometric and dynamic strength loss following eccentric exercise-induced muscle damage. Scand J Med Sci Sports, 11: 134-140, 2001.
2. Borges GM, Vaz MA. Estudo Comparativo da relação existente entre a força, a velocidade de contração ea potência muscular em jogadores e futebol e indivíduos sedentários. Rev. Perfil. a. IV, n. 4, 2000
3. Fonseca ST et al. Caracterização da performance muscular em atletas profissionais de futebol. Rev. Bras. Med. Esporte - v.13, n. 3, p. 143-147, 2007.
4. Terreri ASAP, et al. Avaliação Isocinética no joelho do atleta. Rev Bras Med Esporte, v. 7, n. 5, 2001.

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THE EFFECT OF DEAFNESS IN MASTICATORY CYCLES

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INTRODUCTION

Most deaf individuals present strong dysfunction in facial and masticatory musculature, temporomandibular dysfunctions, bruxism and constant headaches, with no directly relation with deafness. Surface electromyography (sEMG) has been used to study the performance of the musculature in mastication, swallowing and speech and is an important tool for the analysis of physiopathological changes affecting this musculature (Regalo et al., 2003, Regalo et al., 2005, Regalo et al., 2006).
Masticatory mechanisms are flexible and, when disabled, are easily compensated.
This can explain the considerable variation in the magnitude, duration and time of masticatory cycles in deaf individuals. The aim of this study was to analyze electromyographically the masseter and temporalis muscles in deaf individuals comparing them with clinically normal individuals. This was performed in 30 individuals from both sexes with mean age of 23.0 ±5 years, divided into 2 groups of 15 individuals each: 1. deaf individuals; 2. clinically normal individuals (controls), during clinical condition of an unusual habitual mastication.

METHODS

sEMG was performed using five channels of the Myosystem-Br1 apparatus (DataHominis Ltd.), with simultaneous acquisition and common grounding to all channels. sEMG data were collected using surface differential electrodes (two Ag–AgCl bars, 10 × 2 × 1 mm, with 10 mm interelectrode distance, gain of 20, input impedance of 10 GΩ and common mode rejection ratio of 130 dB – Myosystem, São Paulo, Brazil). EMG signals were sampled by a 12-bit A/D converter board with a frequency of 2 kHz, and band-pass filtered at 0.01–1.5 kHz. The non habitual chewing was verified through the electromyographic signal obtained during chewing of unusual process (Parafilm M), representing the myoelectrical activity in a dynamic activity produced by movements. The electromyographic signals of all the masticatory cycles were collected in three replicates of ten seconds, intercalated by two minutes of rest and, after this process, it was used the mean value. The masticatory efficiency of cycles between individuals was evaluated by the ensemble average of the electromyographic signal, and this value was obtained in microvolts/second, during the time. The values of ensemble average were normalized by the value of the electromyographic signal of maximum dental clenching, harvested by four seconds. The electromyographic means were tabulated and subjected to statistical analysis using ANOVA (SPSS 17.0).

RESULTS

The result of the Student t test indicated no significant differences ($p > 0.05$) between the normalized values obtained in masticatory cycles in both groups (Table 1).

CONCLUSIONS

Based on the results of this research, it was possible to conclude that deaf individuals showed no performance and efficiency of masticatory cycles significantly inferior when compared with control subjects during the proposal mastication, but they had electromyographic highest averages for the masseter and temporalis muscles. This result is very important, because it demonstrates the functionality of complex physiological process of mastication in individuals with deafness.

REFERENCES

1. Regalo S.C.H., Vitti M., Hallak J.E.C. et al. (2003). EMG analysis of the upper and lower fascicles of the orbicularis oris muscle in deaf individuals. *Electromyogr Clin Neurophysiol*.; **43**(6):367-72.
2. Regalo S.C.H., Vitti M., Semprini M. et al. (2006). Electromyographic analysis of the masseter and temporal muscles in oralized deaf individuals. *Electromyogr Clin Neurophysiol*. Jul-Aug; **46**(4):217- 22.
3. Regalo S.C.H., Vitti M., Moraes C. et al. (2005). Electromyographic analysis of the orbicularis oris muscle in oralized deaf individuals. *Braz Dent J*.; **16**(3):237-42.

ACKNOWLEDGEMENT

This study was supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (2002/02473-9).

Table 1: Normalized electromyographic means (ensemble average) during the mastication process in individuals with deafness compared to the control subjects (t test for $p < 0.05$).

Clinical conditions and muscles	Deaf	Control	Significance
Parafilm mastication			
Right temporalis	0.25 ± 0.15	0.21 ± 0.08	ns*
Left temporalis	0.24 ± 0.13	0.20 ± 0.06	ns*
Right masseter	0.26 ± 0.14	0.22 ± 0.06	ns*
Left masseter	0.29 ± 0,17	0.21 ± 0.11	ns*

ns* no significance

98 SCRIPT FOR KYNESIOLOGIC ELECTROMYOGRAM PROCESSING DURING SIT-TO-STAND MOVEMENT

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INTRODUCTION

Sit-to-stand movements are performed several times a day. They comprise essential movements to allow the performance of other human functional movements (HFM) (DURWARD et al, 2001).
The electromyogram is a complex signal, where its shape is dependent on many factors (MERLETTI & PARKER, 2004). Hence, due to its dependence on the motor task under execution, the raw signal is of little help for kinesiology studies. Research has been conducted for determination of computational methods for extraction of information related to HFM. The aim of this work is to establish a processing script for generation of electromyogram profiles related to the sit-to-stand movement.

METHODS

Sample. Fourteen volunteers (7 men; 23.3±2.9 years; 70.7±21.kg; 172.6 ± 10.4 cm) joined this study. Pregnant women and subjects with history of musculoskeletal pain were not included. The protocol was approved by the Ethic Committee (protocol nº 001.0.307.000-08) and all tested subjects signed the informed consent form.

Procedures. Electrodes were attached to the clean skin with alcohol at the belly of each studied muscle with perpendicular orientation to the fibers orientation. All volunteers were familiarized with the procedures 24h before their enrollment in the study. Each subject was positioned in a sit position at a chair with fixed height (45 cm). The subject was asked to stand up and keep the orthostatic position for a few seconds. After this pause, the subject was asked to sit down, ending a cycle of movement. Overall, ten cycles were performed by each subject.

Signal Acquisition. Signals were acquired with EMG400C (gain 1000, CMRR>100 dB, (EMG System, Brazil). Bipolar differential electrodes connected to pre-amplified electrodes (gain 20) and an electrogoniometer were connected to an analog-to-digital converter USB NI-6009 with 14 bits resolution, 48 kHz (National Instruments®), both connected to a PC. Ag/AgCl electrodes (10 mm diameter) were placed according to international recommendations of SENIAM (HERMENS et al., 1999) for the studied muscles (soleous and tibialis anterior). The electrogoniometer was used as a reference signal, being fixed below the right maleolus with tape lined up to the tibia and foot base. All electrodes were also fixed with tape to minimize movement and skin artifacts. The sampling frequency was 1.0 kHz/channel. For storage and analysis we used the software SuiteMYO (PhD² Consultoria e Sistemas, Brazil).

Kinesiologic profile. Kinesiologic profile of electric muscle activity was generated in a four-step process based on the work of Merletti & Parker (2004). The first phase comprised the smoothing of the raw EMG signal. The second phase comprised the identification and segmentation of muscle activation in cycles of activity, performing the timing normalization to the whole task. In this phase the electrogoniometer signal was used as a reference of articular position (the time derivative is the angular velocity: null velocity means the segment is not moving). The third phase ensured that all identified cycles presented the same amount of samples by linear interpolation. The last phase comprised the calculus of average and dispersion values of EMG signals for each channel, generating a representative cycle of the HFM sit-to-stand.

Detailed script for signal processing:
1. Remove DC component
2. Low-pass filtering, 450Hz, 2nd order, Butterworth, Zero-lag
3. Low-pass filtering, 1Hz, 2nd order, Butterworth, Zero-lag (electrogoniometer)
4. Notch-filtering, 59Hz-61Hz, 4th order, Butterworth, Zero-lag
5. Full-wave rectification
6. Moving average 0.200s
7. Remove initial value (electrogoniometer)
8. Time derivative (electrogoniometer)
9. Full-wave rectification (electrogoniometer)
10. Limiar detection (triple): Amplitude (%Max), 10%, duration 0.500s, interval 0.250s
11. Limiar detection (double), Amplitude (%Max), 50%, duration 1s (electrogoniometer)
12. Compare detections (OR)
13. Normalization Y axis (Autonormalization)
14. Cut detected events (all segments)
15. Linear interpolation, Mean±Standard deviation

RESULTS and DISCUSSION

Figure 1 presents the kinesiologic profile obtained with the proposed script.

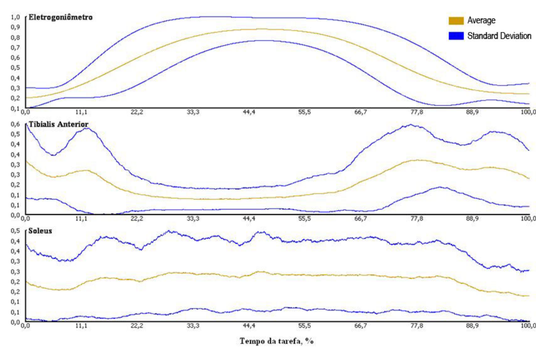

Figure 1 – Kinesiologic profile of electrogoniometer (top), tibialis anterior (middle) and soleous (bottom). Lines represents average±standard deviation.

It can be observed that the two phases of the sit-to-stand-movement are well defined (stand: 0-50%; sit: 50-100%), with antagonic actions of these two studied muscles.

CONCLUSIONS

The proposed script allows the generation of kinesiologic profiles of electromyograms during sit-to-stand HFM. It is recommended that script used to generate the profile is also applied for comparison of the evolution of patients.

REFERENCES

1. Durward BR, et al. (2001). Movimento funcional humano: mensuração e análise. Manole.
2. Hermens JH, et al (1999). European Recomendations for Surface ElectroMyoGraphy: Results of the SENIAM project. Roessingh Research and Development.
3. Merletti R, Parker PA. (2004) Electromyography: Physiology, Engineering, and Noninvasive Applications. IEEE Press.

99 SCRIPT FOR ELECTROMYOGRAM PROCESSING WITH APPLICATION TO MUSCULAR ACTIVITY DURING POSTURAL CONTROL

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INTRODUCTION

The purpose of postural activity is to keep the stability of the musculoskeletal system, which evokes the maintenance of the body position in relation to the base of support and ensures the desired orientation of the body segments not involved in the movement. Hence, difficulties for maintenance of this balance contribute to the increase of falls in diseased subjects (HIJMANS et al., 2007).

Surface electromyography (EMGS) has been extensively used joined with stabilometry for identification of motor strategies related to the postural balance in several situations (MERLETTI & PARKER, 2004). The aim of this work is to propose a script for processing and analysis of stabilometric and electromyographic signals with application to postural sway studies.

METHODS

Sample. Nine volunteers (1 man; 28.2±2.0 years; 70.7±15.2kg; 1.58 ± 0.14m) joined this study. Pregnant women and subjects with history of musculoskeletal pain were not included. The protocol was approved by the Ethic Committee (protocol nº 0003.0.307.000-09) and all tested subjects signed the informed consent form.

Procedures. Electrodes were attached to the clean skin with alcohol at the belly of each studied muscle with perpendicular orientation to the fibers orientation. All volunteers were familiarized with the procedures 24h before their enrollment in the study. Each subject was positioned at the force platform. Subjects were asked to keep four different conditions combined: eyes opened or closed, with base opened or closed.

Signal Acquisition. Signals were acquired with EMG400C (gain 1000, CMRR>100 dB, (EMG System, Brazil). Bipolar differential electrodes connected to pre-amplified electrodes (gain 20) were connected to an analog-to-digital converter USB NI-6229 with 16 bits resolution, 400 kHz (National Instruments®), both connected to a PC. The force platform AMTI AccuSway Plus was used for signal acquisition of the center of pressure, both connected to the computer. Ag/AgCl electrodes (10 mm diameter) were placed according to international recommendations of SENIAM (HERMENS et al., 1999) for the studied muscles (medial gastrocnemius and tibialis anterior). All electrodes were fixed with tape to minimize movement and skin artifacts. The sampling frequency was 1.0 kHz/channel. For storage and analysis we used the software SuiteMYO (PhD² Consultoria e Sistemas, Brazil).

Detailed script for signal processing:

1. Remove DC level
2. low-pass filtering, 10Hz, 4th order, Butterworth, Zero-lag
3. Nothc filtering, 59Hz-61Hz, 4th order, Butterworth, Zero-lag
4. Normalization Y axis (Autonormalization)
5. Calculate: x-0,5
6. Duplicate Y channel
7. Half-wave rectification
8. Calculate: -x
9. Half-wave rectification
10. Threshold detection (simple), Amplitude (%Max), 1%
11. Threshold detection (simple), Amplitude (%Max), 1%
12. Moving average (RMS) 0.250s window

RESULTS and DISCUSSION

Figure 1 presents the result of the script applied to a sample signal. It can be observed the opposite segmentation of the first three channels (anterior displacement, tibialis anterior right and left) and the last three channels (posterior displacement, medial gastrocnemius right and left).

This script identifies sets of muscle activity related to the respective displacements, which allows the quantification of electric activity during each phase.

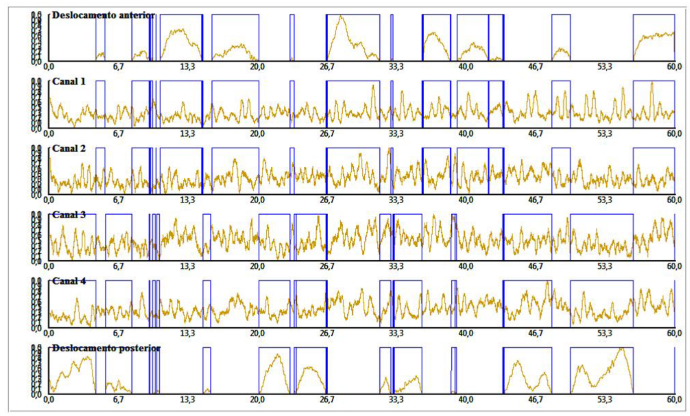

Figure 1 – Segmentation of electromyogram based on stabilometric signal processing using the anterior-posterior displacement signal.

CONCLUSIONS

The proposed script was able to segment the electrocmyograms for identification of movements during both anterior and posterior displacements. This script should be used in balance research for assessment of its potential use in clinical environment.

REFERENCES

1. Hijmans MJ, et al. (2007). A systematic review of the effects of shoes and other ankle or foot appliances on balance in older people and people with peripheral nervous system disorders, Gait and Posture, 25, 316-323.
2. Hermens JH, et al. (1999). European Recomendations for Surface ElectroMyoGraphy: Results of the SENIAM project. Roessingh Research and Development.
3. Merletti R, Parker PA. (2004). Electromyography: Physiology, Engineering, and Noninvasive Applications. IEEE Press.

100 ELECTROMYOGRAPHY ACTIVITY OF GASTROCNEMIUS AND TIBIALIS ANTERIOR MUSCLES WITH DIFFERENT HIGH-HEELED SHOES

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INTRODUCTION

Cumulative effects of overuse caused by high-heeled shoes may provide postural changes and pain. Besides, prolonged use of heeled shoes can cause the shortening of some muscles and changes in the static balance and biomechanical postural reactions (Kendall et al., 1995). Therefore, the aim of this study was to evaluate the electromyography activity of medial and lateral gastrocnemius and tibialis anterior muscles in different heel lifts.

METHODS

Ten female volunteers (24,9 ± 3 years) participated in this study. Elder subjects did not take part in this investigation because they tend to present more changes in the hip muscles than in leg muscles when using heel lifts (Amiridis et al., 2003). Surface electromyography (EMG) was recorded from the lateral (GL) and medial (GM) gastrocnemius and tibialis anterior (TA) muscles. Simple differential surface electrodes (two silver bars positioned 10 mm apart, 10 mm long and 2 mm wide each, 20 times gain, input impedance of 10 GΩ and common mode of rejection ratio of 130 dB (Lynx Tecnologia Eletrônica Ltda, São Paulo, SP, Brazil) were placed over the bellies of lateral and medial gastrocnemius and tibialis anterior muscles. The EMG signals were amplified with gain of 50 times, sampled by 12 bits A/D board (model CAD 12/46, Lynx Tecnologia Eletrônica Ltda, São Paulo, SP, Brazil) with sampling frequency of 2 kHz. The band-pass Butterworth filter was of 20-1000 Hz. Three five-second recordings of the surface electromyography signals were performed on orthostatic posture in different conditions: at rest (with no shoes) and wearing shoes with 2, 6 and 8 centimeters heel lifts. The average of three values was used to analyze the results. The criteria for placement of electrodes followed the rules proposed in SENIAM (Surface Electromyography for the Non-Invasive Assessment of muscles). Matlab 6.5.1 software was used to analyze EMG amplitudes and calculate the normalized root mean square (RMS) values. Because the data had normal distribution, they were analyzed with a parametric test. One-way ANOVA test with Tukey *post-hoc* multiple comparisons test were used for statistical comparisons. The level of significance was set at 5%. The software used to analyze the data was the BioEstat 5.0.

RESULTS and DISCUSSION

Figure 1 shows significant changes in tibialis anterior normalized RMS values in the following comparisons: REST vs 6 cm ($p<0.05$); REST vs 8 cm ($p<0.01$); 2 cm vs 6 cm ($p<0.05$); 2 cm vs 8 cm ($p<0.01$).

It may also be noted the progressive increase of electrical activity of medial and lateral gastrocnemius muscles with the gradual increase in the heel lifts evaluated, though no significant differences. The daily use of heel shoes increases the pressure in the anterior feet and reduces the contribution of the calcaneal region, leading to a decrease in the activation of gastrocnemius muscles. Furthermore, the bipedal posture on high-heeled shoes moves the gravity line to an anterior position, changing the center of gravity and consequently the normal postural orthostatic oscillations (Snow and Willians, 1994). Thus, this can be an explanation for the progressive increase of the electrical activity of the tibialis anterior with increasing heel lifts. Other studies, using similar heel shoes of the present investigation, found a decrease of the electrical activity of gastrocnemius muscle and an increased activity of tibialis anterior muscle in women used to the wearing of high-heeled shoes (Lee et al., 1990; Lee et al., 1987).

CONCLUSIONS

Gradual changes in high-heeled shoes provides an increase in electrical activity of tibialis anterior, however causes no significant change in electrical activity of the medial and lateral gastrocnemius.

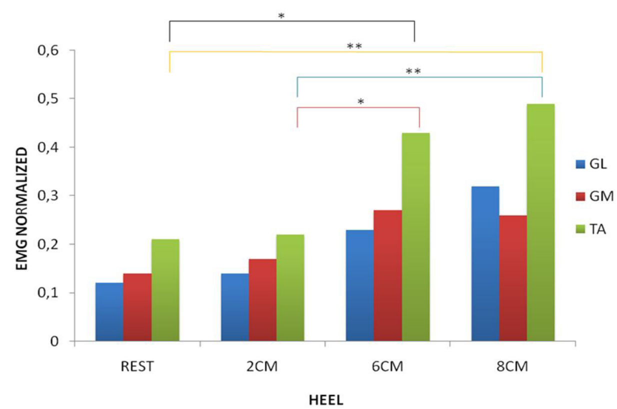

Figure 1: Normalized RMS of medial and lateral gastrocnemius and tibialis anterior muscles in different heels lifts.

REFERENCES

1. Amiridis, et al. (2003). Neurosc Letters. 350,137-40.
2. Kendall PF, et al. (1995). Músculos: provas e funções. Ed Manole.
3. Lee KH, et al. (1990) Arch Phys Med Rehabil. 71, 31-3.
4. Lee KH, et al. (1987). Arch Phys Med Rehabil. 68, 298-301.
5. Snow ER, Willians RK. (1994). Arch Phys Med Rehabil. 75, 568-76.

101 NORMALIZING THE ELECTROMYOGRAPHIC AMPLITUDE OF THE TEMPORAL AND MASSETER MUSCLES DURING MASTICATION

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INTRODUCTION

Normalization is frequently used to improve reliability by decreasing variation within and between individual in electromyographic (EMG) studies (Lin *et al*., 2008) and, to allow for a biologically relevant interpretation of the EMG signal (Lehman, 2002).

However, minority of works reports the method used for normalization procedure in studies about masticatory muscles EMG activity during mastication (Armijo-Olivo *et al*., 2007). The choice of the criterion to normalize the EMG data from dynamic contractions generally is a doubt during data analysis.

The aim of this study was to normalize the EMG amplitude of the elevator muscles and to determine what is the criterion more indicated for EMG signal analysis during mastication.

METHODS

There were selected 16 female healthy volunteers with 18 to 41 years-old (26.7±4.2). This study was approved by Research Ethics Comitee (#004/2005) according to CNS 196/96 resolution.

The EMG signal was registered for three days in the same week with silver/silver chloride bipolar surface electrodes (EMG System Ltda.) joined to preamplifiers of 20 times gain. The electrodes were positioned in the most prominent point during the maximal contraction of the superficial masseter and anterior temporalis muscles along the muscle fibers with an interelectrode distance of 10 mm.

The signal acquisition was made by 12 channels of simultaneous recording equipment (Myosystem I / Datahominis Tec. Co.). The analog EMG signal recorded were digitized using 12 bit A/D converter at a sampling rate of 2KHz. The tasks were bilateral mastication for 10 seconds and maximal voluntary clenching (MVC) for 5 seconds.

The EMG recordings were processed and normalized by MATLAB. There were selected the four masticatory cycles more homogeneous in the habitual mastication. Afterwards, EMG signal was filtered, rectified and linear envelope was obtained. The four masticatory cycles were overlapped and one masticatory cycle represented the masticatory contraction. Mean and standard deviation were calculated of each representative cycle of each volunteer.

The EMG signal was normalized to peak and mean contraction activity during habitual mastication and to MVC. The best reference to normalize EMG data was selected after Coefficient of Variation (CV) calculation that is the quotient between mean and standard deviation. The criterion that presented the lower CV was considered the more appropriate to normalize the EMG masticatory activity.

RESULTS and DISCUSSION

The criteria that presented lower CV were the peak and mean contraction activity of each muscle evaluated. The MVC values presented the higher CV´s. (Table 1).

A high CV represents a great standard deviation, which in turn comes from a low reproducibility of the data. (Ervilha *et al*., 1998).

Some researchers have recomended using the peak or mean EMG value from the dynamic contraction in normalization because doing so reduces the intersubject coefficient of variation (Soderberg & Knutson, 2000). Another advantage of normalizing to dynamic contraction values is no need for the registration of other tasks, such as the MVC to do this proceeding.

CONCLUSIONS

According to results obtained, it can be concluded that EMG measurements obtained from temporal and masseter muscle during mastication were most reliable when normalized to peak or mean versus MVC values.

REFERENCES

1. Armijo-Olivo S, Gadotti I, Kornerup M, Lagravére MO, Flores-Mir C (2007). J Oral Rehabil. 34:397-405.
2. De Luca CJ (2009). Surface Electromyography: Detection and Recording. URL: http://www.delsys.com/.
3. Lin HT, Hsu AT, Chang JH, Chien CS, Chang GL (2008). J Formos Med Assoc. 107(2):175-180.
4. Lehman GJ (2002). J Manipulative Physiol Ther. 25:293-9.
5. Soderberg GL, Knutson LM (2000). Phys Ther. 80:485-498.
6. Ervilha UF, Duarte M, Amadio AC (1998). J. Bras. Fisiot. 3(1):15-20.

Table 1 – Coefficient of Variation (%) for peak, mean and MVC values of each muscle.

	PEAK	MEAN	CVM
LEFT TEMPORAL	**41.9**	44.9	54.9
LEFT MASSETER	**42.1**	44.2	64.9
RIGHT TEMPORAL	51.3	**48.9**	67.6
RIGHT MASSETER	**35.7**	41.1	80.7

102 EVALUATION OF NEUROMUSCULAR STRENGTH PREDICTOR MODEL PROPOSED BY WINTERS

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INTRODUCTION

The goals of this work is to evaluate the model of neuromuscular system proposed by (Winters 1995a,b). The work of Winters innovates presenting a model of neuromuscular system jointly with the model proposed by (Hill, 1938), it was a fundamental start point to study strength prediction through the muscular activation signs, or electromyographyc signs (EMG).
The model proposed by Winters takes as input, the signals of the Central Nervous System (CNS), instead of the EMG activation, as shown in Figure 1, making the validation of this model more difficult, because it is not possible capture these signals to compare the model with the real system. However, for this work, some approaches have been adopted to verify the justification of using the model adopted by Winters.

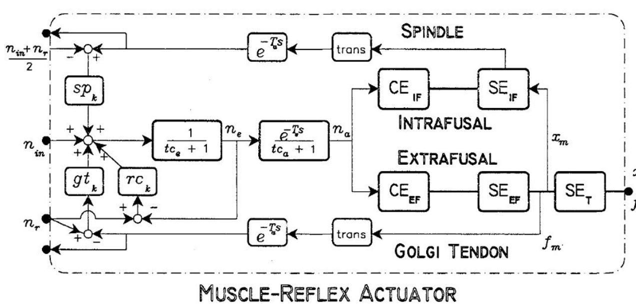

Figura 1 – Neuromuscular model, proposed by Winters (Winters 1995 a,b) for strength muscular prediction.

METHODS

The evaluation of Winters's model was done in two stages, the first one evaluates the Extrafusal (EF) model of muscle fibers and the second evaluates the reflex system incorporated to the Hill's model.
For this experiment, data were collected of isometric contraction from 13 subjects (experiment was previously approved by the ethics committee of UFRJ), where each subject performed two procedures of isometric contraction. The first one was the Maximum Voluntary Contraction (MVC), where each subject was instructed to stay 5 seconds at rest and 10 s with MVC plus 5 s at rest. In the second procedure, the subjects followed a new protocol: 10 s at rest, 10 s in contraction at 20% of MVC, 10 s at rest, 10 s at 60% of MVC plus 10 s at rest. In each of the procedures were collected Myographical signals of the muscles: gastrocnemius medialis, gastrocnemius lateralis, vastus lateralis and tibialis anterior. The experiments followed the SENIAM protocol of data collection, using the electromiography EMGSytem™. The torque was measured with a Cybex™ device. The ratings between the measured torque and estimated torque was evaluated only for the windows of 20% (between 10 and 20 s) and 60% (between 30 and 40 s) of MVC.
The first stage of evaluation used the envelope of the EMG signals, collected from each muscle, as input for the EF model of Winters - each channel was sampled at 2 kHz, filtered from 10 to 350 Hz, rectified and filtered again through a low pass Butterworth filter at 2 Hz, of order 6. The same signal was simulated with the model proposed by (Menegaldo 2001), who introduced improvements in the model proposed by Hill.
The second stage evaluated the contribution of the reflex model to torque estimation. To this simulation, the entry of the CNS, in the Winters model, was assigned as zero, and the signal corresponding to the envelope of the EMG sign in the model was defined as the sum of the signal used in the previous stage plus the reflex response, modeled by Winters. The torque was estimated for each muscle individually and adequately added to find the estimated torque.

RESULTS and DISCUSSION

Evaluating the results of the first stage, the mean absolute difference, percentage, of the torque estimated by the EF model of the Winters and the model of Menegaldo, was 0.85% for 20% of MVC and 4.27% for 60% of MVC. This shows that there is no significant difference between the two models to predict torque from the EMG signal. The error of estimation of the torque for EF model of Winters with the torque measured was 6.38% for 20% of MVC and 12.70% for 60% of MVC. These data indicate the need to improve prediction models of strength, since they present a considerable error, which should be minimizing.
For the second stage, the mean absolute difference, percentage, between the torque estimated by the model of Winters, with the contribution of the reflex system and the torque measured was 4.24% for 20% of MVC and 22.38% for 60% of MVC. In this case there was a slight improvement for the prediction of torque for 20% of MVC and got worse the response for 60% of MVC.

CONCLUSIONS

From the data presented, it's possible to conclude that the modeling done by Winters, changes the prediction of muscle forces. It's not possible, yet, to offer a final conclusion about this model, because, to evaluate it, would be necessary to compare the reflex responses of the model with real situations. But, evaluating the actual responses of the model of Winters , to several levels of activation the response was unsatisfactory, presenting to be worse than Hill's model.
However, in cases where the simulation include the control of the CNS, this may be the basis for developing new models. It is also need to note that the simplification of the reflex system, adopted by Winters, may not be satisfactory, given the inherent complexity of this system. It is understood that it would be interesting a model that suited the adaptive dynamics of this system and in a future work, the authors aim to reassess the reflex model adopted and adapted it to models that have as input the EMG signal, and introduces techniques that best represent the nature of this system.

REFERENCES

1. Hill AV. (1938). The heat of shortening and the dynamic constants of muscle. Proceedings Royal Society Series, no. 126-B, 136-195.
2. Menegaldo LL. (2001). Modelagem Biomecânica e Controle Ótimo da Postura Humana Através de Algoritmos Baseados na Teoria das Aproximações Consistentes. Tese de Doutorado, Escola Politécnica da University from São Paulo, São Paulo.
3. Winters JM. (1995a). An improved muscle-reflex actuator for use in large-scale neuromusculoskeletal models. Annals of Biomedical Engineering, no. 23, 359-374.
4. Winters JM. (1995b). How detailed should muscle models be to understand multi-joint movement coordination? Human Movement Science, no. 14, 401-442.

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103 MEDIAN FREQUENCY AND SIGNAL NORMALIZATION: ELECTROMYOGRAPHIC SIGNAL ANALYSIS OF MASSETER MUSCLE IN MALES

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INTRODUCTION

The mandible muscles participate in a series of motor tasks including bite and mastication food, deglutition and speech (KORFAGE et al., 2005). Mastication is influenced by the specific characteristics of each food (DEGUCHI, KUMAI e GARETTO, 1994). This study aims to analyze the correlation between the EMG normalized signal (NS) and median frequency (Fmed) in masseter muscle of males.

METHODS

The study was characterized as: descriptive, observational, cross-sectional and individual, performed at the Laboratory of Orofacial Motricity and Clinic of Pediatric Dentistry, UFPE. Participated 18 volunteers through a convenience sample, exclusively male individuals, from 18 to 27 years old, mean 22.5 years (SD= +/- 2.2) according with the criteria for inclusion and exclusion pre-established. The Miotool 400 equipment connected to the notebook with Miograph 2.0 software set (sampling frequency of 1024 points, the cutoff frequency of 20Hz-500Hz; Nothi offline filter 59Hz-61Hz) was used. Initially, the muscle surface was cleaned. Volunteer held a sustained maximum voluntary contraction (MVC) and, then, was made the mastication of food (bread, apple, stuffed cookie and peanut, respectively). The mastication sign was standardized by the MVC. Were considered for analysis the median frequency of the signal (FFT - Fast Fourier Transformation) and the normalized signal with the Kolmogorov-Smirnov test for testing the normality assumption of variables and the correlation coefficient considering the 5% margin of error.
This study was approved by the Ethics Committee of UFPE and registered with CEP/CCS/UFPE Nº 116/08, Of Nº 218/2008; SISNEP 0114.0.172.000-08. Financial support from CNPq - Universal 15/2009. Notice PIBIC UFPE/CNPq. 2008/2009.

RESULTS and DISCUSSION

For individuals during mastication of different foods, the normalized electromyographic signal to masseter muscle had more intense on the right side in most events (Table 1). In this population, the study of the correlation coefficient between the median frequency of signal with the normalized signal (Table 2) showed that peanut got a stronger correlation index (right masseter-**R=0.431**; left masseter-R=**0.361**). Individuals had lower correlation coefficients for apple (right masseter-R=0.038; left masseter-R=0.094). The statistical correlation between these parameters showed a positive correlation but in all cases the correlation value was less than 0.6, which features a weak correlation. It's believed that prolonged mastication may reduce the masticatory efficiency as a result of fatigue of mastication muscles (TZAKIS, KILIARIDIS and CARLSSON, 1989).
The literature shows that masticatory performance was significantly influenced by dental state, but not by age or sex (FONTIJIN-TEKAMP et al., 2004) and the strength can be related to the proportions of muscle fiber types (UEDA et al., 2002). It's also possible that the type of food can influence the preferred mastication side.

CONCLUSIONS

There was predominance in most cases for mastication on the right side. However, the results were dominant for mastication of only one food, the peanut.

REFERENCES

1. Deguchi T, et al. (1994). Statistics of differential Lissajous EMG for normal occlusion and Class II malocclusion. Am J Orthod dentofac Orthop,105(1):42-8.
2. Korfage JAM, et al. (2005). Fiber type Composition of the Human Jaw Muscles (Part 1) Origin and Functional Significance of Fiber type Diversity. J Dent Res, 84(9):774-83.
3. Tzakis MG, et al. (1989). Effect of chewing training on masticatory efficiency. Acta Odontol. Scand, 47(6):335-60.
4. Fontijin-Tekamp FA, et al. (2004).
5. Swallowing threshold and masticatory peformance dentate adults. Physiology & behavior, 83(3):431-36.
6. Ueda HM, et al. (2002).Differences in the fatigue of masticatory and neck muscles between male and female. Journal of Oral Rehabilitation, 29(6):575–82.

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Table 1: Data of EMG signal, median frequency (Fmed) and normalized signal (NS) for the masseter muscle during food mastication.

	Bread	Apple	Stuffed cookie	Peanut
		Right masseter		
Fmed (Hz)	166.70	153.16	147.27	149.07
SN	119.95	100.78	100.30	135.00
		Left masseter		
Fmed (Hz)	164.66	152.28	145.02	142.15
SN	111.18	85.93	112.69	122.78

Table 2: Data of the EMG signal correlationn, median frequency (Fmed) and normalized signal (NS) for the masseter muscle during food mastication

	Bread	Apple	Stuffed cookie	Peanut
	Fmed	**Fmed**	**Fmed**	**Fmed**
	R	R	R	R
Right masseter				
NS	0.129	0.038	0.269	0.431
Left masseter				
NS	0.233	0.094	0.170	0.361

104 STANDARDIZATION OF THE ELECTROMYOGRAPHIC SIGNAL THROUGH THE MAXIMUM ISOMETRIC VOLUNTARY CONTRACTION

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INTRODUCTION

To standard an electromyographic signal (EMG) is trying to reduce the differences between the records of the same subject, or different subjects to make the interpretation of the data reproducible. The standardization of the EMG signal has been described in the literature as essential for comparisons between subjects, days of measurement, or muscles in several studies of standardization procedures of the EMG signal. This study aimed to analyze the data EMG before and after the standardization of data.

METHODS

For that 100 normal subjects participated in this study. It was carried out of surface electromyography of masseter and temporal muscles of both sides earlier. Two tests were performed: maximum voluntary contraction (MVC) on cotton rolls and MVC in a position of maximum intercuspation (PMI). The standardization of the EMG signal was performed by the value of the peak of the signal of the first examination.

RESULTS and DISCUSSION

The results of the calculation of the variation coefficient (VC) showed a large amount of VC data for non-standard (Table 1) and lower values of VC for the standardized data (Table 2).

CONCLUSIONS

It was concluded that the standardization of data through the peak of the signal during a MVC was effective in reducing the differences between records of the same subject and different subjects.

REFERENCES

1. Ervilha UF, Amadio AC, Duarte M. Estudo sobre procedimentos de normalização da intensidade do sinal eletromiográfico durante o movimento humano. In: VII Congresso Brasileiro de Biomecânica, 1997, Campinas. Anais do VII Congresso Brasileiro de Biomecânica, 1997. p. 169-174.
2. Felicio CM, Mazzetto MO, Rodrigues da silda MAM, Bataglion C, Hotta TH. A preliminary protocol for multi-professional center for determination of signs and symptoms of temporomandibular. Cranio. v. 24, n.4, p. 258-264, oct. 2006.
3. Tartaglia GM, et al. Masticatory muscle activity during maximum voluntary clench in different research diagnostic criteria of temporomandibular disorders (DRC/ TMD) groups. Man Ther, Edinburgh, v. 13, n.5, p. 434-40, oct. 2008.
4. Ferrario VF, Sforza C, Zanotti G, Tartaglia GM. Maximal bite forces in healthy young adults as predicted by surface electromyography. J Dent, v. 32, n. 6, p. 451-457, Aug. 2004.

Table 1. Summary of data in R.M.S. in micro-volts. Test 1: MVC with cotton rolls; Test 2: MVC in PMI.

Exam	Muscle	Side	N Obs.	Mean	Standart Deviation	CV	Minimun	Median	Maximun
1	Masseter	Right	100	217.46	146.89	67	40	174.9	957.2
		Left	100	208.57	142.83	68	18.3	169.9	764.2
	Temporal	Right	100	174.95	94.64	54	37.8	153.35	772
		Left	100	185.86	85.53	46	66.5	169.35	544.3
2	Masseter	Right	100	204.85	136.87	66	34	181.25	892.8
		Left	100	194.15	130.63	67	26.2	163.2	704.42
	Temporal	Right	100	187.53	112.96	60	17.5	156.9	697.8
		Left	100	195.49	110.43	56	23.7	165.24	691.6

Table 2. Summary of data in R.M.S. After standardization of the data (%).

Exam	Muscle	Side	N Obs.	Mean	Standart Deviation	CV	Minimun	Median	Maximun
Standardized Data	Masseter	Right	100	102.88	49.93	48	27.1	93.3	321.6
		Left	100	103.77	49.08	47	24.2	93.55	284.9
	Temporal	Right	100	110.66	43.04	38	34.1	103.75	359.5
		Left	100	106.93	33.6	31	25.1	100.65	241.7

105 MASSETER ELECTROMIOGRPHY AS A TOOL FOR THE MEASUREMENT OF THE OCCLUSAL SPLINT EFFICACY IN THE TREATMENT OF SLEEP BRUXISM

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INTRODUCTION

The International Classification of Sleep Disorders defines sleep bruxism (SB) as a disease characterized by tooth clenching and grinding harmful movements during the sleep (ICSD, 2005). Sleep bruxism is a controversial phenomenon regarding its etiology, and the diagnosis is described as a complex process composed by peripheral and central factors Lobbezoo, Soucy, Hartman, 1997). Emotional and psychological alterations may start the motor activities during sleep, and disturbances in the central dopaminergic system have been described as the possible cause of SB (Lobbezoo, Zaag, Naije, 2006; Lobbezoo & Naije 2001; Lobbezoo, Soucy, Hartman, 1997).
Research tools as polisomnography (PSG) and surface electromyography (EMG) has been used to measure the physiologic variables and mioelectric activities during SB events (Lavigne, Rompré, Montplaisir, 1996; Tosun, Karabuda, Cuhadaroglu, 2003). Occlusal splint (OS) is the usual treatment to SB, and its efficacy has been shown in the current literature (Amorin, Giannasi, Ferreira et al, 2009). The aim of this study is to analyze the electromyographic signs of masseter muscle in women who presented SB, after a working day and after 45 nighttime use of the OS, in rest position and in maximal voluntary contraction.

METHODS

Tewnty one women were enrolled in this study, mean age 26.5 + 3.0, 40 hours per week working eight hours daily. The oral examination and the anamnesis composed the SB diagnoses. Model casts were required to construction of OS, which was made by acrylic resin. Surface EMG was obtained using an eight channel module (EMG System do Brazil Ltda), consisting of a signal conditioner with a band pass filter with cut-off frequencies at 20–500 Hz, an amplifier gain of 1000 and a common mode rejection ratio >120 dB.
The ground wire was connected to the right wrist of the subject with electroconductor gel Lectron II (Pharmaceutical Innovations, USA) to increase the capacity of electroconduction and avoid external noise interferences (De Luca, 1997).
All data were processed using specific software for acquisition and analysis (Tool Box BR V1.0 by EMG System do Brazil Ltda). Skin was previously cleaned with alcohol 70% to reduce the impedance. The data were collected twice per patient: after a work journey before OS and after a 45 days sleeping night wearing the OS, in rest position and in maximal voluntary contraction. For data statistic analysis, it was used Mann Whitney Test and Wilcoxon Test based on the values of rectified signal of pared samples. The level of significance adopted was 0,05.

RESULTS and DISCUSSION

The results of electromyographic signs acquired of the resting left and right masseter muscles and on right and left masseter muscle in maximal volunteer contraction before and after OS wear is in the table 1 and 2. Our study demonstrated the efficacy of OS in reducing the EMG masseter, according to previous publications (Baba, 2000; Landulpho, Silva, Silva, 2002).
Landulpho et al. (2002), studied the effect of occlusal splint therapy on TMD by surface EMG of masseter and temporal muscles. The authors followed 22 patients with signs and symptoms of TMD during 90, 120, and 150 days of splints wearing.
The polynomial regression analysis of the electric potential of RMS of temporal and masseter muscles, during maximum biting (isometric), showed significant differences ($p<0.05$) between evaluation periods (90/120/150 days), reducing during the treatment. The authors showed that the longer the therapy with splints, the more reduced was the EMG activity of masticatory muscles. Their study justifies our findings on EMG activity registers, as we used a 60-day period of occlusal splint wearing, which was a shorter period compared with the periods.

CONCLUSIONS

The OS has decreased electric activity of right and left masseter in rest position and maximal voluntary contraction after 45 days of OS usage.

REFERENCES

1. Kushida CA, Morgenthaler TI, Litner MR. (2006). Sleep. 29(2);240-243.
2. Lobbezoo F., Soucy J.P., Hartman N.G. et al. (1997). *J Dent Res*. 76,1610-1614.
3. Lobbezoo F., Van Der Zaag J., Naeije M. (2006). *J Oral Rehabil*. **33**,293-300.
4. Lobbezoo F., Naeije M. (2001). *J Oral Rehabil*. **28**,1085-1091.
5. Baba K., Akishige S., Yaka T. et al (2000). *J Oral Rehabil*. **27**,793-801.
6. Landulpho A.B., Silva W.A., Silva F.A. et al. (2002). *Electromyogr Clin Neurophysiol*. **42**,187-191.
7. Lavigne G.J., Rompré P.H., Montplaisir J. (1996). *J Dent Res*. **75**,546-552.
8. Amorim C.F., Giannasi L.C., Ferreira L.M.A. et al (2009). YJBMT.
9. Tosun T., Karabuda C., Cuhadaroglu C. (2003). *Int J Oral Maxillofac Implants*.**18**,286-292.

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Table 1 – EMG signal of masseter muscles in rest

Before use of the OS		After use of the OS	
Right	Left	Right	Left
9.53± 2.9 μV	8.40± 1.6 μV	5.59± 1.5 μV	4.82± 1.3 μV

OS: Occlusal splint; * p<0.05.

Table 2 - EMG signal of masseter muscles in maximal voluntary contraction

Before use of the OS		After use of the OS	
Right	Left	Right	Left
188.90± 7.6 μV	180.60± 6.6 μV	114.40± 6.5 μV	122.37± 5.3 μV

OS: Occlusal splint. * p<0.05

106 NEUROMUSCULAR RESPONSE OF GASTROCNEMIC AND MEDIUM GLUTEUS MUSCLES AFTER DIATHERMY APPLICATION: PRELIMINARY DATA

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INTRODUCTION

Short wave diathermy (SW) is largely used in physiotherapy clinics. It increases the local temperature noninvasively by the application of high frequency electromagnetic energy (SCHWAN, 1992). It introduces a great amount of energy in the body segments by the movement of ions (MITCHELL et al., 2008) and in this way, it has influence on the performance of the neuromuscular system (DEWHURST et al., 2007). However, Pope (1999) emphasizes that the SW needs more studies and that its relevant effects, in different clinic conditions, should be approached.

Considering that the SW may alter the nerve conduction velocity and the tissue metabolism, this study aimed at analyzing the neuromuscular response of the gastrocnemic muscles- lateral portion (GT) and medium gluteus (MG), after the application of heat on the calf of healthy women.

METHODS

The study comprised 5 female volunteers, sedentary, with no history of sensitive and/or osteomiocular lesions in the lower limbs. They signed the informed consent form approved by CEP-FMRP/USP 635/2009.

The diathermy was applied on the calf with the *Thermowave Bioset*®, frequency of 27.12 MHz, continuous mode of maximum intensity for 20 minutes. The temperature was measured with an Imcoterm® digital infrared thermometer, before, immediately, and 35 minutes after the intervention period.

The electric activity of the GT and MG muscles of the non-dominant limb was collected by the EMG-1000 (Lynx®) with 10^9 Ohms impedance, a 16 bit- resolution and an input band of ± 1V, connected to a 12-volt battery with capacity of 10AH, connected to a computer through optical fiber, as described by GUIRRO et al. (2006). Differential surface electrode (Lynxâ) was used following the ISEK and SENIAM guidelines, with pre-amplifier circuit of 20 times (±1%), IRMC > 100 dB and signal noise ratio < 3 μV RMS.

Signal acquisition was carried out with the volunteer in orthostatic, unipodal position during 6 s, repeated 3 times, with the contra lateral limb at 90°, standardized by an electrogoniometer. Measurement was performed before (PRE), immediately (PO) and after 35 minutes (P35) the application.

Data were processed in routines implemented on the Matlab® 6.5.1. software by means of median frequency (MF) in hertz (Hz) and the RMS (*Root Mean Square*) in micro volts (μV), normalized by the maximum volunteer isometric contraction (MVIC). Values were presented as percentage (% MVIC).

For the data analysis, the Shapiro-Wilk normality test was used; the t- student and Wilcoxon tests were used for normal and non normal data, respectively.

RESULTS and DISCUSSION

The anthropometric data are shown in Table 1 and the temperature in Table 2.

Table 1: Mean values of the anthropometric data

	Mean±SD
Age (years)	21.8±2.77
Weight (Kg)	57.66±9.04
Height (m)	1.67±0.11
BMI (kg/m2)	20.56±0.77
Adipometry (mm)	14.02±4.04

BMI: body mass index; SD: standard deviation

Table 2: Mean values ± standard deviation of the calf temperature, in different periods of time.

	Mean±SD
Pre	29.72±0.81
P0	36.85±1.32*
P35	30.91±0.84

*p<0. 05 in relation to pre

According to Table 2, there was a significant increase in temperature (p=0, 0001) reaching 36.85±1.32°C immediately after the application of SW, when compared to the initial value of 29.72±0.81°C. After 35 minutes, the bulk temperature was back to the initial parameters.

The electromyographic parameters are presented in Table 3.

The study revealed that there was no significant difference of the RMS of the GT electromiographic signal after the application of this therapeutic resource in women in unipodal position. However, there was an increase in RMS of the MG, after diathermy was applied (p<0, 05).

The result suggested that after the application of heat, there was higher activation of the MG as the stabilizing hip muscle for the maintenance of the static posture and balance. After 35 minutes, the MG signal amplitude returned to the initial values.

Mitchell et al. (2008) suggested that diathermy induces an increase in muscular temperature enough to produce an increase in the firing rate in fiber type I, explained by the membrane alterations or changes in the motor unit.

With regard to the median frequency, no alterations were found in both muscles, in different time periods.

Due to the fact that it is a widely used therapeutic resource in medical practice, more studies should be carried out for a better understanding of the SW effects on the neuromuscular response.

Table 3: Mean values of the median frequency (MF) and the Root Mean Square (RMS) normalized of GT and MG, in pre, immediately (PO) and 35 minutes after (P35) the application of SW.

		RMS	MF
GT	PRÉ	29.59±23.1	73.33±21.24
	P0	28.31±15.8	71.40±20.16
	P35	28.16±18.2	71.69±20.26
MG	PRÉ	19.18±7.27	111.11±13.77
	P0	25.55±8.11*	117.46±16.91
	P35	19.74±13.7	112.20±7.02

*p<0. 05 in relation to pre

CONCLUSIONS

The study showed that after the heat application on the calf, some alterations were observed in the neuromuscular response of the MG for the maintenance of the motor control. The results are considered preliminary and with restrict sample size; however, the study suggested some response to the heat at a distance to maintain postural control.

REFERENCES

1. Schwan HP. (1992). Br J Câncer, 84, 84-92.
2. Mitchell SM, et al. (2008). Muscle Nerve, 38, 992-1004.
3. Dewhurst S, et al. (2007). Journal of electromyography and Kinesiology, 17, 292-298.
4. Pope G. (1999). Physiotherapy, 85(6), 290-293
5. Guirro RRJ, et al. (2006). Electromyographic neurophysiol, 46(6), 355-363.

107 SURFACE ELECTROMYOGRAPHY AS A METHOD FOR EVALUATION OF SWALLOWING - A SYSTEMATIC REVIEW

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INTRODUCTION

Surface electromyography can be applied in the facial muscles in order to assist in diagnosis and therapy of orofacial disorders, breathing, chewing, speech and temporomandibular disorders (RAHAL and Pierotti, 2004), the identification of the swallowing activity (time and amplitude) and as biofeedback in the treatment of dysphagic patients. This procedure is noninvasive, painless, whose sensors (surface electrodes) are used to detect the smaller amplitude variations in electrical potential that can occur with the activation of the muscle tissue thereby providing the contraction of certain muscle during swallowing (VAIMAN et al 2007).
The objective of this study is to systematically identify the main situations that can be performed surface electromyography (normal and abnormal swallowing) of swallowing and showing the main applicability.

METHODS

Performed a survey of articles related to the evaluation of swallowing using surface electromyography, available in PUBMED, MEDLINE and SCIELO, from 1997 to February 2010. Was performed crossing "EMG" to "swallowing of liquids, "pasty","swallowing solid","cancer of head and neck", "radiotherapy" and "flavor/taste".
In this rewiew were included clinical studies with at least 5 patients, adult subjects, swallowing evaluation (normal or amended) t and biofeedback use for exercises, literature reviews, which were written in English or Portuguese, with or without objective evaluations associated. Excluded were those that addressed issues exclusively dental and physiotherapy, such as measuring orofacial pain and occlusion after extraction of molars and restriction of the upper limbs and neck, respectively. All items selected in the survey were printed and had their criteria for inclusion / exclusion categorized.

RESULTS and DISCUSSION

A total of 55 articles were located at the crossroads. Of these, 8 were excluded because they only dental issues and/or physical therapy, 3 because they were written in German and 3 because they are studies in children, leaving 41 articles, of which 1 is a literature review.
Of these 41, 3 were written in Portuguese and 38 in English and 40 of them this is a prospective study while only 1 is a literature review of non-systematic, with no retrospective or randomized. Thirty two studies using normal subjects as 8 use individuals with some type of change, and 1 study with stroke, 1 with cerebral palsy, 1 with Zenker's diverticulum, 1 with acute tonsillitis, 1 with salivary gland surgery, 1 with malocclusion, oral infection with 1 and 2 with molar extraction.
Of these, 14 assessed the swallowing of saliva in normal and 3 abnormal, 18 evaluate liquid swallowing in normal and 4 abnormal, 3 evaluated semi-solid 1 in normal and altered, 4 evaluate liquid-pasty and pasty in 5 only normal individuals. Seven of these studies add flavor to the consistency of muscle activation reveal specific flavor (water, sweet, salty, sour, bitter) (MIURA ET AL. 2009)

For the muscles tested was found the following provision of normal subjects and changed.

	Normais	Alterados
mm. orbicularis	09	02
mm. masseter	10	06
mm. infrahyoid	14	05
mm.submental	28	05
mm. temporal	02	01
mm. buccinador	00	00
Palate	02	00
Soft Palate	01	00
Pharynhx	01	00

There is no uniformity in the methodology of studies that apply sEMG swallowing, and consequently there is a difficulty in establishing normal values. One reason is related to the fact that most studies involve swallowing normal fluid and saliva swallowing or amended in the same consistency. Another explanation for this concerns the fact that the electrodes may be surface signals from adjacent muscles. Because of this, it is essential that the professional who will use electromyography exam knows more than just how to apply the test. You must have knowledge of the contraction and muscular anatomy of the superficial muscles to be studied (Kotby et al. 1992).
There are 12 studies that showed use of supplementary examination which: 1 with a tool to assess the movement of the mandible, 1 that is associated with electroglottography, 1 to mechanomyography, one to X-ray, 3 to manometry and 4 to videofluoroscopy. None associated with endoscopic evaluation of swallowing. Mostly, the use of tests associated leads to the character of sEMG biofeedback act of swallowing (CRARY et. Al, 2006).

CONCLUSIONS

There were no standardization of consistencies, muscles, population and use of associated exams in surface electromyography's studies for swallowing evaluation. This would be critical for the swallowing characteristics references in normal subjects, allowing for greater understanding and analysis of changes in dysphagic subjects.

REFERENCES

1. Kotby, et al. (1992). J. Voice, 6:159-87
2. RahaL, A, Pierotti, S. (2009) Rev Soc Bras Fonoaudiol , 14(2):160-4
3. Vaiman, et al. (2009) BMC Ear, Nose and Throat Disorders 9:3
4. Crary, et el. (2006). Journal of Speech, Language, and Hearing Research. 49:186-93
5. Miura, et al. 2009. Chem senses. 34:325-31

108 EMG SIGNAL ANALYSIS OF VASTUS LATERALIS MUSCLE USING FOURIER AND WAVELET TRANSFORMS DURING WINGATE TEST IN MEN AND WOMEN

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INTRODUCTION

Muscle fatigue may be defined as the inability to generate work during a muscle contraction (ENOKA; STUART, 1992), and its analysis can be made using the electromyographic signal in the frequency domain through the median frequency (MF). For this purpose, different forms of analysis have been used, notably the Fast Fourier Transform (FFT), which is the main procedure for this type of analysis in isometric contractions. However, this method does not seem to be the most adequate when dealing with dynamic contractions. An alternative method being used is the Wavelet Transform (WT), which unlike the FFT, takes into account the dynamic nature of the signal.

Previous studies indicate that FFT and WT would be similar in static exercise, as well as dynamic (SPARTO et al., 1999; HOSTENS et al., 2004; DA SILVA et al., 2008). However, its behavior is not fully known. Thus, the aim of this study was to compare these methods to evaluate muscle fatigue during supramaximal exercise.

METHODS

The sample consisted of twenty-five college students (13 men, 28.2 ± 2.7 years and 12 women, 23.2 ± 2.7 years), that performed a Wingate test with a load corresponding to 7.5% of body mass, to evaluate anaerobic performance (WINGATE TEST® CEFISE, Brazil), which determined relative peak power (RPP), relative mean power (RMP) and fatigue index (FI) (%).

All participants underwent a reproducibility protocol in two different occasions, with a intra-class correlation coefficient of 0.98, 0.95 and 0.90 for RPP, RMP and FI, respectively.

The EMG signals were recorded during the test according to ISEK, with active bipolar electrodes (TSD 150™, Biopac System®, USA) placed in the vastus lateralis (VL) muscle, according to SENIAM guidelines.

The EMG activity was recorded with a 16-channel electromiograph model MP150™ (Biopac System®, USA) with sampling frequency of 2000 Hz and common-mode rejection rate of 95 dB. The raw EMG signals were filtered (band-pass filter of 20 Hz and 500 Hz). For the spectral analyzes, we used the values of MF obtained using the short time FFT and Wavelet (Daubechies: db5) techniques. Through the techniques the following parameters were obtained: MF, slope of MF – EMG index of fatigue (*NFI*), and MF variance during exercise. The *NFI* was determined by the use of linear regression between the MF and duration of exercise (30 s).

To compare the values of the analyzed parameters, we used the Mann-Whitney U test (P<0.05).

RESULTS and DISCUSSION

No significant differences were found between the FFT and WT methods for the VL muscle in the analysis of MF and NFI in both genders (Table 1). This shows that both analyses provide similar information regarding muscle fatigue

Regarding the MF variance, significant differences were found between FFT and WT for men and women, showing a greater dispersion of the data obtained from the FFT analysis compared to WT (Figure 1). This suggests that WT seems to better fit exercises with dynamic characteristics, since it does not depend that the signal be stationary, unlike FFT, which has this limitation (VONTSCHARNER; GOEPFERT, 2006; DA SILVA et al., 2008).

CONCLUSIONS

According to the results of the present study, both analyzes can be used with the purpose of evaluate muscle fatigue from EMG spectral indicators in supramaximal exercise. However the use of WT seems to have a smaller variation in the EMG signal.

REFERENCES

1. Da Silva RA, et al. (2008). Electromyogr Clin Neurophysiol. 48, 147-162.
2. Beck TW, et al. (2005). J Electromyogr Kinesiol. 15,190-199.
3. Hostens I, et al. (2004). J Electromyogr Kinesiol. 14, 205-215.
4. Sparto PJ, et al. (1999). Spine. 24, 1791-1798.
5. Von Tscharner V, Goepfert B. (2006). J Electromyogr Kinesiol. 16, 188-197.

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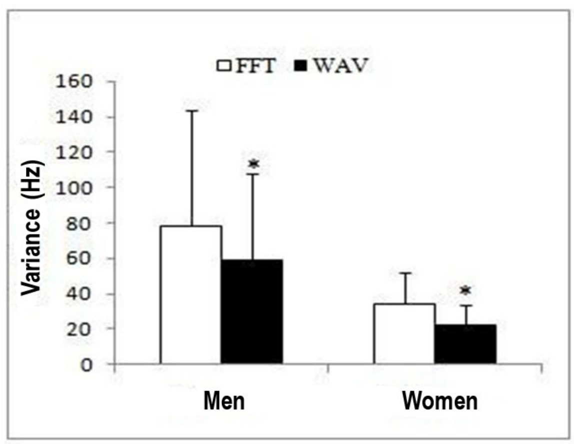

Figure 1: MF variance obtained through FFT and WT over 30 s of exercise. *P < 0.05 from FFT.

Table 1: Values of median frequency (MF) and normalized fatigue index (NFI) obtained through FFT and WT

	Fmed (Hz)		NFI (Hz/s)	
	FFT	WT	FFT	WT
Men	43.3 ± 11.8	43.5 ± 11.9	-0.001 ± 0.002	-0.002 ± 0.002
Women	33.5 ± 3.5	35.7 ± 3.3	-0.001 ± 0.001	-0.001 ± 0.001

109 WAVELET SPECTRAL ANALYSIS OF HEART RATE VARIABILITY DURING SLEEP IN MORBID OBESE UNDERGONE BARIATRIC SURGERY

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INTRODUCTION

Obesity is one of the most serious public healthy problems. It's a multifactor illness characterized by extreme accumulation of body fat that compromises healthy caused by the interaction of genetic factors, ambient, socioeconomics, cultural, metabolic and psychological (Foster, 2003; Aronne, 2002; Mancini, 2001). Obesity is classified degree III when body mass index (BMI) ≥ 40 kg/m². Obesity surgical procedures more used In Brazil are Fobi-Capella and Scopinaro surgeries (Capella RF, Capella J, 1997; Scopinaro et al., 1980). The obstructive sleep apnea syndrome is usually associated with obesity that is a risk factor for hypertension and coronary arterial disease; however, recent studies have shown that Obstructive Sleep Apnea Syndrome is a independent risk factor for cardiovascular disease (Ceneviva et al., 2006). One of the main pathophysiologic effects of the Obstructive Sleep Apnea Syndrome is to interrupt cardiovascular rest state, breaking up sleep and increasing the load imposed to the myocardium. The correlation between the cardiovascular illnesses and sleep disorders can be explained by the airway collapse during sleep associated a increased respiratory effort and nasal or oral flow alteration, that can unchain hypoxemy and hipercapny, taking repetitive arousals during sleep to reestablish the ventilation that stimulates autonomic nervous system with systemic vasoconstriction and arterial hypertension. The objective was to analyze heart rate variability by Wavelet Spectral Analysis (Torrence C, Compo GP., 1998) during sleep in obese subjects degree III submitted to bariatric surgery.

METHODS

We evaluated 22 patients of both gender and the data collection included body mass index classification, abdominal and neck measurements, Epworth sleepiness scale, sleep study through the complete nocturnal polissomnography and heart rate variability analysis.

RESULTS and DISCUSSION

The mean age was 34.21±9.64, the pre BMI was 48.58±5.57 and post was 42.3±5.19, the pre apnea hipopnea index (AIH) was 33.99±29.08 and post was 17.97±16.73. The study of heart rate variability (HRV) behaviour through the Wavelet spectral analysis showed pre and post operatory total values of significance respectively of 2.8775×10^5 and 2.3440×10^5 in frequency domain. It was observed a difference of 18.5%, being statiscally significant. Studies of autonomic nervous activity through the analysis of HRV showed that patients with obstructive sleep apnea syndrome (OSAS) show a decrease in high frequency component of HRV (HF) and an increase in low frequency component (LF), related to parasympathetic and sympathetic respectively. This abnormal pattern seems to reflect a sympathetic predominance in autonomic modulation of the OSA (BELOZEROFF; BERRY; KHOO, 2003, JO et al., 2005). Figure 1 shows that pre RR activity spaced, occurring during the whole collect interval. In figure 2, that represents the post operatory collect, the RR intervals occur in minor intensity and frequency. Both Wavelet spectrums showed a large activity in 200 wavelength, that correspond aproximately to the REM sleep period. The heart rate variability index had shown an increased sympathetic autonomic nervous system activity, predominantly in the pre operatory. The subjects presented HRV alteration during sleep, this alteration was not uniform among the sleep stages and it presented tendency to be more accentuated during the obstructives apneic events.

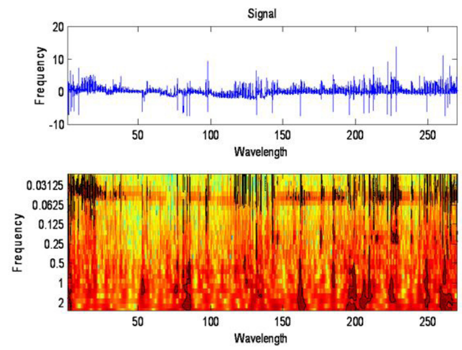

Figure 1 – Wavelet spectral analysis pre- operatory.

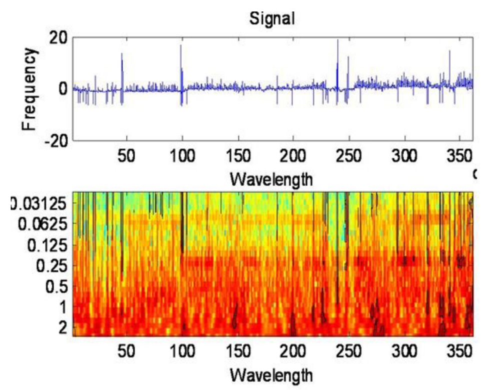

Figure 2 – Wavelet spectral analysis post operatory.

CONCLUSIONS

Through the Wavelet spectral analysis of the RR intervals during sleep of morbid obese subjects submitted to the bariatric surgery, we can conclude that there is a sympathetic activity predominance to the parassimpathetic in pre operatory. The weight reduction showed an improve on anthropometric values, on polysomnografic variables and on heart rate variability.

REFERENCES

1. Foster GD. (2003). Am. J. Respir. Crit. Care Med. V. 168, p. 274-280.
2. Aronne LJ. (2002). Obesity Research. V.10, s.2, p. 105s-108s.
3. Mancini MC. (2001). Arq. Bras. Endocrinol Metab. V. 45, n. 6, p. 584-608.
4. Capella RF, Capella J. (1997). Obes. Surg. V. 7, p. 149-156.
5. Scopinaro N, et al. (1980). Am. J. Clin. Nutr. V. 33, suppl. 2, p. 506-514.
6. Ceneviva R, et al. (2006). Rev. Hosp. Clin. Fac. Med. Univ. São Paulo. V. 39, n. 2, p. 235.
7. Torrence C, Compo GP. (1998). Am Meteorol Soc. 79(1):61-78.
8. Belozeroff V, Berry RB, Khoo MC. (2003). Sleep, v. 26, p. 65-73.
9. Jo JA, et al. (2005). Am. J. Physiol. Heart Circ. Physiol., v.288, p. H1103-1112.

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110 ELECTROMYOGRAPHIC EVALUATION OF PELVIC FLOOR MUSCLES IN PRIMIPAROUS AND MULTIPAROUS WOMEN

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INTRODUCTION

Pelvic floor (PF) integrity goes through changes over the different stages of a woman's life, especially during pregnancy and at childbirth, and may be associated with the occurrence of urinary incontinence (UI). The evaluation of PF functions and the monitoring of the changes that occur in these muscles during gestation and delivery are of great clinic and scientific value in understanding the relation between PF function and pregnancy. Several methods for PF assessment have been proposed including vaginal digital palpation, tactile biofeedback (vaginal cones), ultrasonography, electromyography (EMG) and magnetic resonance (Bo and Sherburn, 2005). The purpose of this work was to evaluate and to compare the function of PF muscles using EMG in primiparous and multiparous women who underwent Cesarean delivery.

METHODS

This study was conducted at the Obstetric Service of Botucatu Medical School Hosptial, São Paulo State University (UNESP), as approved by the institution's Research Ethics Committee. Written informed consent was obtained from all study participants. PF assessment was carried out in primiparous and multiparous women (with up to two Cesarean deliveries) between 24 and 32 weeks of gestation. Those women who underwent vaginal delivery were excluded. Examinations were performed using a two-channel Miotec electromyograph, Miotool model, with software Miograph 2.0. The probe was introduced through the vaginal introitus using hydrosoluble gel as lubricant while the subject remained in gynecological position. The areas where electrodes would be placed were cleansed with 70% alcohol and shaved. Surface electrodes were fixed to the thigh adductors so that the activity of the accessory muscles could be simultaneously recorded during the contraction of PF muscles, and another electrode was applied for reference on the anterior superior iliac crest. Disposable, double-sided, bipolar solid gel (Ag/AgCl) surface electrodes made of polyethylene foam with medical hypoallergenic adhesive were used with a 20-mm distance between edges. For reference, a disposable solid gel Meditrace 100 -Ag/AgCl electrode was used. Muscle activity at rest (baseline) was observed for 30s, after which subjects were asked to perform three fast contractions followed by three sustained contractions at 5s intervals. Subsequently, baseline activity was once more recorded for 30s. Data were processed in RMS with a band-pass filter of 25-500Hz and all values were recorded in µV.

RESULTS and DISCUSSION

Seventeen pregnant women were allocated into two groups: G1 consisting of 8 primiparous participants, and G2 including 9 multiparous subjects. Median age was 26 and 29 years in G1 and G2, respectively. BMI was 28.06 Kg/m2 in G1 and 34.48 Kg/m2 in G2, respectively classified as overweight and obesity according to Atalah (1997). Differences in age and BMI were not statistically significant. Median gestational age significantly differed between G1 (29 weeks) and G2 (26 weeks) (p=0.046). EMG findings are shown in Table 1. Group medians were compared by the test of Mann-Whitney.
Except during micturition, defecation and Valsalva maneuvers, PF muscles, differently from other skeletal striated muscles, show constant electromyographic activity (Wester and Brubaker, 1998). Given that studies using EMG for PF assessment in pregnant women are scarce, comparing our results with those obtained by others was not possible. In this study, no significant difference was observed between groups during fast or sustained contractions. According to Scheer et al. (2007) pelvic organ support significantly weakens after the first vaginal delivery, but not during gestation. Baessler and Schuessler (2003), in a review of the literature, reported that the strength of these muscles remains unchanged in women undergoing Cesarean sections.

CONCLUSIONS

There was no significant difference in PF muscle function measured by EMG between primiparous and multiparous women undergoing Cesarean delivery.

REFERENCES

1. Atalah E. (1997). Rev Med Chile. 1997; 125:1429–36.
2. Baessler K, Schuessler B. (2003). Urology. 62, 39-44.
3. Bo K, Sherburn M. (2005). Phys Ther. 85, 269-282.
4. Scheer I, Thakar R, Sultan AH, et al. (2007). In: 37thAnnual Meeting of the International Continence Society [homepage on the Internet]; 2007 aug 20-24; Rotherdan. Bristol: ICS;2007 [cited 2008 nov 11]. Available from: https://www.icsoffice.org/publications/2007/pdf/0094.pdf.
5. Wester C, Brubaker L. (1998). Obst. Gynecol Clin North Am. 25, 707-722.

Table 1: Electromyographic findings, maximum amplitude median (µV) during PF Fast and Susstained Contractions.

	Primiparous women(n=8)	Multíparous women(n=9)	p-value
Fast Contractions	57.95	78.76	0.541
Sustained Contractions	55.03	64.50	0.815

111 ANALYSIS OF INSPIRATORY MUSCLE ACTIVITY DURING MANEUVERS OF MAXIMUM INSPIRATION AFTER ELECTROSTIMULATION

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INTRODUCTION

The respiratory muscles have the primary function to move the chest wall to allow air flow into and out of the lungs helping a perfect maintenance of gas exchange. However, a satisfactory muscle activity depends on the number of motor units recruited during breathing.
The objective of this study is to evaluate muscle strength through the manovacuometry and the activation of the respiratory muscles by surface electromyography (EMG) before and after the implementation of a session of electrical stimulation (Russian current) in the right diaphragm.

METHODS

The study was conducted at the Laboratory of Biomechanics and Bioengineering, Federal University of Goias (UFG) and approved by the Ethics in Research Committee of UFG under No. 157/2009.
Twenty three volunteers aged between 20-29 year old male, without history of previous lung disease, body mass index (BMI) <30 kg/m^2 and not practicing regular exercise, participated of the study.
Participants had mean age of 21.6 years ± 1.5 and BMI of 23 kg/m^2 ± 2.7.
The maximal inspiratory pressure (MIP) which reflects inspiratory muscle strength was obtained from the residual volume (RV) according to the protocol proposed by Neder *et al*, (1999). From 3 to 5 maneuvers acceptable and reproducible were performed and (difference of less or equal to 10%) was selected the maneuver with greater value (Neder *et al*., 1999).
The electromyographic signals of respiratory muscles were obtained by a signal conditioner with sixteen channels, with band-pass filter with cutoff frequencies of 20 and 500 Hz, amplifier gain of 1000 times and sampling rate of 2kHz. The bipolar electrodes were placed on the sternocleidomastoid (SCM) on the right (R) side (Falla et al., 2002), scalene (L) and diaphragm R in accordance with Leis & Trapani (2000). To capture EMG participant's the skin was shaved and cleaned with ethyl alcohol diluted 46 ° in order to reduce the electrical resistance of the skin. The session of electrical stimulation was applied in Kots + / Russian current, bipolar type, T 0.2 mS and a frequency of 2000 Hz, modulated at 50 Hz. After administration of the current, the force and the electromyographic activity of the inspiratory muscles were again captured.
The signals were processed through MATLAB. Statistical analysis was done in SPSS and MedCalc.

RESULTS and DISCUSSION

The Figure 1 show the maneuver of maximal inspiration where the activation of the diaphragm muscle, a intense and prolonged signal, occurs first followed by the activation of SCM rand scalene L.

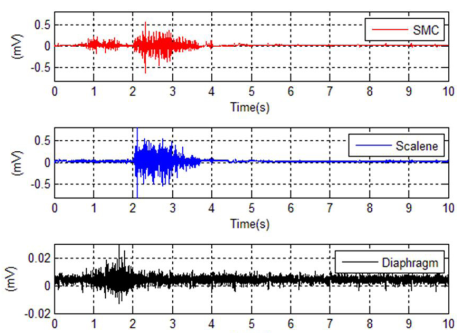

Figure 1 – Electrical activity in maximal inspiration of the muscles SCM, scalene and diaphragm.

The mean and standard deviation of the MIP and the peak to peak values of EMG are presented in Table 1. The values of MIP after the session are in accordance with Black and Hyatt (1969) and Neder et al (1999).
It was expected higher peak to peak values of diaphragm muscle activity. However, our values are within the limits found by Maarsingh et al. (2000). This can also be explained by the variability of adipose tissue underlying the area of application of the electrode, positioning indirectly only in the right diaphragm, the size of the diaphragm in relation to others muscles, its formation (55% of slow fibers, 21% oxidative fibers and 24% glycolytic fibers) and finally the crosstalk phenomenon of adjacent muscles which may influence the transcutaneous EMG (Duiverman et al. 2004; Polla et al, 2004).

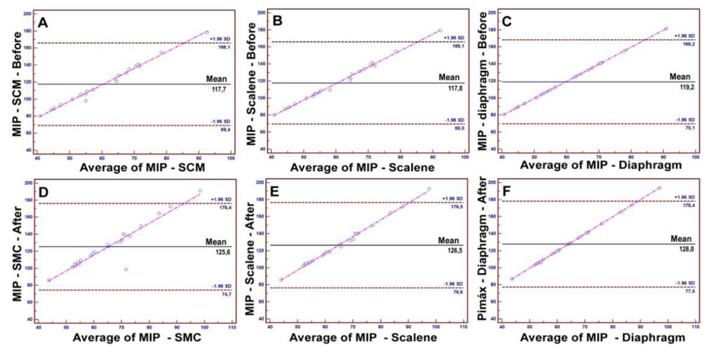

Figure 2 - Bland and Altman graphics of the mean difference between two methods versus the average and its corresponding trend line. Figures A, B and C show the correlation and trend line of the difference and the average MIP with EMC D, diaphragm and scalene D muscles pre stimulation. D, E, F show the correlation and trend line of MIP with EMC, scalene and diaphragm muscles after electrical stimulation. Confidence interval 95% (mean ± 1 SD 96).

It was expected higher peak to peak values of diaphragm muscle activity. However, our values are within the limits found by Maarsingh et al. (2000). This can also be explained by the variability of adipose tissue underlying the area of application of the electrode, positioning indirectly only in the right diaphragm, the size of the diaphragm in relation to others muscles, its formation (55% of slow fibers, 21% oxidative fibers and 24% glycolytic fibers) and finally the crosstalk phenomenon of adjacent muscles which may influence the transcutaneous EMG (Duiverman et al. 2004; Polla et al, 2004).

Table 1. Mean and standard deviation.

	Before	After
MIP (cmH2O)	119.20 ± 25.0	128.04 ± 25.69
SCN R*	1.49 ± 1.35	2.47 ±4. 42
Scalene L*	1. 40 ±1.00	1. 50 ± 0.83
Diaphragm R*	0.06 ± 0.11	0. 09 ± 0. 20

*Values in mV

The application of the Wilcoxon test showed that 16 patients had improvement in MIP. After the stimulation session, SCM R, scalene L and diaphragm R muscles showed an increase in the peak to peak values of EMG in 14, 17 and 11 subjects, respectively (significance level p <0.05).
In this study, the agreement of MIP with the EMG of the respiratory muscles was evaluated by Bland and Altman method. Figure 2 shows the agreement before and after application of electrical stimulation.

CONCLUSIONS

This study showed improvement in the muscle strength and electrical activity of inspiratory muscles SCM D, scalene E and diaphragm D after a session of electrical stimulation. According to Bland and Altman analysis there was a good agreement between the two methods, EMG and manovacuometry, used for evaluation of respiratory muscles.

REFERENCES

1. Black LF, Hyatt RE. (1969). American Review of Respiratory Disease. 99, 696-702.
2. Bland JM, Altman DG. (1986). The Lancet, i:307-310.
3. Duiverman ML, et al. (2004). J Appl Physiol. 96, 1723-1729
4. Maarsingh, et al. (2000). J Appl Physiol. 88, 1955-1961.
5. Neder, et al. (1999). Braz J Med Biol Res. 32, 719-727.

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112 EVALUATION OF THE METHODS FOR SEGMENTATION OF EMG SIGNALS

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INTRODUCTION

The segmentation process is based on the separation of the electromyographic (EMG) signal into windows containing motor units action potentials (MUAPs), discarding those regions with only base activity and noise.
Segmentation is the first step used for several methods of EMG signal decomposition. It provides temporal information that can be used to automate the processing of EMG signals and reduce processing costs by limiting the analysis only to the areas of activity.
Several methods can be found in literature, especially as part of EMG decomposition algorithms. However, those methods are rarely evaluated outside the scope of the decomposition algorithm. This paper proposes a direct assessment of a set of segmentation methods using the same set of signals and the same evaluation criteria.

METHODS

In order to evaluate and compared the performance of each method against the others, a set 70 synthetic EMG signals was generated using the simulator proposed by Andrade et al. (2005). In so doing, it was possible to control every aspect of the EMG signal that was applied to each segmentation algorithm. The simulated signals represented an EMG acquired for 30 seconds, at a rate of acquisition of 10.040Hz. The number of motor units (MU) varies from 3 to 10 and the signal to noise ratio (SNR) from 20db to 0db.
Ten segmentation algorithms were studied (Mcgill, K.C., Cummins, K.L. *et al*., 1985; Hassoun, M.H., Chuanming, W. *et al*., 1994; Christodoulou, C.I. e Pattichis, C.S., 1995; Nikolic, M., Sorensen, J.A. *et al*., 1997; Fang, J., Agarwal, G.C. *et al*., 1999; Chauvet, E., Fokapu, O. *et al*., 2003; De Luca, C.J., Adam, A. *et al*., 2006; Florestal, J.R., Mathieu, P.A. *et al*., 2006; Andrade, A.O., Nasuto, S.J. *et al*., 2007; Zarei, E., Maghooli, K. *et al*., 2007). The algorithms were implemented using MATLAB ® version 7.9.
Two evaluation methods were used. The first consists on checking the ability of the algorithm to detect regions of activity. To do so, each algorithm should process the synthetic EMG signal and return a binary signal with the same number of samples as the EMG signal. The values of the binary signal equals to one represent points where the algorithm detected EMG activity, and zero if otherwise. The percentage of accuracy of the algorithm can be calculated based on the correlation between the synthetic signal and the binary signal.
The second method consists in assessing the ability of the algorithm to correctly detect the beginning and end of the EMG activity. For this, each algorithm should process the synthetic EMG signal with one or more segments of activity and returns a set containing the beginning and the end of each segment detected. The output set is compared with the start and the end of each segment of the synthetic EMG, with a tolerance band of 2ms. Again, we calculated the percentage of accuracy of each method in relation to the number of segments present in the simulated signal.

RESULTS and DISCUSSION

To evaluate the ability of detecting regions of activity, it was created, for each algorithm, a vector with 70 samples representing the percentage of accuracy of the method when processing the 70 synthetic EMG signals. These vectors were used to generate the boxes diagram shown in Figure 1. As observed, the methods of Andrade (2007), De Luca (2006) and Forest (2006) present a better performance, achieving 90% accuracy for about 75% of the EMG samples tested.
To evaluate the ability of the algorithms to correctly detect the beginning and end of the EMG activity, a similar vector as above was created for each method, representing the percentage of accuracy of the method when processing the 70 synthetic EMG signals. Again, it is possible to highlight the methods of Andrade (2007), De Luca (2006) and Florestal (2006) as those with the best performance.

CONCLUSIONS

The experiments allow us to conclude that, from the 10 most used algorithms for segmentation of EMG signals, the method proposed by Florestal (2006) achieved the best results, followed closely by the algorithms proposed by De Luca (2006) and Andrade (2007). However there is room for improvement in the process of detecting the beginning and end of EMG activity, since the performance of the algorithms is a little poor, in this case.

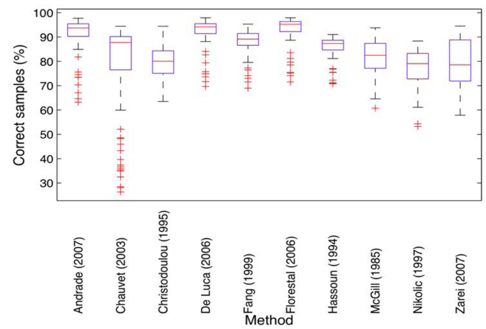

Figure 1 - Results of regions of activity evaluation for the different segmentation methods.

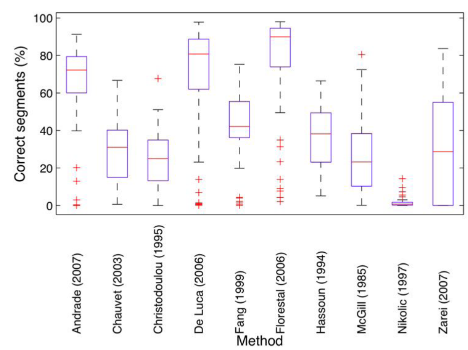

Figure 2 - Results of segments evaluation for each segmentation method.

REFERENCES

1. Andrade AO, Nasuto SJ, et al. (2005). Med. App. of Sig. Proc., 2005. The 3rd IEEE Int. Sem. on, 125-130.
2. Andrade AO, Nasuto SJ, et al. (2007). J. Franklin Inst. 344, 3-4, 154-179.
3. Chauvet E, Fokapu O, et al. (2003). Med. and Bio. Eng. and Com. 41, 6, 646-653.
4. Christodoulou CI, Pattichis CS. (1995). Proceedings of IEEE ICNN'95, 2303-2308 vol.2305.
5. De Luca CJ, Adam A, et al. (2006). J. of Neurophys. 96, 3, 1646-1657.
6. Fang J, Agarwal GC, et al. (1999). Biom. Eng., IEEE Trans. on. 46, 6, 685-697.
7. Florestal JR, Mathieu PA, et al. (2006). Biom. Eng., IEEE Trans. on. 53, 5, 832-839.
8. Hassoun MH, Chuanming W, et al. (1994). Biom. Eng. IEEE Trans. on. 41, 11, 1039-1052.
9. Mcgill KC, Cummins KL, et al. (1985). Biom. Eng., IEEE Trans. on. BME-32, 7, 470-477.
10. Nikolic M, Sorensen JA, et al. (1997). Proceedings of EMBS'97., 1257-1260 vol.1253.
11. Zarei E, Maghooli K, et al. (2007). Proceedings of DSP'07, 119-122.

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113 USE OF A CURVE FITTING TOOL IN THE ELECTROMYOGRAPHIC SIGNAL FOR THE STUDY OF THE RELANTIONSHIP BETWEEN PHYSIOLOGICAL TREMOR AND AGE

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INTRODUCTION

Physiological tremor is a normal oscillation of low amplitude, with modal frequency around 9 to 12 Hz in healthy individuals and, in general, is not seen with the naked eye. Several factors can contribute for the increase of this tremor, between them, there is the process of aging, which is associated to a general decline of the biological functions, including deterioration of muscular system (Deluca, 1979; Sturman et al, 2005). One way to study the function of the muscular system is through surface electromyography (EMG). In the literature, several studies are being conducted with the purpose of development of tools capable of analyze the human pathological tremor (Deutsch, Newell 2006; Morrison, Sosnoff 2009).

However, there are few studies that address the physiological tremor and its correlation with age. Because of this, this study proposes the identification of characteristics extracted from EMG signals that can be used to analyze the relationship between physiological tremor and age.

METHODS

Participated, voluntarily, of this experiment 20 healthy individuals, from both genders, 10 of them aging between 20-29 years and the other 10 between 60-69 years, from Uberlandia-MG. data were collected in the Biomedical Engineer Laboratory from the Federal University of Uberlandia – UFU after approval of the Ethical in Research Committee - UFU. Surface electromyography were performed in the extensor carpi ulnaris muscle of the dominant arm of each volunteer, while they were holding a pen-laser pointing to a fixed point in a screen, for a period of 20 seconds. To prevent unwanted movement, leaned against the forearm of each volunteer. The process was repeated three times. The equipment used for acquisition of electromyographic signal was the MyosystemBr1_P84 from DataHominis Tecnologia, having 8 EMG channels plus 4 auxiliary channels.

The analysis and systematization of the data was performed using MATLAB®, by which differences in the characteristics of each group was verified.

RESULTS and DISCUSSION

To analyze the data collected, we used the following statistical tools: variance, skewness, kurtosis, maximum absolute value (MAV), maximum absolute value slope (MAVS), root mean square (RMS), slide slope change (SSC), wave length (WL) and zero crossing (ZC).

The data were processed with a windowing of 5 ms, and used a polynomial curve fitting, without smooth and robustness based on the least absolute residuals (LAR) method. The results were analyzed using a 95% confidence interval.

Table 1 presents the results of curve fitting for the statistical variables applied to electromyographic signals. For the result to be considered acceptable, the R-square must be superior to 0,7. Interesting to note in the age group of 60-69 years there was a lower utilization of the data, so that only one-third of the results could be acceptable. Important to note that the results derived from MAVS for the age group of 20-29 years showed a result very discrepant from the others, therefore, omitted from Table 1.

CONCLUSIONS

We observed that only the kurtosis obtained representation in the two age groups, as well as the fact that the group of 60-69 years have a lower rate of usable results. Features with values below 0,7 indicate that there is not a good correlation between the electromyographic signals of volunteers, according to that statistics. On can therefore say that there is greater stability, while stationary, of individuals aged 20-29 years, for the characteristics studied here, which works with data already seen in the literature.

REFERENCES

1. Deluca CJ. (1979). Physiology and Mathematics of Myoelectric Signals. IEEE Transactions on Biomedical Engineering. 26, 313-325.
2. Deutsch KM, Newell KM. (2006). Age-related changes in the frequency profile of children's finger tremor. Neuroscience Letters. 404, 191-195.
3. Morrison S, Sosnoff JJ. (2009). Age-Related Changes in the Adaptability of euromuscular Output. Journal Motor Behavior. 41, 274-283.
4. Smaga S, (2003). Tremor. American Family Physician. 68, 1545-1553.
5. Sturman MM, Vaillancourt DE, Corcos DM. (2005). Effects of Aging on the Regularity of Physiological Tremor. Journal of Neurophysiology. 93, 3064-3074.

Table 1: Fitting result using the R-square method in the data.

	Age Group	
Statistic	**20-29**	**60-69**
Kurtosis	0.819	-0.993
Skewness	0.01054	-0.8563
Variance	-0.972	-0.01354
RMS	-0.003909	-0.01354
MAV	-0.8433	-0.009634
MAVS	---	0.975
SSC	0.8973	-0.1347
WL	-0.9837	-0.02188
ZC	-0.8711	0.005306

114 INFLUENCE OF HISTOMORPHOMETRY VARIABLES ON THE ELECTROMYOGRAPHIC PARAMETERS OF HUMAN VASTUS LATERALIS MUSCLE

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INTRODUCTION

According to Wakeling & Rozits (2004), the electromyographic signal (EMG) provides information about the shape of action potentials of motor units and therefore could explain some aspects of the active muscle electrophysiology.
It has been shown that muscle fibers of great diameter (type II) have a higher conduction velocity of action potentials (GERDLE et al., 1997). Within this context, single muscles which are formed by a high percentage of fibers with great diameter should exhibit higher values of median frequency. However, the influence of fiber type composition and/or the fiber area on the electromyographic parameters is not completely clear.
Thus, the aim of this study was to correlate the electromyographic parameters and muscle force with the histomorphometric variables of *vastus lateralis* (VL) muscle.

METHODS

Eleven women (22.0 ± 2.1 years; 56.2 ± 8.6 kg and 1.62 ± 0.1 m) and seven men (23.3 ± 2.5 years; 76.1 ± 9.9 kg and 1.77 ± 0.06 m) took part in the study. All 18 subjects were healthy, were not engaged on regular physical training and did not have orthopedics injuries in lower limbs. All subjects signed an informed consent term and research was approved by the institution's Ethics Committee (65/05).
Previously to experimental procedures, a baseline was made, for 3 non-consecutive days, to determine the maximum force of leg extension of each subject (load cell MM-100 Kratos). A signal acquisition module [model EMG1000 (Lynx®)], with impedance of 10^9 Ohms, resolution of 16 bits and entry band of ± 5V, was used to record the electromyographic signals of VL muscle in the dominant limb. To capture the action potentials, one simple differential, active surface bipolar electrode (Lynx®) (20 times gain, IRMC > 100 dB, signal noise rate < 3 μV RMS and interelectrode distance of 10mm) was used. The channels were adjusted for a total gain of 1000 times, with band-pass filter of 20-1000 Hz (Butterworth type) and sampling frequency of 2000 Hz. The reference electrode was attached to the anterior tibial tuberosity of the evaluated leg. Before the electrodes were put into place, the skin was prepared, trichotomized and cleaned with 70% alcohol. The active electrode was placed over the belly of VL, according to the recommendations of SENIAM.
For electromyographic and leg force recordings, subjects remained seated on the *Bonet* table, with the hip joint at 90º and the knee joint at full extension. Recordings were made in different intensities of contraction [10%, 50% and 100% of maximum voluntary isometric contraction (MVIC)]. Signals were simultaneously recorded in the active electrode and in the load cell for 5 seconds. The procedure was repeated for 3 times (one minute interval) and with 2 minutes of interval among the different intensities.
After data recordings, the signals were processed in routines specified for the analysis of the Root Mean Square (RMS) in μV and median frequency (MF, in Hz) in the software Matlab® 6.5.1. Twenty-four hours after EMG recording a muscle biopsy of VL was made, in the exact location where the EMG signals were recorded. Biopsy was performed by an experienced physician with a *Bergström* needle. Subjects remained in supine position with lower extremities in neutral positions.
The sample was immediately frozen in liquid nitrogen – cooled isopentane at -159 ºC and stored at -74 ºC until further analyses. Histological sections (12 μm) were obtained in a cryostat microtome Microm HM 505E at –25 ºC and were submitted to mATPase reaction (pH 4.35, 4.65 and 10.64) to identify muscle fiber types (I and II). Cross-section area (CSA) of each fiber type was calculated in μm^2 (software Image Pro-Plus 6.2).
Statistical analysis was performed by Pearson correlation test with the level of significance set at 5%.

RESULTS and DISCUSSION

Table 1 shows that force of leg extension was positively correlated with RMS and type I and II muscle fiber areas; however, force was not correlated neither with MF nor with type I and II percentages.
RMS showed positive correlation with type I and II muscle fiber areas; no significant correlation was observed between RMS and MF or fiber type percentages.
MF presented a positive correlation with type I fiber percentage in 50% and 100% of MVIC and a negative correlation with type II fiber percentage in the previously mentioned intensities of contraction.

CONCLUSIONS

Muscle fiber area had a significant influence on leg extension force and electromyographic signal amplitude, but not on median frequency. This parameter was influenced by the muscle fibers percentages in high intensities of contraction.

AKNOWLEDGEMENTS: CNPq

REFERENCES

1. Gerdle B. et al (1997). *Acta Physiol Scand*. **160:** 341-351.
2. Staron R.S. (1997). *Can. J. Appl. Physiol*. 22(4): 307-327.
3. Wakeling J.M., Rozits A.I (2004). *The Journal of Experimental Biology*. **207:** 2519-2528.

Table 1: Correlation between electromyographic variables (RMS and MF), force of leg extension and histomorphometry (type I and II fiber area; type I and II fiber percentages - %) in different intensities of contraction (10%, 50% and 100% of MIVC).

	10%		50%		100%	
	R	p	r	p	r	p
Force x RMS	0.479	0.004	0.697	0.001	0.641	0.001
Force x MF	0.011	0.951	0.001	0.997	0.031	0.862
RMS x MF	-0.186	0.291	0.027	0.881	-0.030	0.865
Force x Type I Area	0.392	0.019	0.431	0.009	0.366	0.030
Force x Type II Area	0.415	0.013	0.452	0.006	0.355	0.036
Force x Type I %	0.121	0.489	0.139	0.426	0.038	0.828
Force x Type II %	-0.121	0.489	-0.139	0.426	-0.038	0.829
RMS x Type I Area	0.357	0.035	0.381	0.024	0.274	0.112
RMS x Type II Area	0.462	0.005	0.441	0.008	0.338	0.047
RMS x Type I %	0.236	0.171	0.186	0.285	0.014	0.936
RMS x Type II %	-0.238	0.168	-0.186	0.282	-0.015	0.933
MF x Type I Area	-0.172	0.329	0.137	0.438	0.288	0.099
MF x Type II Area	-0.171	0.333	0.078	0.661	0.287	0.099
MF x Type I %	0.142	0.422	0.413	0.0152	0.413	0.015
MF x Type II %	-0.142	0.424	-0.412	0.0154	-0.412	0.015

115 THE INFLUENCE OF GENDER ON THE ELECTROMYOGRAPHIC SIGNAL CHARACTERISTICS OF QUADRICEPS FEMORIS

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INTRODUCTION

It has been related that muscle fiber diameter and composition of men are different from women's and that these variables influence the electromyographic signal, as for time as for frequency domains (BILODEAU et al., 2003). In general, the highest median frequency values are found in muscles with high percentage of type II fibers or with larger diameter (GERDLE et al., 2000). Besides, some studies have shown that within quadriceps femoris there is a variation in the fiber composition on the muscles that compound it (BILODEAU et al., 2003). In view of the foregoing, the aim of this study was to evaluate the influence of gender on the electromyographic signal characteristics (RMS and median frequency) of the different components of quadriceps femoris.

METHODS

Twenty-three subjects [14 women (22.3 ± 2.1 years) and 9 men (23.2 ± 2.2 years)], all of them healthy, sedentary and with no history of systemic or orthopedic diseases, gave written informed consent to participate in this study. Approval for the project was obtained from the Ethics Committee on Human Research of the institution where the study was developed (protocol number 65/05).
Initially, the electrical activity of the vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF) muscles of the dominant member was obtained by a signal acquisition module, model EMG1000 (Lynx®), with impedance 10^9 Ohms, resolution of 16 bits entry band of ± 5V, and interface with a Pentium III microcomputer. Data acquisition and storage was carried out with Aqdados software (Lynx®), version 7.02 for Windows®.
The subjects remained seated on the Bonet table, with the hip joint at 90° and the knee joint at full extension. Before the electrodes were put into place, the skin was prepared, trichotomized and cleaned with 70% alcohol. To capture the action potentials, 3 simple differential, active surface bipolar electrodes (Lynx®) (20 times gain, IRMC > 100 dB, signal noise rate < 3 μV RMS and interelectrode distance of 10mm) were used and placed according to SENIAM specifications. The channels were adjusted for a total gain of 1000 times, with band-pass filter of 20-1000 Hz (Butterworth type) and sampling frequency of 2000 Hz. The reference electrode was attached to the anterior tibial tuberosity of the analyzed leg. To measure the force (Kgf) of leg extension a properly calibrated load cell model MM-100 (Kratos®) was used. Signals were collected simultaneously in the 3 electrodes and in the load cell during maximum voluntary isometric contraction (MVIC) for 5 seconds, repeated 3 times and with an interval of 1 minute between them. After collection, the signals were processed in routines specified for the analysis of the Root Mean Square (RMS) in μV and median frequency (MF) in Hz (FFT of 512 points, with *hanning type* window of 256ms) in the *software* Matlab® 6.5.1.
Normality test was performed by K-S test and all data presented normal distribution.
For the comparisons among the 3 quadriceps femoris muscles in the same group, the oneway ANOVA and Tukey's post-hoc test was used. For gender comparisons the statistical test used was independent student's *t* test Level of significance was set at 5%.

RESULTS and DISCUSSION

We verify in figure 1 that male group showed statistically higher leg extension force than female group (p=0.0023). As for RMS (μV) of quadriceps femoris compounding muscles, we verify in table 1 that for female group there was no significant difference among the 3 muscles; for male group, RMS of VM was significantly higher than the values found for VL. In gender comparisons, men values of RMS were significantly higher than women's for all the 3 analyzed muscles (VL, VM and RF). As for median frequency (Hz) analysis, the female group showed higher values for RF compared to VM and VL; for male group there was no significant difference among the 3 muscles. In gender comparisons, there was no significant difference for the 3 muscles (Table 1).

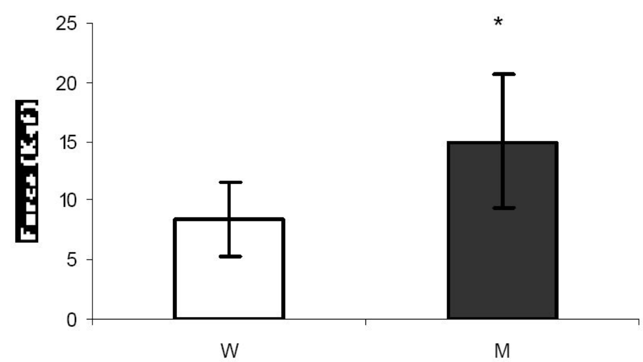

Figure 1: Leg extension force (Kgf) during MIVC of female (W) and male (M) groups, n=23. *p<0.05 in relation to female group. Values expressed as mean ± standard deviation (SD).

CONCLUSIONS

Based on results obtained from this study, we can conclude that force and RMS index of quadriceps femoris of men are higher than women's and that median frequency is not affected by gender differences.

REFERENCES

1. Bilodeau, M. et al. (2003). J. Electromyogr and Kinesiol, 13, 83-92.
2. Gerdle, B. et al (2000). Eur J Appl Physiol, 81, 2-10.

Table 1: RMS index (μV) and median frequency (Hz) of vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF) muscles of female (W) and male (M) groups. *p<0.05 in relation to the respective muscle of female group; #p<0.05 in relation to VL of the same group, ψp<0.05 in relation to VM of the same group, n=23. Values expressed as mean ± SD.

	RMS (μV)		Median Frequency (Hz)	
	W	M	W	M
VL	81.91 ± 28.12	154.6 ± 66.47 *	79.52 ± 7.97	81.45 ± 17.34
VM	77.48 ± 45.19	219.61 ± 125.3#*	74.99 ± 13.26	82.14 ± 23.65
RF	78.18 ± 25.8	186.68 ± 74.22*	86.24 ± 10.62# ψ	86.98 ± 17.19

116 EMG AND EEG SIGNALS AS TOOLS FOR QUANTIFICATION, REGISTRY AND ANALISYS OF PHYSIOLOGICAL

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INTRODUCTION

Tremor is a kind of movement disorder with rhythmic characteristics, oscillatory and involuntary. When it is present, it interferes in mental and physical well-being of the subject and can result in anxiety and discomfort affecting the motor functions and balance. The detection, quantification and precise measurement which differs pathological and physiological tremor is a challenge for researchers and professionals of many areas of study. Nowadays, some methods, classifications and characteriscs are used and cited in the literature, as well as equipments and techniques to aid in clinical exams. In this context, this study seeks to establish a relationship between the physiological tremor as function of age, from the registry of electromyographic (EMG) and electroencephalic (EEG) signals in subjects without neurological dysfunction.

METHODS

Participated voluntarily in this study 59 healthy subjects, with different ages and from both genders. They were divided in 07 groups, according to age, in conformity with the ethical principles prepared by the Committee of Ethic in Research of the Federal University of Uberlandia. EMG and EEG examinations were performed using three different experimental protocols, during the execution of the Arquimedes spiral (outward and inward movement and stopped in the center):

- EMG, with an electrode positioned in the surface of the extensor carpi ulnaris and a reference electrode over the shoulder of the dominant arm of the subject, which was comfortably sitting on a chair for the procedure. The device used was the MyosystemBrl_P84, having 08 EMG channels and 04 auxiliary channels.
- EEG, with electrode positioning in conformity with the 10/20 system, further processed according to standard longitudinal imbricate pattern. The device used was the BrainNET-36, having 23 channels, generating a compound signal of 23 temporal vectors representing the cerebral activity of some specifics points of the head.

For each subject, the EMG registered the quantitative movements during the execution of the Arquimedes spiral, with the EEG exam recording the brain activity of cortical regions (agents).

The data were organized and analyzed by a program using a mathematical tool. Statistical analysis were performed to identify differences and characteristics that distinguish each group in response to variations shown from the signals collected. The results are analyzed and compared visually through graphs and tables.

RESULTS and DISCUSSION

After extraction, organization, division of data over the regions of interest it were used for analysis of possible correlations of two characteristics: mean and kurtosis with the objective of finding correlation between data using the EEG and EMG signals to confirm the correlation of kinetic tremor with age. Table 01 represents the analysis and data comparition:

Table 1: Results of EMG and EEG characteristics. D: inward, F: outward e P: stopped.

Characteristic	EEG			EMG		
	D	F	P	D	F	P
Mean	0.75	0.87	0.81	0.72	0.83	0.9
Kurtosis	0.89	0.88	0.82	0.85	0.91	0.8

During the research we have obtained data with innovations that relate characteristics of physiological tremor of healthy individuals and can be changed with the course of aging. Using a sample of 59 individuals and with realization of EMG and EEG exams, they form na important tool for the diagnosis of various disorders related to movement and the Central Nervous System. The processed data with their respective correlations are posted in Table 01, where a significant correlation between the EMG and EEG measurements with age of the individuals were found, considering correlations above 0,7. The mean is a statistical measure of the magnitude of the signal, ie, from the intensity of this, there is a hypothesis that needs to be deepened, with the increase on the intensity of the EMG and EEG signal it can indicate that the signal is distributed over the motor units of the CNS, which increases the amount received by each of them confirming the correlations. Regarding kurtosis, which is the fourth statistical moment, is a measure of flatness or appointment of a distribution, showing information about the location and variability of a sample set of subjects represented in Table 01.

CONCLUSIONS

Researches has shown that patients with proven characteristics of higher physiological tremor index are more likely to develop pathological tremor. But the transition from physiological to pathological tremor remains incomprehensible, being the primary question to be answered.

Final analysis of this research showed an increase in tremor with age, this confirms the concern in pursuing this work because it is in the elderly that tremor could be a symptom of diseases that needs medical attention, like essential tremor and Parkinson's.

REFERENCES

1. Quillfeldt JAA. "Origem dos Potenciais Elétricos das Células Nervosas," pp. 35, 12/maio/2005, 2005.
2. Swider M. "The application of video image processing to quantitative analysis of extremity tremor in humans", Journal of Neuroscience Methods. pp. 167-172, 1998.
3. Halliday DM, et al. "Coherence between low-frequency activation of the motor cortex and tremor in patients with essential tremor", The Lancet. pp. 1149-1153, 2000.
4. Elan D Louis, Pullman SL. "Comparison of Clinical vs. Electrophysiological Methods of Diagnosing of Essential Tremor". pp. 668-673, 2001.

117 EMG SPECTRAL ANALYSIS OF INCREMENTAL CYCLING EXERCISE USING FOURIER AND WAVELET TRANSFORMS

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INTRODUCTION

One technique used to study muscular fatigue is the surface electromyography (EMG), which provides information of the muscle electrical activity during muscle contraction (DE LUCA, 1997). EMG analysis is usually performed by spectral decomposition of the signal, using mathematical algorithms such as the Fast Fourier Transform (FFT) (DE LUCA, 1997). Changes in force, speed and muscle length over time introduce variations in the spectral content of the EMG signal, creating difficulties in the use of the FFT. Given the limitations imposed to the use of the FFT in dynamic contractions, another technique called Wavelet Transform (WT) has been used to decompose the EMG signal (HOSTENS et al, 2004).

Thus, the aim of this study was to compare the electromyographic indices of fatigue, slope of Median Frequency (NFI) and median frequency (MF) and MF variance, calculated with the Fast Fourier Transform (FFT) and Wavelet Transform (WT) in untrained individuals during cycle exercise.

METHODS

Twelve healthy subjects, untrained (24.9 ± 3.92 years, 72.6 ± 8.7 Kg, 174.4 ± 6.6 cm) participated in this study, after signing an informed consent form.

All participants performed a maximal incremental test to determine the peak power (Wp) and EMG activity in a CompuTrainer DYNAFIT (RacerMate®, Seattle, WA, USA) cyclesimulator, which allows the determination of the generated power and cadence during the test. The test protocol consisted of an initial load corresponding to 0 W, with increments of 20 W.min-1 until volitional exhaustion or the inability to maintain a cadence of 90 RPM for 5 s. The Wp was considered as the power generated in the last second of the test.

The EMG signals were recorded according to ISEK guidelines. The active bipolar electrode (TSD 150™, Biopac System®, USA), with an inter-electrode distance of two cm, was placed over the vastus lateralis (VL) muscle. The electrode was positioned according to the SENIAM.

The EMG activity was recorded by a 16-channel electromiograph model MP150™ (Biopac System®, USA) with sampling rate of 2000 Hz and common-mode rejection ratio of 95 dB. The raw EMG signals were filtered (band-pass filter of 20 Hz and 500 Hz). For the spectral analyzes, we used the values of MF obtained using the short time FFT and Wavelet (Daubechies: db5) techniques.

Through the techniques the following parameters were obtained: MF, slope of MF – EMG index of fatigue (NFI) and the MF variance during exercise. The NFI was determined by the use of linear regression between the MF and duration of exercise. The analyzed parameters were obtained for each period corresponding to 0, 25, 50, 75 and 100% of total duration of the maximal incremental test.

Analysis of variance for repeated measures was used to compare the data regarding the FFT and WT techniques. Mauchly's sphericity test was applied, and whenever this test was violated, the necessary technical corrections were made using the Greenhouse-Geisser test. Whenever the F test indicated statistical significance, the analysis was complemented by means of the Tukey's comparison test ($P < 0.05$).

RESULTS and DISCUSSION

No statistical significant differences were found between the mean values of MF and fatigue index of the two techniques (FFT and WT) ($P>0.05$). However, we observed that the values of MF variance obtained using FFT were significantly higher than those obtained by the WT (Table 1). These results corroborate the findings of Da silva et al. (2008) that showed that WT has less variation than FFT.

CONCLUSIONS

The results of the present study suggest that both FFT and WT can be used to analyze muscle fatigue using EMG spectral indicators in long duration dynamic exercise. However, the use of the WT technique shows less variability in the EMG signal analysis.

REFERENCES

1. Da Silva RA, et al. (2008). Electromyogr Clin Neurophysiol. 48, 147-162.
2. De Luca CJ. (1997). J Appl Biomech. 13, 135-163.
3. Hostens I, et al. (2004). J Electromyogr Kinesiol. 14, 205-215.

ACKNOWLEDGMENTS

The authors thank CAPES, CNPq and FAPESP for the financial support and scholarship.

Table 1: Mean values ± standard deviation of median frequency (MF), normalized fatigue index (NFI) and MF variance obtained by FFT and WT.

%TT	MF (Hz)		NFI (Hz/s)		Variance (Hz)	
	FFT	WT	FFT	WT	FFT	WT
0%	71.2 ± 5.7	68.2 ± 4.9	-0.08 ± 0.1	-0.07 ± 0.1	158.06 ± 11.97	73.12* ± 5.74
25%	66.9 ± 5.5	64.4 ± 5.7	0.01 ± 0.0	0.01 ± 0.0	130.16 ± 8.68	60.62* ± 4.67
50%	68.6 ± 4.6	67.1 ± 5.2	0.00 ± 0.1	0.00 ± 0.1	145.43 ± 11.89	64.23* ± 6.27
75%	66.6 ± 5.3	66.3 ± 4.3	-0.02 ± 0.1	-0.03 ± 0.1	151.93 ± 24.52	68.60* ± 7.96
100%	64.5 ± 9.5	63.5 ± 8.5	-0.04 ± 0.1	-0.04 ± 0.1	131.82 ± 14.43	73.11* ± 9.45

Note: TT = % of total time; *$P < 0.05$ of FFT

118 COMPARISON BETWEEN THE RMS VALUE AND INTEGRAL OF ENVELOPMENT FOR GETTING THE LEVEL OF MUSCLE ACTIVATION

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INTRODUCTION

With the advancement of technologies in electronics and computing, especially in terms of conditioning and processing of biomedical signals, has seen a growing interest in EMG signals for various assessments. When the EMG signal is used for analysis of repetitive movements, such as chewing [Camargos at al., 2008, Rosa at al., 2007], calculating the RMS value is presented as one of the ways commonly used to evaluate energy level of the signal.
However, in some applications in which the RMS value of an EMG signal is used to obtain the intensity of activation of a muscle during a contraction, it may happen that the value obtained is modified by the width and position of the window. This may compromise the studies based on that value. Alternatively, while maintaining the goal of achieving the level of activation of muscle contraction, one can use the integral of the envelope [Barros, 2005], which consists in calculating the full wave rectified EMG signal. This paper compares the results obtained by calculating the RMS value and the integral of the envelope (∫env) when the window is changed by calculating positions and extensions of the window, which could be set by different operators or even by the same operator software processing, at different times.

METHODS

The methodology started with samples of EMG signals of a sequence of contractions of the masseter muscle during mastication. Was then selected a sample of the EMG signal containing a cycle of activation of that muscle, which was defined as a separate calculation and thereafter, we obtained the RMS values and the integral envelope. After that, the window was changed in width and position and the new values of RMS and complete the envelope were generated.

RESULTS and DISCUSSION

Figure 1 refers to a cycle of activation of the masseter and the window calculation involving the cycle of activation, which was defined as 1 second.

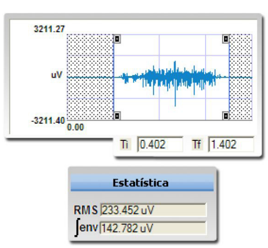

Figure 1 - Window 1 second to calculate the RMS and Integral Envelopment.

In Figure 2 we used the same EMG signal, but with the window raised, that this analysis is 1.205 seconds.

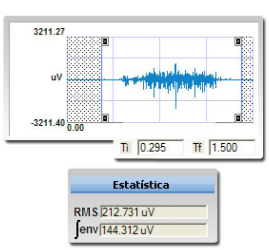

Figure 2 - of 1.205 seconds for the calculation of the RMS and Integral Envelopment.

For the figure, the window still includes the full cycle of muscle activation, however, only the RMS value was significantly changed from 233.452uV to 212.731uV, which is equivalent to a change of about 8.87%. In the integral of the envelope, the value rose from 142.782uV to 144.312uV equivalent to a variation of 1.06%.
In Figure 3 we used the same sign and the same width of window in Figure 2, but now shifted to the right.

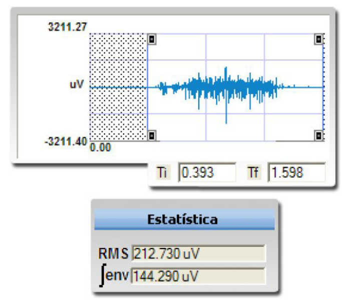

Figure 3 - Window 1.205 Mon shifted to the right to calculate the RMS and Integral Envelopment.

The figure also shows that the RMS values
and ∫env remain virtually unchanged from the values shown in Figure 2 (RMS: 0.00048% and ∫env : 0.01525%).

CONCLUSIONS

In light of the results, it appears that the integral of the envelope has a lower dependence on window width and positioning of the same involving the cycle of muscle activation. Currently, most software applications for processing EMG signals has two ways of defining the window calculation manual positioning by the operator or automatically by a mathematical method for detecting EMG activity. However, both forms have, to date, significant uncertainties. Thus, it is believed that, for comparative analysis of dynamic EMG activity, the use of the integral of the envelope, instead of the RMS value, can generate results more accurate and reliable.

REFERENCES

1. Camargos, GV, Silva, MR, Neto, AJF, Souza, GC, Rodrigues, MM. Evaluation of occlusal splint Resilient Control in Patients with Temporomandibular Disorder-TMD. (2008).
2. Barros, KR Methodology for Classification of EMG signals to control prostheses with low computational effort, Master Dissertation - Federal University of Uberlandia (2005).
3. Rosa LB, Vitti M, Santos CM, Pagnano VO, PB Vasconcelos, Mello RFH, SIESSERE S, Regalo SCH, Electromyographic Analysis in Partially Edentulous Individuals, Braz Oral Res (2007);
4. Talita, SPS. Design of a Control System for Under-Actuated a Hand Prosthesis, Master's Thesis - Instituto Militar de Engenharia (2008).

119 STRENGTHENING OF THE QUADRICEPS MUSCLE WITH TWO PROTOCOLS OF NEUROMUSCULAR ELECTRIC ESTIMULATION: AN ELETROMIOGRAPHIC EVALUATON

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INTRODUCTION

Neuromuscular electrical stimulation (NMES) is a therapeutic tool commonly used to restore sensorial and motor functions and to evoke muscle strengthening and hypertrophy (HOLCOMB et al., 2000). According to Low and Reed (2001), there are different kinds of NMES currents and they can be separated in low and medium frequency currents. An example of low frequency current is the functional electrical stimulation (FES). On the other hand, Russian current is a medium frequency example. In view of the foregoing, the aim of this study was to evaluate the electromyographic activity and the force of knee extensor muscles before and after two different electrostimulation training programs.

METHODS

Twelve sedentary women (23 ± 3,74 years), with no systemic or orthopedic diseases, gave written informed consent to participate in this study. Approval for the project was obtained from the Ethics Committee on Human Research of the institution where the study was developed (protocol number 07-07/008). Initially, the electrical activity of the vastus medialis (VM), vastus lateralis (VL) and rectus femoris (RF) muscles was obtained by a signal acquisition module, model EMG1000 (Lynx®), with impedance 10^9 Ohms, resolution of 16 bits. Data acquisition and storage was carried out with Aqdados software (Lynx®), version 7.02 for Windows®.

The subjects remained seated on the Bonet table, with the hip joint at 90º and the knee joint at full extension. Before the electrodes were put into place, the skin was prepared, trichotomized and cleaned with 70% alcohol. To capture the action potentials, 3 simple differential, active surface bipolar electrodes (Lynx®) (20 times gain, IRMC > 100 dB, signal noise rate < 3 μV RMS and inter-electrode distance of 10mm) were used and placed according to SENIAM specifications. The channels were adjusted for a total gain of 1000 times, with band-pass filter of 20-1000 Hz (Butterworth type) and sampling frequency of 2000 Hz. The reference electrode was attached to the anterior tibial tuberosity of the analyzed leg. To measure the force (Kgf) of leg extension a properly calibrated load cell model MM-100 (Kratos®) was used. Signals were collected simultaneously in the 3 electrodes and in the load cell during maximum voluntary isometric contraction (MVIC) for 5 seconds, repeated 3 times and with an interval of 1 minute between them.

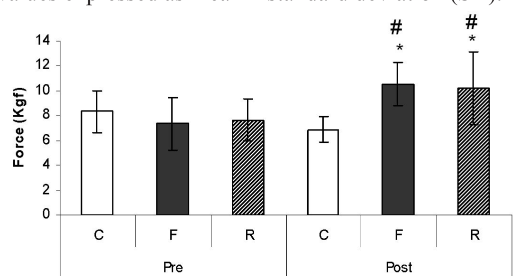
After the initial electromyographic evaluation, 3 experimental groups were formed: 1) Control (C), 2) FES electrostimulated group (F) (f=50Hz; T=300us and on/off ratio=5s); 3) Russian current electrostimulated group (R) (f=2500Hz modulated in 50Hz; on/off ratio=5s). For both electrostimulated groups, 4 silicon-carbon (10 X 4 cm), were placed over the belly of quadriceps femoris. The intensity of the electrostimulation was determined by the maximum tolerance of each subject. The electrostimulation programs lasted 5 weeks (3 sessions *per* week, each session lasting 30 minutes). After the end of the training programs each subject was revaluated following the procedures previously described.

Electromyographic signals were processed in the software Matlab 6.5®, for the analysis of the Root Mean Square (RMS) in μV. Statistical analysis consisted of the Wilcoxon test performed for paired data (intra-group comparisons) and the Kruskal-Wallis test followed by Dunn post-hoc test (inter-groups comparisons). Level of significance was set at 5%.

RESULTS and DISCUSSION

As to the leg extension force, we verify in figure 1 that there was a significant increase for both stimulated groups after 5 weeks of electrostimulation training programs. Regarding RMS index of VM, VL and RF muscles, there was a significant increase for F and R groups after electrostimulation programs (table 1). However, there was no significant difference between the stimulated groups.

Figure 1: Leg extension force (Kgf) of the experimental groups under pre and post-training evaluations, n=12. *p<0.05 in relation to the respective group in pre-condition; #p<0.05 in relation to C group in the same condition. Values expressed as mean ± standard deviation (SD).



CONCLUSIONS

Under our experimental conditions, we can conclude that both electrostimulated groups (FES and Russian) had increases of force and RMS index of quadriceps femoris after 5 weeks of training; however, there was no difference between them.

REFERENCES

1. Wolf SL, et al. (1986). Phys. Ther.¸ 66, p. 218.
2. Low J, Reed A. (2001). Eletroterapia Explicada: Princípios e Prática. 3 ed, Editora Manole.

Table 1: RMS index (μV) of VM, VL and RF muscles of the different experimental groups under pre and post-training evaluations. *p<0.05 in relation to the respective group in pre-condition; #p<0.05 in relation to C group in the same condition, n=12. Values expressed as mean ± SD.

	C		F		R	
	Pre	Post	Pre	Post	Pre	Post
VM	36.82±17.56	59.80±35.84	20.6±10.27	121.13±58.37* #	13.22±1.96	145.39±99,01* #
VL	33.93±23.00	55.32±18.87	15.60 ± 6.21	91.92±18.95* #	15.67±3.57	143.83±71.63 * #
RF	31.67±22.77	37.59±12.74	19.43±9.13	154.22±41.20* #	12.86 ± 4.39	100.17±51.98* #

120 GROUND-LEVEL GAIT TRAINING COMBINING PARTIAL BODY WEIGHT SUPPORT AND FUNCTIONAL ELECTRICAL STIMULATION IN INDIVIDUALS WITH CHRONIC STROKE

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INTRODUCTION

Partial body weight support system (BWS) combining treadmill and functional electrical stimulation (FES) has been proposed as a strategy for gait training in individuals with stroke (Lindquist et al, 2007). Considering that ground level is the most common locomotion surface, and that there is little information about individuals with stroke walking with BWS and FES on this surface, the aim of this study was to investigate the effects of gait training combining BWS and FES on ground level in individuals with chronic stroke.

METHODS

Twelve individuals with chronic stroke took part in the study (stroke interval grater than 6 months). An A-B-A design was applied as follows: phase A included gait training on ground level with BWS, and phase B included the same gait training combining FES of the peroneal nerve. Each phase has occurred 3 times a week, lasting 45 minutes each section, for 6 weeks. The individuals were evaluated before and after each phase. The following variables were examined: mean walking speed, step length, stride speed, stride length and duration; and foot, leg, thigh and trunk segment range of motion (ROM). Two analysis of variance (ANOVA) and two multivariate analysis of variance (MANOVA) were employed, using body side (non-paretic and paretic) and evaluations (pre-training, post-phase-A1, post-phase B, and post-phase A2) as factors, all of them treated as repeated measures. An alpha level £ 0.05 was adopted for all statistical tests.

RESULTS

Table 1 depicts mean and standard deviation of the descriptive gait variables.
ANOVA revealed differences for the mean walking speed among the evaluations, F(1,11)=37.99, p=0.01, with paired comparisons showing an increased mean walking speed after phase A2 when compared to the pre-training (p= 0.02).
ANOVA revealed no difference for step length. MANOVA showed differences among the evaluations for the stride length, F(3,33)=7.08, p=0.01, with unvaried tests showing a increased stride length after phase A1(p=0,03) and after phase A2 (p=0.04) when compared to the pre-training evaluation. MANOVA also indicated differences for the stride speed, F(3,33)=7.68, p=0.01, with unvaried tests showing a higher stride speed after phase A2 when compared to the pre-training (p=0.02).
Regarding to the ROM,
MANOVA showed differences among the evaluations for foot F(3,33)=4.63, p=0.01, leg F(3,33)=4.63, p=0.01, thigh F(3,33)=9.18, p=0.01, and trunk F (3,33) = 3.42, p = 0.03, and between body sides for foot F (1,11) = 34.87, p = 0, 01; leg F (1,11) = 44.20, p = 0.01 and trunk F(1,11)=28.60, p=0.01 segments. However, paired comparisons revealed that only leg and thigh segments showed differences among the evaluations. The leg showed an increased ROM after phase A1 (p=0.03), and the thigh showed an increased ROM after phase A1 (p=0.01) and A2 (p=0.01) when compared to the pre-training.
Regarding to the body sides, all segments showed differences between the paretic and non-paretic side for all evaluations (p=0.01), except to the thigh.

Table 1: Descriptive gait variables and segmental range of motion values

Variable	Side	Pré-training	After A1	After B	After A2
Mean walking speed (m/s)		0.39 (0.2)[a]	0.52 (0.3)	0.52 (0.3)	0.55 (0.3)[a]
Step length (m)	Nonparetic	0.33 (0.1)	0.39 (0.1)	0.38 (0.1)	0.38 (0.1)
	Paretic	0.32 (0.1)	0.35 (0.1)	0.35 (0.2)	0.36 (0.2)
Stride length (m)	Nonparetic	0.62 (0.1)[a b]	0.75 (0.2)[a]	0.73 (0.2)	0.74 (0.2)[b]
	Paretic	0.63 (0.1)[a b]	0.76 (0.2)[a]	0.74 (0.2)	0.75 (0.2)[b]
Stride speed (m/s)	Nonparetic	0.38 (0.2)a	0.50 (0.3)	0.50 (0.3)	0.53 (0.3)[a]
	Paretic	0.39 (0.2)a	0.51 (0.3)	0.51 (0.3)	0.54 (0.3)[a]
Stride duration (s)	Nonparetic	1.8 (0.7)	1.8 (0.7)	1.7 (0.6)	1.6 (0.5)
	Paretic	1.9 (0.8)	1.8 (0.7)	1.7 (0.6)	1.5 (0.4)
Foot ROM (°)	Nonparetic	58.2 (12.9)*	65.9 (16.5)*	64.7 (16.5)*	65.3 (15.1)*
	Paretic	38.6 (15.8)*	44.3 (14.9)*	43.5 (15.1)*	43.6 (13.1)*
Leg ROM (°)	Nonparetic	50.1 (8.1)*[a]	54.9 (9.7)*[a]	54.4 (10.9)*	54.8 (9.9)*
	Paretic	33.9 (11.7)*[a]	39.4 (11.5)*[a]	38.3 (12.5)*	39.1 (10.7)*
Thigh ROM (°)	Nonparetic	30.9 (4.8)[a b]	35.1 (6.8)[a]	34.2 (6.8)	34.5 (5.2)[b]
Paretic		27.7 (6.4)[a b]	33.1 (8.6)[a]	32.2 (9.2)	32.4 (7.7)[b]
Trunk ROM (°)	Nonparetic	8.2 (2.4)*	9.1 (3.1)*	8.3 (2.4)*	7.8 (2.1)*
	Paretic	12.7 (2.5)*	14.6 (3.7)*	14.6 (3.2)*	14.4 (3.6)*

Values are presented as mean and standard deviation: M (SD); ROM = range of motion; * represent differences between body sides; same letters (a, b) represent differences among the evaluations.

DISCUSSION

The increased mean walking speed found at the end of the training is a measurent of clinical relevance, since walking speed is an important parameter of motor recovery (Olney and Richards, 1996). This outcome is associated with the increased stride length and speed and the increased range of motion of the leg and thigh segments, which has been considered too as a determinant factor for a comfortable gait speed (Chen et al., 2003).
The positive outcomes found at the end of training are related only to the phase A1, contrary to Lindquist et al. (2007), who had developed the same training system on a treadmill, with only 3 weeks of duration in each phase and showed positive results associated with the FES.

CONCLUSIONS

Ground level gait training with BWS was effective to improve some gait parameters of these individuals. However, the association with FES did not provide an additional improvement.

REFERENCES

1. Lindquist A. R., et al. (2007). Gait training combining partial body weight-support, a treadmill, and functional electrical. *Phys Ther*. 87, 144-1154.
2. Chen C. L., et al. (2003). Gait performance with compensatory adaptations in stroke patients with different degrees of motor recovery. *Am J Phys Med Rehabil*. 82, 925- 935.
3. Olney S. J., Richards C. (1996). Hemiparetic gait following stroke. Part 1: characteristics. *Gait & Posture*. 5, 136-148.

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121 INFLUENCE OF ORAL CONTRACEPTIVE USE IN HIP ABDUCTOR TORQUE AND IN FUNCTIONAL PERFORMANCE

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INTRODUCTION

The anterior cruciate ligament (ACL) injuries have been typically associated with the increase of dynamic knee valgus measures during functional and/or sports activities (Russell *et al*., 2006). In this context, the use of oral contraceptives (OC) has been hypothesized as a prophylactic measure for these lesions, since they seem to have potential to modulate the ligament structure and laxity (Martineau *et al*., 2004).
Although it is known that the incidence of ACL injuries may also be influenced by neuromuscular factors, which are directly related to functional performance, there are few reports in the literature about the effects of the use of OC on these aspects (Drake *et al*., 2003; Elliott *et al*., 2005), as they are still inconclusive. Whereas the OC present some positive influence on hip abduction torque, the one directly responsible for the control of femur adduction movement (dynamic knee valgus component), its benefit as a protective factor for ACL injuries seem obvious. Similarly, whether the functional performance can be influenced by the use of OC is another question of interest, especially in the sports arena.
Thus, the present study aimed to evaluate the effect of oral contraceptive use in hip abductor torque and in functional performance in healthy women.

METHODS

The study included 28 volunteers divided into 2 groups: 1 – Women who use 3rd generation of oral contraceptives (20, 25 or 30μg ethinyl estradiol with desogestrel or gestodene as progestin agents - OCG; n=11; 21.18±2.44 years; 58.30±7.72 kg; 1.64±0.06 m) for at least 3 months and 2 – Women who didn't use OC in the last 6 months – control group (CG; n=17; 20.59±1.62 years; 57.92±11.03 kg; 1.63±0.07 m).
After a appropriate warm-up and familiarization with the study procedures, subjects underwent to a maximum eccentric isokinetic evaluation of the dominant limb hip muscles in an *Biodex Multi-Joint System 2* isokinetic dynamometer (Biodex Medical Inc.®, Shirley, New York, USA) at angular velocity 30°/s, considering a range of motion from 0 to 30º of hip abduction and using two sets of 5 maximal eccentric contractions of the hip abductor muscles, with an interval of 3 minutes between them.
After the isokinetic evaluation of hip muscles, the volunteers underwent to a functional evaluation, which consisted of a extensive clinical use test (6-meter timed hop), which they should go (in three attempts) a 6-meter distance jumping only on the dominant leg as soon as possible, with 1 minute rest between each attempt.

RESULTS and DISCUSSION

The t-Student test for independent samples (considering α=5%) showed no significant difference between the groups in terms of average of eccentric hip abductor peak torque/body mass (p=0.72) – Table 1.

Table 1: Mean and standard-deviation of eccentric hip abductor torque/body mass (EHAT) and of the 6-meter timed hop test (6-meter) of control (CG – n=17) and experimental (OCG – n=11) groups.

Group / Test	CG	OCG
EHAT	1.16 ± 0.22 Nm	1.13 ± 0.18 Nm
6-meter	2.64 ± 0.64 s	2.18 ± 0.26 s

Despite the methodological differences, these findings are in agreement with those of Drake *et al*. (2003), who concluded that the use of oral contraceptives did not affect the isometric muscle activation of rectus femoris. Likewise, they agree with Elliott *et al*. (2005), which showed no effect of OC on the quadriceps, hamstrings and first dorsal interosseous isometric and isokinetic torques. Thus, the OC potential as a protective factor for ACL injuries, acting under the control of dynamic knee valgus still needs further investigation
However, in this study was observed a significant difference between groups in terms of functional performance (p=0.005), with the OCG showing better performance (Table 1). This result is consistent with Davies *et al*. (1991), who noticed better muscle performance during the early follicular phase of the menstrual cycle in relation to other phases. Whereas in the early follicular phase both hormone concentrations (estrogen and progesterone) are at low levels, and this is just one of the functions of OC, it is possible that they positively influence the functional performance, which implies in the implementation of further studies involving other variables of isokinetic and/or functional nature, as well as its impact on the lower limb dynamic alignment and in the occurrence of ACL injuries.

CONCLUSIONS

The use of 3rd generation of oral contraceptives seems not to influence the eccentric hip abductor torque measures. However, they can positively affect the functional performance in healthy women, by mechanisms not yet understood.

REFERENCES

1. Davies BN, et al. (1991). Variations in performance in simple muscle tests at different phases of the menstrual cycle. J. Sports Med. Phys. Fitness, 31(4), 532-537.
2. Drake SM, et al. (2003). A pilot study on the effect of oral contraceptives on electromyography and mechanomyography during isometric muscle actions. J. Electromyog. Kisiol., 13(3), 297-301.
3. Elliott KJ, et al. (2005). Does oral contraceptive use affect maximal force production in woman. Br. J. Sports Med., 39, 15-19.
4. Martineau PA, et al. (2004). Effect of the oral contraceptive pill on ligamentous laxity. Clin. J. Sports Med., 14(5), 281-286.
5. Russell KA, et al. (2006). Sex differences in valgus knee angle during a single-leg drop jump. J. Athl. Train., 41(2): 166-171.

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122 BIOFEEDBACK IMPLEMENTATION TO OPTIMIZATE THE TEACHING AND LEARNING AT SPEECH, LANGUAGE AND HEARING SCIENCES UNDERGRADUATE DEGREE

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INTRODUCTION

The implementation of new technological approaches to assist the teaching process allows the student a better practical training understanding. The use of technological tools such as Biofeedback of muscle action during the performance of Stomatognathic System (SS) functions evaluates the physiological and pathological conditions of muscle to get the knowledge of their specific activity. It also provides subsidies that make up the principles of muscle function, serving to help in monitoring the various miopathologies in kinesiological studies and prognosis of rehabilitation.

The Biofeedback use appears in Speech, Language and Hearing Sciences as an objective way to analyze the muscle activity, leading to an improvement in evaluation and treatment of SS diseases. Using this tool, it's could be had a better understanding of the muscle groups' physiology involved in SS functions and a analysis during the evaluation and Speech, Language and Hearing Sciences by the student and/or professional in Speech, Language and Hearing Sciences. It also makes possible that the patients receive the information from muscles, assimilate and be able to modify their behavior during therapy.

With the implementation of concepts and practices about Biofeedback applied to the teaching of Speech, Language and Hearing Sciences, the knowledge becomes the enlarged and improved clinical investigative method which results in optimization of teaching and learning at undergraduate degree.

METHODS

A literature survey on virtual databases in the major publications of scientific literature about the follow descriptors: Biofeedback, Teaching-learning and Speech, Language and Hearing Sciences were done.

RESULTS and DISCUSSION

In relation to the processes and resources involved in education, technology and images have a privileged place in the communication and learning (SARDELICH, 2006). The perception and understanding of images are an important aspect of teaching and learning. In certain learning strategies, the images are used as a starting point, as a sensitizer element for the understanding of problems or concept. The stimulation of memory through imagery can offer important contributions to the learning of many subjects (ALMEIDA, 2001).

The Biofeedback term corresponds to treatment techniques which people are trained to improve their capacity for self-regulation using their own body signs through the view of pictures equivalent to the action performed.

Through the use of electronic devices that emit signals and/or visual signals and allows that the patient have a contact with some aspects of their biological system, the Biofeedback promotes the learning by trial and error and manipulation of these voluntary or involuntary events CONCEIÇÃO, M. I. G. (2000).

In Speech, Language and Hearing Sciences, the technique's use for monitoring through tools with biofeedback, shows moderate evidence to the good prognosis of functional dysphonia treatment (BEHLAU, 2008).

In patients with peripheral facial paralysis, proposals for rehabilitation are varied. With regard to nonsurgical rehabilitation, the use of biofeedback is the most appropriate. In 1994, Beurskens et al. performed a review of types of physical therapy that had been used in facial paralysis and observed that most studies focused on a combination of exercises and biofeedback (WALRAVENS, 1986).

Conceição (2000) presented the effectiveness of electromagnetic biofeedback technique which increased the muscle response in patients with spinal cord injury.

The use of images helps the learning mechanism and the graphics display generated by the Biofeedback device allows to the patients a better control and a monitoring of their functions. So, the undergraduate student of Speech, Language and Hearing Sciences who have the opportunity to study the physiological phenomena with demonstrations mediated by Biofeedback, will get an optimized understanding of physiological mechanisms.

CONCLUSIONS

The biofeedback use in Speech, Language and Hearing Sciences undergraduate degree can help the learning process by students because this practice allows a better understanding of the physiological changes incurred during functions performed by Stomatognathic System components, illustratively and dynamic.

REFERENCES

1. Almeida EBL. (2001). Os Caminhos da Aprendizagem: Conexões entre educação, imagem e as tecnologias da informação e comunicação, São Paulo: UNICAMP.
2. Behlau M. (2004). Atualização Científica em Fonoaudiologia e Educação: Prática baseada em evidências para o tratamento dos distúrbios da voz, Rev CEFAC v.10, n.4, out - dez.
3. Conceição MIG. (2000). The use of the technique of biofeedback for EMG in the whitewashing of patients with injury to medular. Brasília: Universidade de Brasília; s.n; 189 p.
4. Sardelich ME. (2006). Leitura de imagens e cultura visual: desenredando conceitos para a prática educativa. Educ. ver.;Jan / June no. 27, p. 203-219.
5. Walravens S. (1986). Using EMG-Biofeedback in the treatment of facial paralysis. Acta Oto-Rhino-Laryngol Belg, 40: 174-177.

123 PROPOSAL OF PROTOCOL FOR ELECTROMYOGRAPHIC EVALUATION OF LARYNX EXTRINSIC MUSCLES IN VOICE CLINIC

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INTRODUCTION

In Speech, Language and Hearing Sciences, surface electromyography (SEMG) is a procedure used to helps in the diagnosis of mastication, deglutition and stuttering.

In the voice area, it's not used so much and the studies have focused on functional dysphonia and investigate, particularly, the electrical activity of the extrinsic suprahyoid (SH) muscles of the larynx and the infrahyoid (IH) muscle is underreported. It's important to give greater objectivity to the external evaluation of larynx whose clinical examination takes place through the quality inspection by visual and manual ways.

Therefore, the objective of this paper is to propose a protocol for clinical use of SEMG as an additional complementary instrument of vocal evaluation.

METHODS

To develop the protocol were used some studies published between 1980 to 2009 which analyzed the electrical activity of the SH and IH muscles and other neck muscles with different methodologies.

Were accessed the Pubmed and Scielo databases and CAPES thesis database, using the keywords: surface electromyography, voice, voice and laryngeal disorders. Was also evaluated whether there was a recommendation from the *Surface EMG for the Non-Invasive Assessment of Muscles* (SENIAM) for the SH and IH muscles evaluation.

The group of researchers in SEMG implemented a new model (Table 1) extended to other types of voice disorders such as organic voice disorders and organic-functional voice disorders which also investigate the IH group. The protocol is being tested.

RESULTS and DISCUSSION

Were found six articles and two thesis. Patients with hyperfunctional dysphonia during typical speech in emission of sustained vowel, connected speech and at rest were evaluated. (Redenbaugh, Reich, 1989; Silvério,1999; Hocevar-Boltezar *et al*.,1998 ; Sapir *et al*.; 2000; Pettersen,Westgaard, 2004; Nelli, 2006).

The SENIAM had no reference to the evaluation of SH and IH. This paper proposes the use of SEMG in other types of dysphonia as the organic-functional and organic. For clinical measurement of muscle recruitment, the evaluation of SH and IH shown to be sufficient to obtain the information. The sustained /ε/ vowel emission and the count from 1 to 10 in habitual phonation of individuals and in strong intensity must be tested, that various protocols for voice evaluation.

To the signal normalization, the group tested many maneuvers, concluding that the use of tongue retracted with open mouth technique gives the best myoelectric signal and which it's considered as maximal voluntary contraction.

CONCLUSIONS

It seems reasonable to adapt the principles recommended to the use of SEMG to evaluate muscles that are related to speech and their disorders to the voice clinic, as the IH and SH in different phonatory tasks.

Thus, the use of SEMG in this area can provide more objective information correlated with the clinical history of individuals.

REFERENCES

1. Hocevar-Boltezar I, Janko M, Zargi M. Role of surface EMG in diagnostics and treatment of muscle tension dysphonia. Acta Otolaryngol. 1998;118(5):739-43.
2. Silvério KCA. Atividade elétrica dos músculos esternocleidomastóideo e trapézio fibras superiores em indivíduos normais e disfônicos. (dissertation). State University of Campinas, 1999. 148p.
3. Pettersen V, Westgaard R. The Activity Patterns of Neck Muscles in Professional Classical Singing. J. Voice. 2004;19(2):238-51.
4. Sapir S, Baker KK, SA, Larson CR, Ramig LO. Short-latency changes in voice F0 and neck surface EMG induced by mechanical perturbations of the larynx during sustaneid vowel phonation. J Speech Lang Hear Res. 2000; 43:268-76.
5. SENIAM. Disponível em http://www.seniam.org. acessado em 20 de dezembro de 2009.
6. Redenbaugh MA, Reich AR. Surface EMG and related measures in normal and vocally hyperfunctional speakers.J Speech HearDisorders.1989;54:68-73.

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Table 1. Protocol of electromyographic evaluation of SH and IH muscles in voice area.

Stage 1	**Preparation for the test and laryngeal palpation:** Volunteer comfortably seating in a chair with back support and no support for the head, hands on thighs, the feet soles on the ground, head erect and look forward. Before each experiment, will have a training with each volunteer, with all necessary instructions and information. Laryngeal inspection will be conducted by palpation and visualization of the larynx in neck as: tension, reaction to touch, symmetry and position. The skin must be clean with gauze and alcohol 70º and if necessary, held trichotomy.
Stage 2	**Electrode placement position:** It begins by placing the reference electrode, used to minimize interference from external electrical noise. It's placed, conditionally, in ulnar styloid process of the right arm of volunteer, far from the points of muscles evaluated. It will be necessary use 03 channels with 02 electrodes each one, as: 01 channel with 02 electrodes in submandibular region, longitudinally of anterior belly of digastric muscle and 02 channels placed bilaterally between the larynx 1.0 a 1.5cm from the thyroid notch. Should respect the interelectrode distance not exceeding 1.5cm. Proof of two channels in electromyographic.
Stage 3	**Signal normalization by MVA:** Will be done the Tongue Retracted with Open Mouth with a sustained contraction for 05s, 03 consecutive times, with 10 seconds of interval between each repetition.
Stage 4	**Capture of baseline muscle activity at rest:** The rest will be captured with the patient in silent, without swallowing or make any other movement for 1 minute.
Stage 5	**Phonatory tasks to electromiographic devices:** 1. /ε/ vowel on habitual emission, for 5seconds, for 03 consecutive times at 5s time interval between each emission 2. Count from 1 to 10 on habitual emission, for 03 consecutive times at 5s time interval between each emission 3. /ε/ vowel on high intensity emission, for 5seconds, for 03 consecutive times at 5s time interval between each emission 4. Count from 1 to 10 on high intensity emission, for 03 consecutive times at 5s time interval between each emission

124 FORCE VERSUS EMG FOR BIOFEEDBACK IN ISOMETRIC TRAINING

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INTRODUCTION

Biofeedback techniques are often used in the training of athletes and subjects with neuromuscular disorders. They involve monitoring and recording physiological body response to internal or external stress, being possible, for instance, when one measures parameters such as muscle electrical activity or force and torque (CAMPENELLA, 2000).
Electromyogram (EMG) amplitude is related to a certain extent to muscle force. However, this correlation is not yet fully defined and it is not known which of these signals provides better performance in muscle force training (BASMAJIAN & DE LUCA, 1985).
Thus, the objective of this work is to compare quadriceps muscle force and vastus lateralis electrical activation gain in subjects submitted to isometric training using force and EMG biofeedback.

METHODS

Forty-two healthy active women with 18 to 25 years of age (22.8 ± 2,1) were assigned randomly for one of these three groups: A) EMG biofeedback B) force biofeedback C) control.
During the experiments, volunteers were submitted to shaving and cleaning of the skin with alcohol. Disposable surface electrodes were applied using a bipolar configuration in the vastus lateralis muscle belly, according to SENIAM recommendations.
In the first evaluation the low-pass envelop (LPE) of the rectified EMG and the force signal were recorded during 3 maximal isometric contractions (CIVMs) with 6 s duration and 60 s interval between contractions. Peak force and LPE mean of the highest CIVM were used as reference values for the training sessions.
Training was performed with 2 CIVMs series. In each of them volunteers were encouraged to surpass 10 % (updated for each new series) of the reference value. If the volunteer was not able to reach this value in the next series, an adjustment was made lowering 5 % and, if they failed again, training was halt at this point.
In the training, between each series, a 2 min interval was allowed and A and B groups received visual stimulation (computer screen) of the EMG and force signal, respectively, while C group trained without any biofeedback.
To measure force a Bonett chair was used with force transducers (strain gage) attached to the resistance arms of the chair. The amplified signal was digitized using a 16 channels A/D converter with a 1000 Hz sampling frequency, 12 bits resolution.
EMG was amplified using a biological amplifier (CMR> 95 dB), low noise (<5 mV RMS), 10 to 490 Hz pass band and 1500 gain. The software employed to acquire and process the signals was the digital polygraph *BioMed* (CARVALHO et al., 1998).
Statistical analysis was performed using SPSS 16.0 software. To compare intra-group initial and final means of each variable, the paired Student t-test was used.
One-way ANOVA was employed to compare percent mean gain for LPE and peak force between groups. *Post hoc* Tukey test was used to spot the differences. A 5 % ($p<0.05$) level of significance was used.

RESULTS and DISCUSSION

Vastus lateralis EMG and quadriceps force increased significantly in all groups comparing the initial reference parameters with post training parameters ($p< 0.01$ for A and B groups and $p< 0.05$ for C group). (Table 1).
In the comparison of mean percent gain between groups, only the B group had a significant difference compared to the control group (Table 2).
EMG during CIVMs has been used to evaluate neural adaptation before and after force training (SALE, 1998). These records show that trained muscles recruit more motor units and have a higher firing rate than non-trained muscles. We did not find in the specialized literature other publications comparing EMG and force signal efficacy as biofeedback driving signals. However it has been suggested that biofeedback training using isometric and isokinetic contractions increase both, force level and EMG (LUCCA & RECHIUTTI, 1983).
One hypothesis for the results presented here is that force signal increases steadily with increase effort while EMG remains constant when sub-maximal levels are reached.

CONCLUSIONS

In the experimental conditions presented here the force signal was more efficient than the EMG as a biofeedback tool for isometric training.

REFERENCES

1. Basmajian DV, DeLuca CJ (1985). *Muscle Alive*. Willians & Wilkins.
2. Campenella B, et al. (2000). *Isok Exerc Sci*. 8, 1-6.
3. Carvalho, L.C. et al. (1998). Anais do 1er Congreso Latinoamericano de Ingeniería Biomédica (CD-ROM), 207-210.
4. Lucca JA, Recchiuti SJ (1983). *Phys Ther*. 63, 200-203.
5. Sale DG (1998). *Med Sci Sports Berc*. 20, 135-145.

Tabela 1: Variação intragrupo dos valores de EMG e Força (* $p < 0.05$ ** $p < 0.01$).

	EMG (mV)		Força (kgf)	
	Aval. Inicial	Aval. Final	Aval. Inicial	Aval. Final
Grupo A	0.117 ± 0.031	0.139 ± 0.032**	55.38 ± 11.75	67.05 ± 18.95**
Grupo B	0.098 ± 0.025	0.136 ± 0.037**	54.52 ± 12.03	72.65 ± 19.45**
Grupo C	0.108 ± 0.043	0.123 ± 0.059*	53.77 ± 15.89	60.42 ± 21.82*

Tabela 2: Comparação da variação percentual (var %) do EMG e Força entre os grupos.

Grupo (var %)	Grupo (var %)	EMG - Valor de p	Força - Valor de p
Grupo A (20%)	Grupo B (42%)	0.053	0.248
Grupo A (20%)	Grupo C (12%)	0.647	0.542
Grupo B (42%)	Grupo A (20%)	0.053	0.248
Grupo B (42%)	Grupo C (12%)	0.006**	0.028*

125 KINESITHERAPYIMPROVESSECONDARYANORGASMICOFWOMEN:FUNCTIONALANDELECTROMYOGRAPHY VALUATION.

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INTRODUCTION

Anorgasm is the lack of sensation of orgasm during sexual intercourse. Considered secondary when the trouble starts sex at a certain time without previous occurrence.
The causes are mostly psychological, but physical problems may also cause it, such as the involvement of muscles that form the pelvic floor, especially the pubococcygeus muscle, accounted for the interaction of neuromuscular orgasm (Kegel, 1952).
Given this study aims to evaluate the effects of exercises to strengthen pelvic floor muscles in the function and orgasmic capacity in women with secondary anorgasmia.

METHODS

Forty-five female volunteers participated in the study realized in the city of Poços de Caldas/ Brazil. All patients signed a Consent Form, and the study was approved by the Ethics Committee.
Of initial population, twenty patients were included in a randomized, blind, controlled study and were divided into two groups. Group 1 were composed of 10 women (26.3 ± 6.1 years), which were performed a kinesitherapy protocol (12 individual sessions of 30 minutes, twice a week). Group 2 included other 10 women (27.0 ± 6.5 years), which were assessed concomitantly, but only were treated later, after the end of the comparisons.
All were fully continent, showed impairment in the pelvic floor and sexual dysfunction. All evaluations were performed by second “blind” physiotherapist, and included:
(a) Functional assessment of pelvic floor muscles (AFA) by palpation and grading of muscle contractility second by Ortiz standardized scale from 0 to 5 (Contreras, Coya e Ibañez, 1994);
(b) Electromyography of pelvic floor (electromyograph EMG 400C - EMG® System, Brazil), through transvaginal probe (Physio-Med Services®), introduced by hand lubricant allergy KY (Johnson’s & Johnson’s®). Were asked three maximal contractions, voluntary and subsequent pelvic floor, separated by a rest period of twice the time of its maximum contraction. Each contraction was recorded for 5 seconds in micro-volts (μV), and subsequent analysis of Root-mean-square (RMS). Was used as the parameter, the arithmetic mean of the RMS of the three contractions.
All patients answered the questionnaire Female Sexual Function Index (FSFI) (Thiel et al, 2008) and the coefficient of orgasmic capacity (CCO) (Penteado, 2002) was calculated for all patients before and after the treatment.
Statistical analysis was used to the *t* test of Student and Pearson’s correlation, both with a significance level of 5%.

RESULTS and DISCUSSION

Women who had carried out PFMT presented significant improvement of the force of pelvic contraction (mean of AFA score varied in G1 of 3.2 ± 0.6 for 4.5 ± 0.4, p= 0.00001 and G2 of 3.5 ± 0.5 for 4.9 ± 0.1, p= 0.000008) and in the EMG evaluation (G1 as of 37.8 ± 10 μv for 58.2 ± 8 μv, p = 0.01 and G2 for 41.6 ± 9.3 μv of 61.5 ± 4.3 μv, p= 0.000004). FSFI improved score (in G1 of 23.2 ± 2.3 for 27.9 ± 0.8, p =0,0000009 and G2 of 22.4 ± 3.5 for 28.7 ± 1.1, p=0.00001), in particular the domain orgasm, where in G1 of 2.0 ± 0.7 evolved for 4.8 ± 0.6, p=0.00000003 and G2 of 2.1 ± 0.5 for 4.5 ± 0.5, p=0.0000009 and CCO in G1 was 0.3 ± 0.2 for 0.8 ± 0.3, p = 0.000003 and G2 of 0.2 ± 0.09 for 1.1 ± 0.3, p=0.00005.
Women with orgasmic ability have adequate electrical potential, analyzed by EMG, around 120 μV, while the anorgasmic has potential of about 40 μV (Vargas, 1995). The current study did not corroborate these data, because the analysis of the G1 got an average of 37.8 ± 10 μV and G2, 41.6 ± 9.3 μV, before therapy, which corresponded to the values dysfunctional orgasm and low orgasmic ability in both groups. After therapy, met electromyography values of 58.2 ± 8 μV in G1 and 61.5 ± 4.3 μV in G2 which is positively correlated with the increase in orgasmic function and capacity of these groups.
In assessing the evolution of the force (AFA - degrees) of the groups showed significant gains by pre therapy, 3.2 ± 0.2 evolving to 4.5 ± 0.5 in G1 and 3.5 ± 0 , 5 to 4.9 ± 0.1 in G2, after the training that correlated with improved function and orgasmic capacity. These results support the electromyographic findings and strengthen the evidence that the increased strength of contraction of the pelvic floor correlates positively with improvement in function and orgasmic capacity.

CONCLUSIONS

The kinesitherapy was effective in the treatment of secondary anorgasmic in women. The results of this study demonstrate a significant increase in contractility of the pelvic floor, concomitantly with the improvement in values of the function and orgasmic capacity induced by the therapy to strengthen the pelvic floor muscles.

REFERENCES

1. Kegel AH. Sexual functions of the Pubococcygeous muscle. W J of Surgery Obstetric and Gynecologic, 1952; 60:521.
2. Contreras O, Coya NF, Ibañez G. Evaluación funcional del piso pelviano feminino. Boletim de La Sociedad Latinoamericana de Uroginecologia y Cirurgia vaginal, 1994; 1: 5-9.]
3. Thiel RRC, Dambros M, Palma PCR, Thiel M, Riccetto C, Ramos MF. Tradução para português, adaptação cultural e validação do Female Sexual Function Index. Rev Bras Ginecol Obstet. 2008; 30(10):504-10.
4. Penteado SRL. Avaliação da sexualidade em mulheres na menopausa (Dissertação) São Paulo: Faculdade de Medicina University from São Paulo (USP), 2002.
5. Vargas MC. Pressão vaginal *versus* Eletromiografia Vaginal versus Orgasmo. In: Congresso Internacional de Urologia, Pequim/China. Anais do I Congresso Internacional de Urologia; 1995. p. 87.

126 EVALUATION OF THE KNEE JOINT PROPRIOCEPTION IN HEALTHY AND PATELLOFEMORAL PAIN SYNDROME SUBJECTS

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INTRODUCTION

The patellofemoral pain syndrome (PFPS), a disorder related to anterior knee pain and functional deficit that result in decrease of daily activities (Belchior et al, 2006), most frequently occurs in athletes, women, young and sedentary people (Bevilaqua-Grossi et al, 2008).
It has been suggested that the pain and the increase of patellar stress, originated by the patellar malalignment in such people, can result in smaller knee joint proprioceptive sensibility, i.e., the joint perception of position and movement. (Baker et al, 2002)
The aim of this study was to compare, through joint positioning sense, the knee joint proprioceptive sensibility in healthy and asymptomatic PFPS subjects.

METHODS

There were selected 17 sedentary volunteers: 8 women (24.5 ± 4 years) in the healthy group and 9 asymptomatic women (25.11 ± 5.13 years) in the PFPS group. Each volunteer signed a consent form to participate in the study, witch was approved by the Ethics Committee for Human Experimentation of the Camilo Castelo Branco University (protocol number: 2824-3044/09).
The target angle selected for the proprioceptive sensibility evaluation was 60° of knee flexion and it was measured by a universal goniometer with the device's centre rotation positioned directly over the joint's rotation centre. The proximal arm was fixed over the thigh's lateral line and aligned with the lateral midline of the femur, using the greater throcanter as reference. The distal arm was fixed on the lateral aspect of the lower leg and aligned with the lateral midline of the fibula, using the lateral malleolus as reference. Over the anatomical landmarks above cited, skill markers were fixed. Prior to the experiment, the volunteers were submitted to a short training in order to become used to testing procedures. They remained in sitting position in high chair with backrest and blindfolded.
The knee joint was, firstly, positioned at 90º of knee flexion and the passive knee extension at the target angle of 60º was performed and maintained for 10 seconds. Following the return to the initial positioning at 90º, maintained for 10 seconds, each volunteer was instructed to perform the active knee extension at the target angle perceived. Three repositioning exercises were executed following 10 seconds intervals and the images were captured by a digital camera Olympus® u710 (7.1 mega pixels) placed on a 90 cm highness platform at a distance of 1.5m from the volunteer.
Each image was uploaded to the evaluation postural software (SAPO), with the centre and vertices positioned on the skill marks for the analysis of the performed angle (figure 1). The mean of the inaccuracy information, i.e., the absolute difference between the perceived and real angle of knee flexion, was calculated for each repetition. The date were compared by the Student t test ($p \leq 0.05$).

RESULTS and DISCUSSION

The results, as presented in the figure 2, showed the there was no significant differences (p=0.16) between the healthy (X=4.6±3.5) and PFPS (X=6.4±3.9) groups.
Some studies also did not verified significantly differences during the proprioceptive sensibility evaluation between healthy and PFPS subjects, using electric goniometer (Kramer et al, 1997) and isokinetic dinamometer (Lobato et al, 2005).However, Baker et al (2002), during the video graphic analysis, found proprioceptive deficit of the knee in symptomatic PFPS subjects, when compared with healthy subjects at 60o of knee flexion.
The authors did not find, in the investigated literature, studies that evaluated the sensibility proprioception of the knee joint with images caption and software analysis.
Nevertheless, further investigation, with a greater number of subjects, would be necessary in order to compare the proprioceptive sensibility of the knee joint in healthy, asymptomatic and symptomatic PFPS subjects.

CONCLUSIONS

Under the experimental conditions utilized, the study data showed that there was no significantly difference in the proprioceptive sensibility of the knee joint between the groups, suggesting that, at 60º of knee flexion, it could be possible that there is no proprioceptive deficit in the knee of PFPS subjects.

REFERENCES

1. Belchior ACG, et al. (2006). Revista Brasileira de Medicina do Esporte, 12(1), 6-10.
2. Bevilaqua- Grossi D, et al. (2008). Revista Brasileira de Fisioterapia, 12(1), 26-30.
3. Kramer et al (1997). Clinical Journal of Sports Medicine, 7, 113-118.
4. Baker V, et al. (2002). Journal of Orthopaedics. Research, 20(2),208-214.
5. Lobato DFM, et al. (2005). Revista Brasileira de Fisioterapia, (9)1, 57-62.

Figure 1: Software SAPO analysis of the passive joint positioning at 60o of knee flexion.

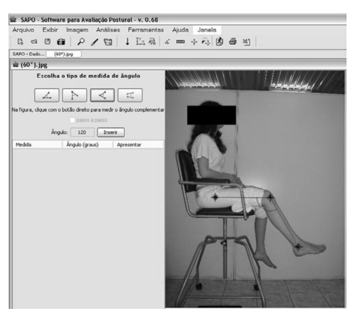
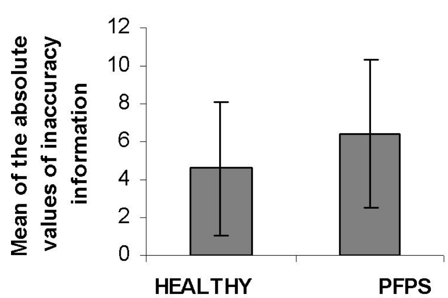


Figure 2: Mean and standard deviation of the inaccuracy information obtained by healthy (n=8) and PFPS (n=9) groups.



127 ELECTROMYOGRAPHYC STUDY OF MASTICATORY MUSCLES BEFORE AND AFTER OCCLUSAL ADJUSTMENT: DESCRIPTION OF CASE REPORT

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INTRODUCTION

The complex of sensory and motor nuclei of the trigeminal nerve does not relate only to the territory of innervation of its branches. These centers are also related to other cranial and cervical nerves, and occlusal imbalance may influence the biomechanics of muscles in other territories1.

Recent studies have evaluated the existence of relationship between occlusion and cervical muscles using surface electromyography.

The aim of this investigation was to evaluate the effect of occlusal adjustment on the electromyographic activity of chewing muscles and cervical muscles.

METHODS

A volunteer participated of this research, woman of 53 years, with complaints of neck discomfort and a clinical indication of an imbalance of chewing muscles activity.

Palpation of masseter and temporal muscles bilaterally at the first tooth contact during the elevation of the jaw, and marks made with articular paper on the occlusal surface of teeth in maximum intercuspal position, were performed as auxiliary functional occlusal diagnosis. The sequence of these muscular contraction and the visual assessment of occlusion suggested the procedure of occlusal adjustment (OA) by addition of restorative material in the lower molars on the left, in order to obtain simultaneous bilateral contacts.

For the electromyography test was used equipment BIOEMG1000 (Lynx® Sao Paulo, Brazil) with 16-bit resolution and input range of ± 2 volt, and a microcomputer. Amplification of 1000 times with bandpass filter of 20-1000 Hz, and sampling frequency of 2000 Hz.Utilizou electrodes simple differential (Lynx®). The electrodes were placed in the belly of masseter (M), anterior temporal (T), sternocleidomastoid (ECM) and upper trapezius (TRAP) bilateral muscles, and suprahyoids, and the reference electrode in the sternal notch.

The data was collected during rest position and isometric contraction of jaw elevator muscles, before and after the occlusal intervention. The material parafilm M®, was not used, for the purpose of recording the electromyographic activity of muscles were related to teeth contact.

The collection after occlusal intervention was performed three hours after the adaptation of the restorative material.

RESULTS and DISCUSSION

The electromyographic activity of the tested muscles at rest position showed an improvement of 62% on average after the intervention aspect. (Fig 1)

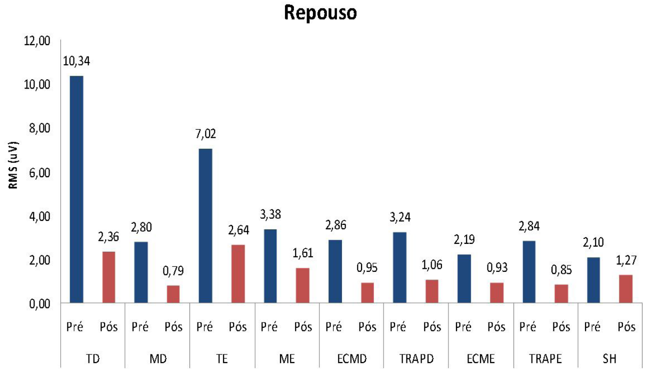

Fig1. Electromyographic activity (mV) before and after occlusal adjustment, of the muscles right sternocleidomastoid (RECM) and left (LECM), right trapezius (RTRAP) and left (LTRAP), right masseter (RM) and left (LM), right anterior temporal (RT) and left (LT) and suprahyoid (SH) during the mandibular rest position.

The adjustments that change the traditional position of the jaw may be the result of the direction of muscular work, when performed differently than normal.[2]

Knowledge of biomechanics collaborates with the identification of occlusal imbalances that drive the placement of the jaw, changing the working muscle related directly or indirectly with her.[3,5]

The use of visual examnation with articular paper and muscle palpation are complementary to the functional occlusal diagnosis and can give orientation to the oral rehabilitation.[4]

The sternocleidomastoid, especially on the left side, had reduced electromyographic activity in isometry, about 90% after the occlusal intervention, as related to muscle palpation and occlusal contact´s direction, that have guided the maximum intercuspal position. The suprahyoids reduced their activity in 75% during the elevation of the jaw, after occlusal intervention, suggesting that in conditions of occlusal imbalance, are more requested to act as antagonists of the mandible´s elevation.

Electromyographic activity of neck muscles after occlusal intervention decreased on average 80%, suggesting a lower participation of cervical muscle in the isometry activity associated with lower occlusal imbalance.[2, 5] (Fig 2)

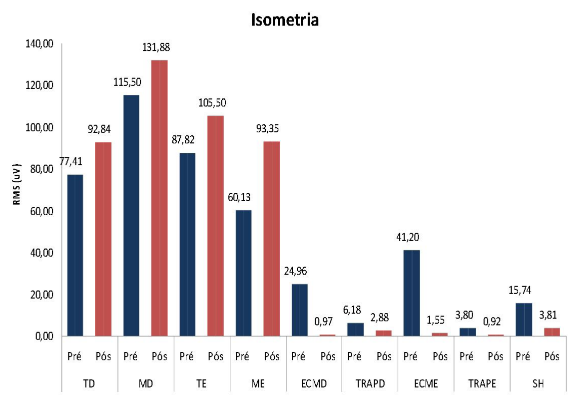

Fig 2. Electromyographic activity (RMS mV) before and after occlusal adjustment, of the muscles right sternocleidomastoid (RECM) and left (LECM), right trapezius (RTRAP) and left (LTRAP), right masseter (RM) and left (LM), right anterior temporal (RT) and left (LT) and suprahyoid (SH) during isometric contraction of jaw elevator muscles.

CONCLUSIONS

A change in the electromyographic activity of muscles studied was observed after the occlusal adjustment, what confirm the relationship between cervical muscles, chewing muscles and occlusal contacts. There is a need of more studies about the biomechanical relationship between these studied factors.

REFERENCES

1. Okenson J. (2000) Edit. Artes Médicas Ltda. 4ª Ed.
2. Herring S. (2007). Arch Oral Biol, 52(4): 296–299
3. Funakoshi M. (1974). J Dent Res. 53:598.
4. Santos JLB. (1996). Atual. Clinica Od. Edit. Artes Médicas Ltda. Cap 19.
5. Koolstra JH. (2002). Crit Rev Oral Biol Med. 13(4):366-76.

128 EFFECT OF CRYOTHERAPY ON SPASTICITY OF A PLEGIC UPPER LIMB: AN ELECTROMYOGRAPHIC ANALYSIS

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INTRODUCTION

Spasticity is a motor disorder related to increased excitability of the stretch reflex and characterized by an increased muscle tone (LIANZA, 2000). Cryotherapy is a type of treatment of spasticity due to the elevation of neuromuscular spindles threshold and the decrease of spasm (SMITH et al., 2000). According to Pereira et al. (2002), electromyography (EMG) can be used to assess spasticity. Merletti et al. (1984) refers that median frequency (MF) is able to quantify the changes in the conduction velocity of the muscle fiber.

Therefore, the aim of this study was to evaluate the effect of cryotherapy on MF of men with spasticity.

METHODS

Five male volunteers (61,2 ± 8 years) who had a stroke that resulted in spasticity of upper limb were evaluated. The electrical activity of flexor carpi ulnaris (FCU) Muscle of the affected limb was obtained by a signal acquisition module, model EMG1000 (Lynx®), with impedance 109 Ohms, resolution of 16 bits entry band of ± 5V, and interface with a notebook. Data acquisition and storage was carried out with Aqdados software (Lynx®), version 7.02 for Windows®. The subjects remained seated on a chair with the evaluated upper limb relaxed and laid down a table while the electrical activity of FCU muscle in resting condition was recorded. Before the electrode was put into place, the skin was prepared, trichotomized and cleaned with 70% alcohol. To capture the action potentials, 1 simple differential, active surface bipolar electrode (Lynx®) (20 times gain, IRMC > 100 dB, signal noise rate < 3 μV RMS and inter-electrode distance of 10mm) was used and placed over the belly of FCU muscle according to SENIAM specifications. The channel was adjusted for a total gain of 1000 times, with band-pass filter of 20-1000 Hz (Butterworth type) and sampling frequency of 2000 Hz. The reference electrode was attached over the ulna styloid process of the same limb.

After the initial EMG recording, cryotherapy treatment was applied over the FCU muscle (ice pack – 1.5 kg) for 20 minutes5. After this procedure EMG was recorded again. After data collection, the signals were processed in routines specified for the analysis of the median frequency (MF) in Hz in the software Matlab® 6.5.1.

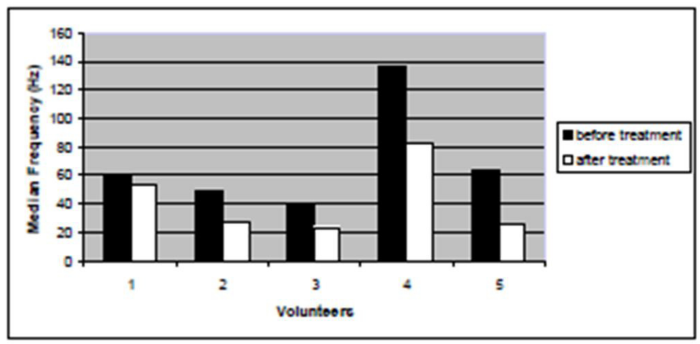
RESULTS and DISCUSSION

Table 1 shows that all five subjects presented lower MF values after 20 minutes of cryotherapy treatment. This response can be occurred due to the fact that cold slows nerve conduction velocity, decreases the neuromuscular junction transmission, inhibits gama motoneuron activity and reduces spasticity (GUIRRO et al., 1999).

Table 1: Median frequency values (Hz) before and after cryotherapy treatment.

	Before cryotherapy	After cryotherapy
1	59.24	52.73
2	49.15	27.99
3	40.04	23.76
4	136.39	82.36
5	63.47	25.72

Figure 1: Median frequency values (Hz) before and aftercryotherapy treatment



CONCLUSIONS

According to our results, cryotherapy was effective in decreasing median frequency values of a spastic muscle of five subjects.

REFERENCES

1. Lianza S. Rio de Janeiro, p.16, 2000.
2. Smith, et al. Muscle & Nerve, 153-163, 2000.
3. Pereira, et al. Rev Bras Fisiot, 6(3): 127-134, 2002.
4. Merletti, et al. Eur J Appl Physiol 52: 258-265, 1984.
5. Guirro, et al. Rev Bras Fisiot, 6(2): 14-17, 1999.

129 ELECTROMYOGRAPHIC STUDY OF SWALLOWING AND BUCCINATOR MUSCLE ACTIVITY IN ANGLE'S CLASS I AND III SUBJECTS.

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INTRODUCTION

Electromyographic studies about buccinator muscles are mostly performed with needle electrodes, because of the difficulty in signal registration, due to the location and the presence of adipose tissue beneath this muscle. However this procedure cause pain and discomfort to the patient, and it may produce unsatisfactory results. The main function of the buccinator muscle is suction and it also helps in chewing and swallowing. The understanding of kinesiology during stomatognathic function has aroused researchers interest about correlation of this muscle to mastication and milohyoid muscles. (Harn, Shackelford, 1982; Figún, 2003).
In prognathic subjects, the buccinator muscle may present a different behaviour due to possible jaw instabilities.
The aim of this study was to investigate the electromyographic activity of the buccinator muscle in Angle´s Class I and III subjects. To reduce difficulties in EMG registration, a function muscular test recommended by De Luca (1997) was applied, surface electrodes forming a differential circuit were used, and EMG data were normalized.

METHODS

There were studied 32 male and female subjects with 18 - 25 years old divided into Angle's Class I (n=16) and Class III (n=16) during deglutition. The subjects were examined in sitting position, with eyes opened and the Frankfurt plane parallel to the floor. The surface electrodes used were from Meditrace® Kendall-LTP, modelo Chicopee MA01 connected to a preamplifier Lynx Tecnologia Eletrônica Ltda, modelo PA 1010-VA. The electromyograph was Mysosystem from Datahominis Tec. Co., with 12 bytes resolution, CMRR of 112 db, sampling frequency of 2000Hz.
The signal registration was done in right buccinator muscle during water swallowing. The EMG signal was filtered with a passband filter of 20-500 Hz and normalized by the peak. The investigated variables were Root Mean Square and Active Period (ON).
In statistical data analysis, Wilcoxon Rank-Sum Test was calculated by SAS system. The choice of the non-parametric test was based on the sample size that was composed for 13 volunteers in each group which can make parametric tests more susceptible to type I error.

RESULTS and DISCUSSION

After EMG data normalization, qualitatively there was observed that subjects presented activity period clearly demarcated, but with different muscular behaviour between the classes.
Class I subjects presented balanced increase and decrease of amplitude (Figure 1) and, Class III subjects irregular activity periods (Figure 2).
The results in Table 1 demonstrates that buccinator muscle acts during swallowing with RMS values significantly higher in Class III subjects (RMS = 23.064) than in Class I subjects (RMS = 8.126).

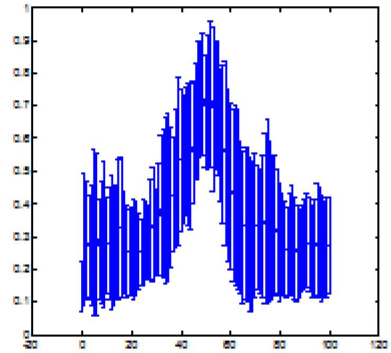

Figure 1. EMG recordings overlay of all Class I subjects after data normalization.

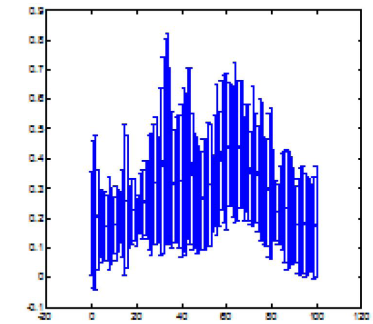

Figure 2. EMG recordings overlay of all Class III subjects after data normalization.

CONCLUSIONS

Buccinator muscle presented a different pattern of electrical activity between Angle's Class I and Class III subjects.

REFERENCES

1. Harn SD, Shackelford LS. Anat Record. 1982; 202: 537-548.
2. Figún ME, Garino RR. Anatomy Odontologic, 71p, 3th edn. Porto Alegre: Panamericana. 2003.
3. Ricketts RM. Am J Orthod. 1964; 55: 244-264.

Table 1. Mean, confidence limits, standard deviation and Wilcoxon Rank Sum Test of the RMS value in subjects Class I and III (n = 26).

Classe	N	Mean	Confidence Limits (95%) Upper 95%	Lower	Std Dev
I	13	8.126	10.727	5.525	4.304
III	13	23.064	29.149	16.979	10.070
Wilcoxon Test		Chi-Square	16.2113		
		DF	1		
		Pr > Chi-Square	<.0001		

130 ELECTROMYOGRAPHIC STUDY OF THE THIGH MUSCLES AFTER A RUSSIAN CURRENT SESSION

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INTRODUCTION

Strengthening programs are important procedures widely used in physical therapy practice. One of the methods that the therapist has to increase the tropism of a muscle is the electrical (EE) for Russian current, in which electrical stimulation can recruit a larger number of motor units, which result in a higher recruitment of muscle fibers and a greater synchrony between them (Brustolimn et al., 2007).
Canavan (2001) reports that by associating with an isometric contraction to stimulation, there is the possibility of promoting a greater recruitment of the fibers, thus giving more strength.
However, there is still controversy when someone considered the muscle strengthening using EE), specially on the effectiveness of EE in a single session with or without muscle contraction.
This study aimed to verify the EMG activity of the thigh muscles related of the movement of knee extension before and after EE using current average frequency with or without voluntary isometric contraction.

METHODS

The study included twelve students (18 to 30 years), sedentary, with no history of neuromuscular or musculoskeletal injuries in the lower limb. They were randomly divided into two groups, with three men and three women each.
Both groups were submitted to ES of the quadriceps. Was used for EE a current average frequency of phasic square pulse with a frequency of 2500 Hz modulated at 50 Hz, depolarized symmetric. The time parameters of stimulation were: rise time and fall time of the pulse train of 6.5 seconds. Length of stay current: 9 seconds, rest time: 27 seconds. The intensity was adjusted according to the sensitivity of the patient, a total of 30 minutes of therapy. For subjects in group A was oriented to the left quadriceps was relaxed and not to voluntary contraction during the session. In group B, subjects were instructed to perform an isometric contraction of the quadriceps during the entire period of transition from current (ON cycle).
In both groups was recorded and quantified the EMG activity before and after the experiment. To record EMG signals were used differential active electrodes, attached to the skin, vastus medialis (VM), rectus femoris (RF), vastus lateralis (VL), biceps femoris (BF) and semitendinosus (ST), according with the protocol of the European community SENIAM electromyography (Surface Electromyography for the Non-invasive Assessment of Muscles), with the help of adhesive tape, after shaving and skin cleaning with alcohol. A ground electrode, or reference, was fixed with tape on the contra lateral limb assessed.
During data collection, the room temperature was maintained at 24° C. The volunteers remained lying on a stretcher with the knee flexed at 30 (supported on a pillow), and hands at their sides. We asked the volunteer to do voluntary isometric contraction (MVIC) of the quadriceps muscles for 6 seconds with resistance in the anterior leg limb assessed, the procedure was repeated 3 times at intervals of 30 seconds between each attempt. The electromyographic examination was performed before and five minutes after the EE. The signals were evaluated throughout the collection period for the Root Mean Square (RMS) and median frequency (FM).

RESULTS and DISCUSSION

Statistical analysis (ANOVA) revealed a similarity between the EMG activity of the VM, RF, VL, BF and ST, before and after the implementation of EE (Figures 1 and 2). There was no effect on EMG activity nor to with isometric contraction (RMS $p = 0.52$, $p = 0.13$ FM), or without isometric contraction (RMS $p = 0.21$; FM 0.91), but there was no difference between muscles ($p = 0.0001$).
These results may be related to a tendency to fatigue (Molina et al, 1997) and the fact that there was done just in a single session of EE (Currier & Mann, 1983).

CONCLUSIONS

A single session of electrical stimulation of medium frequency with or without maximal voluntary contraction isometric muscle in the thigh muscles do not cause changes in the electromyographic signal in accordance with the methodology used.

REFERENCES

1. Brustolini M, Briel AF, Guerin MR. Effect of the current Russian on the tropism of the quadriceps. Journal of Biology and Health Unisep,2007.
2. Canavan KP. Realilitação in sports medicine, São Paulo: Manole, 2001.
3. Currier SD, Mann R. Muscular strength development by electrical stimulation in healthy individuals. Phys. There., 63:915-21, 1983.
4. Molina RM, Galan AT, Garcia MSM. Hamac avec eletromyographic changes during a muscular strengthening training based don electrical stimulation. Electromyogr. Clin. Neurophysiol., V.37, p. 287-295, 1997.

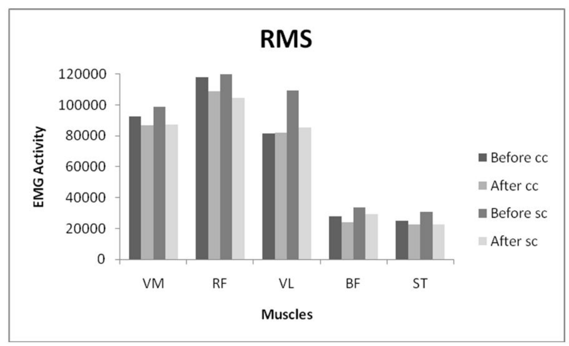

Figure 1. RMS value of the studied muscles (VM, RF, VL, BF and ST) before and after the EE with (cc) and without contraction (sc).

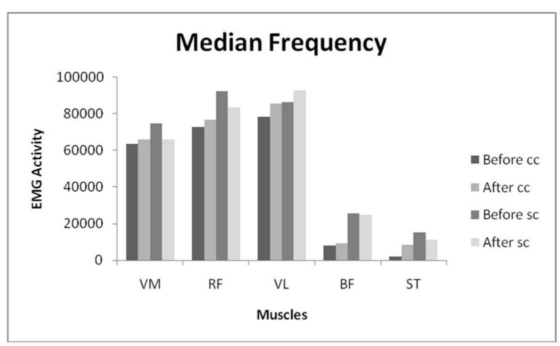

Figure 2. Median frequency of the studied muscles (VM, RF, VL, BF and ST) before and after the EE with (cc) and without contraction (sc).

131 ELECTROMYOGRAPHY ANALYSIS OF THE APPLICATION OF TWO ELECTROPHYSICAL RESOURCES IN THE CURRENT ALTERATIONS OF THE SYNDROME OF THE CORPORAL DISCORD

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INTRODUCTION

The surface electromyography is used to know the electric activity produced by the muscle, however it is influenced for of different anatomical properties, among them the thickness of the subcutaneous layer that it alters the width of the electromyography sign, could be useful to evaluate the effects of the application of the electrophysical resources used in dermato-functional physical therapy. The objective of this study was to verify the influence of the use of therapeutic ultrasound (UST) and of the electrolipophoresis on the electromyography sign in patients submitted to the treatment of the syndrome of the corporal discord (SDC).

METHODS

The present study refers to a prospective clinical rehearsal randomized, approved for CEP of the Academical Center of the Triangle under registration no. 635815. They announced in the study 22 volunteers, that sign the term of free and illustrious consent. The inclusion criteria were: feminine gender, age group between 18 and 35 years, sedentary, with presence of FEG degrees 1 and/or 2 in buttock region (appraised and classified by the same appraiser), IMC among 18 and 25 Kg/m2, and using contraceptive. The criteria for exclusion were: smoking, diabetes, pregnancy, use of another type of dermato-functional treatment, use of medicines for weigh loss or alimentary diet, FEG degree 3 in buttock region. The volunteers were submitted to the initial evaluation composed by the evaluation anthropometric, epithelial bioimpedance and electromyography, where the measures were accomplished of weight, height, IMC, perimeter of the waist and of the hip and RCQ. The evaluation for bioimpedance was accomplished by a portable apparel, for the obtaining of the values of total fat, thin mass, water, rates metabolic basal, IMC and impedance. For the registration of EMG two active surface electrodes were used differentiate simple positioned in the muscle maximum gluteus bilaterally, in agreement with the protocol of SENIAN (1999), and a reference electrode stuck in the left lateral malleolus. The sign was amplified in the electrode differential assets with earnings of 20 times. Before beginning the collection, the sign was registered EMG to the muscular rest, in order to determine the presence of undesirable signs. The volunteers were positioned in ventral decubitus, being accomplished the removal of the hair and asepsis of the areas of placement of the electrodes that were fastened with adhesive plasters. It was explained and demonstrated to the volunteer the movement the accomplished being and requested to the accomplishment of the voluntary maximal voluntary isometric contraction (MVIC) of hip extension with knee flexing against manual static resistance for 5 seconds, aided by constant verbal commands, initiate for the right inferior member and after rest of 2 minutes, accomplished in the left member, until completing three collections in each member. The EMG was connected in a computer for processing of the data through the software Myosystem-Br1 (version 3.05). Previously to the beginning of the evaluation, the channels were gaged properly. After the initial evaluation it completes, the volunteers were allocated 11 for each one of the proposed groups. After the due calibration of the apparels the 10 sessions of the treatments began being 2 a week. UST was applied in the continuous way, in the frequency of 3 MHz, and intensity of 1,0 Wcm2, with time of 2 minutes for each area of 10 cm2, middle counted gel without any I begin assets, bilaterally becoming separated the buttock region in four quadrants. The electrolipophoresis was used four channels and the certain program of application epicutaneus, totaling 40 minutes. The volunteers were positioned in ventral decubitus and, the plates were fastened to the pairs inserting the positive and negative poles in bilateral buttock. The intensity respected the patient's sensibility. After the 10 sessions all were revalued the analyzed measures. The medium values of the analyzed variables were tested as for the normality for the test Kolmogorov-Smirnov, and then applied the test of T Student. The significance level $p < 0,05$.

RESULTS and DISCUSSION

Before the found results if it didn't observe statistically significant difference for the anthropometric measures or in bioimpedance in none of the analyzed groups. With that EMG so much for FM as for RMS, also statistically significant difference was not observed, as display the table 1. The results suggest that the resources electrophysicals was not capable of best SDC with 10 treatment sessions. However, those results should be seen with caution, and certainly futures better studies will explain about the effectiveness of the electrophysical resources and the possibility of EMG to be used as tool of evaluation of SDC.

CONCLUSIONS

Starting from the results obtained in this study, it is ended that the application as much of UST as of ELF, they didn't present satisfactory result for improvement of SDC, not altering the thickness of the appraised subcutaneous layer for EMG.

REFERENCES

1. Mesin L, et al. (2008). Medical Engineering e Physics. 31, 374-83.
2. Hermens HJ, et al. (1999). In: Roessingh research and development. Enschede.
3. Nordander C, et al. (2003). Eur J Appl Physiol. 89,514–9.
4. Marchetti PH, Duarte M. (2006). Instrumentação em eletromiografia.

Table 1 - Average values, standard deviation and significance level (p), for the measures anthropometric, epithelial bioimpedance and electromyography before and after each treatment.

Variable	UST		p	Electrolipophoresis		p
Average (DP)	Before	After		Before	After	
Weigh (cm)	55(±4)	56(±6)	0.90	56(±7)	56(±7)	0.97
IMC (Kg/m2)	21(±2)	21(±2)	0.90	21(±2)	21(±2)	0.95
Waist (cm)	70(±4)	70(±5)	0.87	70(±4)	69(±4)	0.76
Hip (cm)	96(±5)	95(±5)	0.70	96(±5)	96(±5)	0.78
RCQ (cm)	0.72(±0.03)	0.72(±0.04)	0.89	0.66(±0.20)	0.72(±0.02)	0.35
Fat (%)	25(±4)	24(±3)	0.72	25(±3)	26(±3)	0.90
Thin mass (%)	42(±4)	43(±4)	0.71	42(±6)	42(±5)	0.91
Water (%)	53(±3)	53(±3)	0.78	53(±3)	53(±3)	0.78
Impedance (z)	682(±69)	676(±59)	0.83	688(±77)	710(±38)	0.80
GM_L (FM-Hz)	36(±9)	38(±5)	0.53	44(±5)	44(±7)	0.80
GM_R (FM-Hz)	37(±7)	40(±6)	0.20	44(±8)	42(±10)	0.69
GM_L(RMSµV)	30(±16)	30(±11)	0.94	32(±19)	40(±22)	0.37
GM_R(RMSµV)	28(±11)	27(±13)	0.83	32(±18)	35(±11)	0.70

132 MASTICATORY PROCESS ANALYSIS OF ASTHMATIC CHILDREN: CLINICAL AND ELECTROMYOGRAPHIC STUDY

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INTRODUCTION

Asthma is considered an important public health problem, according to data from the *International Study of Asthma and Allergies in Childhood* – ISAAC[1].
Mouth breathing is a respiration often used by individuals with asthma[2], is a consequence of various disorders[3] and reflected in decreased oral tone muscle, like the mandible elevator muscles (masseter and temporal)[4]. Anatomo-functional changes, not associated with asthma, may influence the masticatory process[4].
So, there is an interest for studies that relate this pathology to functions alterations of the Stomatognathic System and this study had as objective to verify the characteristics of mastication in asthmatic children treated at pediatric allergology ambulatory of the Hospital of Clínicas of Pernambuco.

METHODS

This work was approved by the ethics committee in research of Universidade Federal of Pernambuco with nº 0247.0.172.000-06 and was developed in the pediatric allergology ambulatory of the Hospital of Clínicas which is a descriptive and cross-sectional study.
Sixty children between 06 and 10 years of both sexes were divided into two groups: group I (asthmatic), consisting of thirty children of Allergology sector of HC-UFPE diagnosed with asthma. The group II (non-asthmatic), consists of thirty healthy children of pediatrics sector of HC-UFPE in routine follow-up of children.
The objective was to identify the prevalence of mastication side, number of cycles, total time of mastication and electrical activity of masseter and temporal o both hemifaces in asthmatic and non-asthmatic children.
The protocol for mastication evaluation[6] was adapted by one of the researchers (Cunha, D.A). It was requested that the child sit in a chair and eat a French bread 25g, normaly. During the mastication process was record with a Sony Digital Hand Cam, set on a tripod with a distance of five feet and the time of mastication was recorded with a Casio® stopwatch, too.
In electromyography, the masseter and temporal muscles were measured in microvolts (microvolts) across the device MIOTOOL 200/400 - 4 channels (Miotec®) Miograph 2.0 software, using the gain of 1000, 4 sensors SDS500, Power Reference (land) , Draft and disposable electrodes surface MEDITRACE®.
The masseter and temporalis muscles were evaluated in microvolts (µV) by MIOTOOL 200/400 equipment of Miotec® (4 channels), with Miograph 2.0Software, used to 1000gain, 4 sensors SDS500, Cable Reference (earth), calibrator and MEDITRACE® draft and disposable electrodes of surface.
Before placing the electrodes, the skin of each child was cleaned with alcohol 70% to remove the excess of oily skin that promotes the impedance of the uptake signal. After this, the electrodes were placed bilaterally and arranged longitudinally to muscle fibers. To avoid interference in the capture of signal, the reference electrode was placed at the ulnar styloid process of the right arm.
Were recorded the rest position in centric occlusion (5 seconds) and mastication of one French bread. To the evaluation of all objectives, there was the selection of the time of 2nd masticatory process (count from the second incision of French bread to the end of last deglutition) of this same portion of food.

RESULTS and DISCUSSION

The alternate bilateral mastication occurred in 20 of the non-asthmatic (66,7%) children and 16 of asthmatic (53,3%). Unilateral and simultaneous bilateral mastication were reduced in both groups of children.
Thus, the literature said that the alternate bilateral mastication makes distributions of mastication strength, alternating periods of work and muscles and joints rest, leading to synchrony and muscle and functional balance.
Table 1 shows the total number of cycles and total time of mastication a French bread (25g). Table 2 refers to the Pearson's correlation coefficient between time of each piece of bread and number of masticatory cycles.
It was observed that the relation is straightforward. With increasing the number of masticatory cycles, also increases the mastication time of each piece of bread, except between the number of masticatory cycles on the right side with mastication time of each piece of bread.
On the right face at rest, the masseter of asthmatic children had higher values than non-asthmatics (6.61µV of asthmatic masseter and 6.33µV of non-asthmatic masseter). The right anterior temporal at rest of asthmatic children also had higher value of electrical activity (15.80µV) compared to non-asthmatics (11.56µV). In the left facial, masseter and temporal of asthmatic children showed, at rest, the lowest value (6.78 and 12.79µV, respectively) as opposed to 13.93µV and 6.86µV in non-asthmatics.
During the mastication of asthmatic children, the average electrical activity in both muscles was reduced. It shows that the musculature of asthmatics did not have the average electrical activity equivalent to the measured in non-asthmatic group when was solicited to increase the muscle strength.

Table 1: Total number of masticatory cycles and total time of mastication in asthmatic and non-asthmatic children (n = 30)

	N	Average	Standard Deviation	p-value
Number of masticatory cycles				
Non-asthmatic	30	30.00	15.84	
Asthmatic	30	26.90	13.33	0.415
Total time of mastication				
Non-asthmatic	30	262.25	179.38	
Asthmatic	30	256.78	129.92	0.893

Table 2: Pearson's correlation coefficient between mastication time of each piece of bread and number of masticatory cycles (n=30)

Number of masticatory cycles	Mastication time of each piece	
	Non-asthmatic	Asthmatic
Right side	0.63[1]	0.27
Left side	0.45[1]	0.42[1]
Right and left side	0.41[1]	0.41[1]
Total	0.93[1]	0.87[1]

[1] $p<0,05$

CONCLUSIONS

The masticatory process of asthmatic children may have some alterations in the anatomo-functional changes caused by signals of asthma.

REFERENCES

1. Asher MI, et al. (1995). International study of asthma and allergies in childhood (ISAAC): rationale and methods. Eur Respir J. 8, 483-91.
2. Venetikidou A. (1993). Incidence of malocclusion in asthmatic children. J Clin Pediatr Dent. 17, 89-94.
3. Motonaga SM, et al. (2000). Respiração bucal: causas e alterações no sistema estomatognático. Rev Bras Otorrinolaringol. 66, 373-9.
4. Tessitore A. Alterações oromiofuncionais em respiradores orais. In: FERREIRA, L.P.; BEFI-LOPES, D.M.; LIMONGI, S.C.O. (orgs.). Tratado de Fonoaudiologia. São Paulo: Roca, 2004.
5. Simons FER. (1999). Allergic rhinobrochitis: the asthma-allergic rhinitis link. J Allergy Clin Immunol. 104, 534-40.
6. Junqueira P. Avaliação miofuncional. In: MARCHESAN, I. Q. Fundamentos em Fonoaudiologia: aspectos clínicos da motricidade oral. Rio de Janeiro: Guanabara Koogan, 1998.

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133 ELETROMIYOGRAPHIC ANALYSIS OF THE ANTERIOR, MEDIAL AND POSTERIOR PARTS OF THE TEMPORAL MUSCLE DURING MASTICATION

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INTRODUCTION

According to American Academy of Orofacial Pain the prevalence of temporalmandibular disfunction (TMD) in the American population is very high (Siqueira & Teixeira, 2001), and proposes a classification based on its etiology, that is, myogenic, arthrogenic and mixed, with the last being considered the most prevalent. According to Bérzin (2004), an alteration in the kinetics of the three parts of the temporal muscle is one of main etiologies, because the temporal muscle controls the position of the mandibular chondyle in temporomandibular articulation during mastication.
Due to the presence of hair in the region, studies using surface electrodes are rare. Electromyographic studies are more often carried out with needle or wire electrodes, which involve a small area of signal capture, pain, discomfort difficult with the fixation of electrodes and other methodologic problems, which could produce unsatisfactory results (Basmajian & De Luca, 1985).
The aim of this work was to study the kinesiology of the three parts of the temporal muscle during mandibular movements using surface electrodes.

METHODS

The study involved 7 young subjects without any signs of the orofacial pathology, with complete dentition with the temporal region shaven in conformity with social convetion. Measurements were made during mastication of parafilm, with left, right and bilateral chewing, and at rest. The subjects were examined in the seated position, with eyes open and the Frankfurt plane parallel to the floor. The surface electrodes used were from Noraxon USA Inc., model 27-2, connected to an electromyography (Myoystem, Datahommis Tec. Co., 12 bytes resolution, CMRR of db at 60Hz, sampling frequency of 2000Hz passband filter 20-500Hz, and signal value calculated in RMS.
Three measurements were taken for each individual. The means of these measurements were then calculated, which based on the central limit theorem makes the data normally distributed, satisfying a basic condition for application of analysis of variance. As the data were not normalized, inter individual differences were suppressed by adopting a mathematical model that considered each individual as a block, and consequently analysis of variance followed a model adapted for a randomized blok desing experiment, with two factors (side of mastication of the individual and part of the temporal muscle analyzed) and interaction. A significance level of 5% as well as Tukey's test were determinate a priori as appropriate for this study.

RESULTS and DISCUSSION

First, the results of the analysis of variance individualized in each of the movements studied, are presented in Table 1.
The four movements studied showed level ($p<0.05$) of the existence of differences in means of the true RMS values among the different parts of the muscle examined, but there were no observed indictions of a significant effect for the side of the muscle.
Since indications of significant effect were demonstrated, Tukey's test was applied for comparison of the RMS means of the different parts of the muscle.
It was observed initially that at rest, the RMS values are much lower than those observed in the different activities examinated. In the resting condition, a significantly greater activation was observed for a medial part of temporal muscle in relation to the anterior and posterior parts, with a mean RMS of 186 versus 97 and 99 for the anterior and posterior parts, respectively.
In the three types of mastication examined, it is always seen that the posterior part of temporal muscle displays a lower mean RMS, indicating that this part displays less electrical activity compared to the anterior and medial parts.

CONCLUSIONS

The three parts of temporal muscle act as an agonist in mastication, where the posterior part is the least active electromyographically. There is no significant difference in muscular electrical potential in any of the three muscle regins whether mastication occurs on the left or right side or bilaterally.
However, at rest, the medial part of the muscle is significantly more active than the anterior and posterior parts.

REFERENCES

1. Bérzin F. (2004). Braz J. Oral Sci. 3(10), 484-91
2. Basmajian JV, De Luca CJ. (1985) Muscle alive: their function revelated by electromyography. Williams & Wilkins, Baltimore.
3. Siqueira JTT, Teixeira MJ. (2001). Dor orofacial: diagnóstico, terapêutica e qualidade de vida. Editora Maio, Curitiba.

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We thank to FAPESP, which financed this study.

Table 1. p values obtained in the analysis of variance of the RMS data for movements studied.

Cause of Variation	Mastication Right	Mastication Left	Mastication Bilateral	Rest
Side of mastication	0.7138	0.0585	0.3309	0.3841
Part of muscle	0.0013	0.0164	0.0045	0.0006
Side *Part	0.4923	0.4162	0.8319	0.2760

134 NORMALIZATION OF THE ELECTROMYOGRAPHIC SIGNAL OF SUPRAHYOID AND INFRAHYOID MUSCLES TRHOUGH THE POSITION OF TONGUE AND MOUTH

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INTRODUCTION

In the voice area there are few studies investigating the electrical activity (EA) of the extrinsic suprahyoid (SH) and infrahyoid (IH) muscles, in dyphonia. The signal normalization of EA of these muscle groups through maximal voluntary isometric contraction (MVIC) seems to be controversial and studies are parsimonious in describing this aspect. Therefore, the aim of this paper is to investigate the EA of IH and SH in maneuvers position of the tongue and mouth for signal normalization, by the surface electromyography (SEMG).

METHODS

Were evaluated 12 individuals of both sexes, aged between 18 and 45 years without dysphonia, hearing loss and musculoskeletal cervical disorders. To collect the electrical potential of the IH and SH muscles, measured in microvolts (μV), were used MIOTOOL 200® electromyography, provided the possibility of selecting eight independent gains per channel, using a gain of 1000. Three sensors were used are: SDS500® with plugin claws; reference cable; calibrator; *Software Miograph*® 2.0, USB communication cable, all Miotec® mark, and MEDTRACE® electrodes disposable surface. After cleaning the area with, two electrodes were placed on submandibular region, along the fibers of the anterior belly of digastric muscle and two electrodes bilaterally to the larynx, between 1 and 1.5cm from the thyroid notch, according to other previous studies for evaluation of this muscle group. The reference electrode was placed on the right arm of elbow of individuals and The SEMG equipment was connected to the LG® notebook. Were tested 04 maneuvers: tongue against the palate with effort with mouth open (TAPOM) and closed (TAPCM); tongue retracted with open mouth (TROM) and closed (TRCM). The maneuvers were selected to promote pressure in the muscles of the floor of the mouth (Palmer *et al*, 2008), and the mouth position to evaluate possible differences in the signal. Each maneuver was performed three times with maximum sustained contraction for five seconds, then 10 seconds rest between each one for the average extraction of EA. Among the testing of each maneuver, was requested that the subject relax, to avoid the measurement bias. This activity took five minutes. The AE signal was converted using the root mean square (RMS) in microvolts (μV). For characterization of each subject, were calculated the mean of three measurements, subtracted from the resting potential (R), considered as basal activity. For characterization of each maneuver were considered the mean and standard error of the mean of 12 subjects. To compare the maneuvers, utilizes the Student t test for mean differences in level of significance of 0.05. For the election of the maneuver that could be used for normalization of the signal, was employed to test for differences in mean level of 0.05. The measurements were converted into percentage of the resting potential.

RESULTS and DISCUSSION

In Table 1 the data expressed in microvolts indicate the TROM maneuver that has more AE joint SH and IH right and left (IHR and IHL). However, the Graph 1 shows that the TROM and TRCM maneuvers had greater homogeneity among the groups evaluated and submitted to the mean differences test, which had no significant differences between them (SH: p=0.547; IHR: p=0.825; IHL: p=0.187). Because there are no references to the EA of this maneuvers, especially in the IH group (Palmer *et al*, 2008), this study revealed higher reliability to normalization of the signal in order to reduce the crosstalk, already this groups support the larynx. However, due to the plasticity of the vocal tract and being the IH and SH groups of small muscles, the maneuvers TROM and TRCM should be considered as maximum voluntary action (MVA) to normalize the signal and not MVIC, load of effort applied is unknown.

CONCLUSIONS

These studies contributes to the use of SEMG in voice, since the maneuvers TROM and TRCM and are feasible and promote high AE in IH and SH groups that support the vocal tract.

REFERENCES

1. Warnes E, Allen KD. Bioffedback treatment of paradoxical vocal fold motion and respiratory distress in adolescent girl. J Apll Behav Anal. 2005; 38:529-32.
2. Palmer PM. et al. Quantitative Contributions of the Muscles of the Tongue, Floor-of-Mouth, Jaw, and Velum to Tongue-to-Palate Pressure Generation. J Speech Lang Hear Res.2008; 51:828-35.

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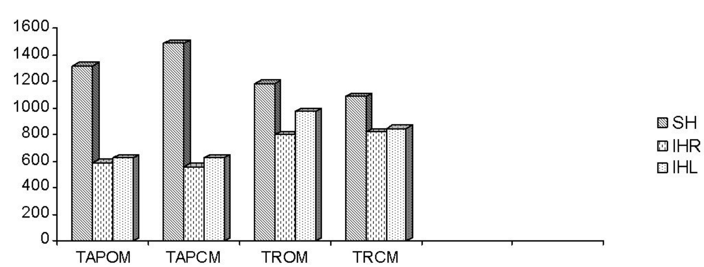
The authors thank the National Council of Technological and Scientific Development (CNPq), which had a financial support with Edictal MCT/CNPq 14/2009 - Universal / Edictal MCT/CNPq 14/2009 - Universal - Faixa B Process: 476412/2009.

Table 1 - Average potential difference of maneuvers of muscle groups in microvolts.

Muscle Groups	Manuevers			
	TAPOM	TAPCM	TROM	TRCM
SH	43.8±7.9	49.0±10.7	37.8±12.4	34.5±8.4
IHD	31.6±17.4	29.4±14.1	40.0±12.6	41.2±14.5
IHE	29.1±18.7	28.3±15.2	36.9±10.7	42.4e13.4



Graph 1: Average percentage variation from the rest to the maximum contraction during the different maneuvers

135 ABDOMINAL - PELVIC TRAININING IN PREGNANT WOMEN - CLINICAL AND ELECTROMYOGRAPHICAL EVALUATION

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INTRODUCTION

The pelvic floor muscles training during pregnancy is a technique that must be done with safety and efficacy to restore or provide muscle strength, improve the resistance to fatigue, relaxation and coordination, thus helping the control of weight over the pelvic floor during pregnancy at the same time it prepares this region to the expulsive period of the delivery (Salvesen, 2004; Pereira, Silva e Pereira, 2009).
For this reason, the obstetrics physiotherapy aims the biomechanical balance, providing an improvement of the pelvic floor muscles contractility, which tends to reduce the secondary urinary symptoms in pregnancy. However, few studies objectively demonstrate the effects of the pelvic floor muscles during gestation.
This study had as objective to evaluate the efficacy of the pelvic floor training in pregnant women through contractility of the pelvic floor and urinary symptoms evaluation.

METHODS

This was a controlled, prospective, simple blind clinical study.
The sample was of 11 primiparous women with 23,6 mean age and gestational age of $\leq$ 25 weeks who were part of the Programa Materno-Infantil da Secretaria Municipal de Poços de Caldas-MG. All patients signed the informed consent, approved by PUC MINAS Research Ethics Committee (CAAE Nº 0306.0.213.213-07).
In order to attest for a blind study, the evaluations and re-evaluations were made by a second researcher. Both evaluation and re-evaluation were composed of:
(a) Functional Evaluation of the pelvic floor muscles (AFA), through palpation (using two fingers) grading the contraction accordingly to the standardized Ortiz's muscle contractility graduation table from 0 to 5 (Contreras, Coya e Ibañez, 1994);
(b) Surface electromyography of the pelvic floor (*electromyograph EMG 400C - EMG System do Brasil®*) was recorded by a vaginal probe introduced using a little amount of anti-allergenic lubricating gel KY (Johnson's & Johnson's®). All women were asked to perform three consecutive pelvic floor contractions with maximum effort, each one followed by a rest period of twice the length of the preceding contraction;
(c) Questionnaire answering: *International Consultation on Incontinence Questionnaire – Short Form (ICIQ- SF)* and International Consultation on *Incontinence Questionnaire Overactive Bladder (ICIQ-OAB)*.
After evaluation, the physiotherapeutic treatment began, being supervised by the main researcher.
(a) Strengthening and relaxing exercises of the pelvic floor muscles;
(b) Exercises aiming on respiratory and abdominal-pelvic reeducation. Both the exercises were started with the patient in dorsal decubitus, changing to sat position and then orthostatic. During the exercises, the patients were coached to perform pelvic floor muscles recruitment, totaling 50 sustained contractions (8 seconds holding the contraction and double the time of rest) and 30 fast-paced contractions. Each patient went through 10 individual sessions, being those at their homes, 3 times a week and duration of 40 minutes each session.
The statistic analysis used the *Student-T test* with 5% significance level.

RESULTS and DISCUSSION

The table 1 shows through functional (AFA) and electromyographic (EMG) evaluation, a significant improvement of pelvic floor muscles contractility after 10 training sessions.

Tabel 1. AFA and EMG of the pelvic floor muscles

	Pre	Post	P-value*
AFA	2.72	3.63	0.001
EMG	43.32	50.62	0.01

*P < 0.05 (Student-T)

Regarding urinary symptoms (Table 2), our studies found a significant score reduction in ICIQ-SF, showing improvement of the urine loss during physical activities and life quality of the patients. However, there were no significant findings regarding ICIQ-OAB scores, showing that the irritative symptoms – urinary frequency, nocturia, urinary urgency and urge incontinence.
According to Scarpa et al. (2006) the irritative symptoms are common during pregnancy and may be related to the pression made by the featus' head over the bladder, resulting reduction of the vesical capacity.

Tabel 2. Pre and post treatment urinary symptoms.

	Pre	Post	P-value*
ICIQ-SF	7.90	2.18	0.01
ICIQ-OAB	6	5.54	0.61

*P < 0.05 (Student-T)

ICIQ-SF: Escore - 0 to 21. ICIQ-OAB: Escore - 0 to 16. As higher the score, the greater the gravity of the urinary symptoms.

CONCLUSIONS

The abdominal and pelvic training in pregnant women allows for a significant improvement of the pelvic floor muscles contractility as well as for stress incontinence. This training does not have any influence over the irritative urinary symptoms.

REFERENCES

1. Salvesen KA, Morkeved S. (2004) Randomised controlled Trial of PFMT during pregnancy. BMJ. 329: 378-80.
2. Pereira SB, Silva JM, Pereira LC. Treinamento dos Músculos de Assoalho Pélvico. In: Palma, P. (Org) Urofisioterapia – Aplicações Clínicas das Técnicas Fisioterapêuticas nas Disfunções Miccionais e do Assoalho Pélvico (2009) Personal Link Comunic. Campinas - SP. 347-354.
3. Contreras O, Coya NF, Ibañez G. Evaluación funcional del piso pelviano femenino - Classificacion funcional. (1994). Boletim de La Sociedad Latinoamericana de Uroginecologia y Cirurgia vaginal, 1: 5-9.
4. Tamanini JTN, et al. (2004). Validação para o português do "International Consultation on Incontinence Questionnaire – Short Form" (ICIQ-SF) Rev. Saúde Pública .38(3)438-444.
5. Pereira SB. Thiel RRC, Riccetto C, Silva JM, Pereira LC, Herrmann V, Palma P. Validação do International Consultation on Incontinence Questionnaire Overactive Bladder para a língua portuguesa. RBGO "in press".
6. Scarpa KP, et al. (2006) Prevalências de sintomas do trato urinário inferior no terceiro trimestre da gestação. Rev Assoc Med Bras. 52(3):153-6.

136 EFFECT OF GLOBAL POSTURAL REEDUCATION ON THE MASTICATORY CYCLE IN WOMEN WITH TMD

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INTRODUCTION

The temporomandibular disorder (TMD) comprises alterations related to masticatory muscles, temporomandibular articulation, and associated structures. Individuals with TMD present alteration of activity of the masticatory muscles (Rodrigues-Bigaton et al., 2008).
The Global Postural Reeducation-GPR (Sestare, 2009) stands out among the procedures used in physiotherapy for the TMD treatment. It focuses on stretching the entire set of postural, internal rotation and inspiratory muscles (Souchard, 1981).
This study aimed to evaluate the effect of GPR on the electromiographic activity during isotonic contraction of the masticatory muscles in women with TMD.

METHODS

The subjects comprised 8 women (23±3.34 years) with TMD provided by RDC/TMD Axis I, with shortening of the previous master chain and correction of mandibular lateral deviation. The exclusion criteria were: women with missing tooth, with total or partial dental prosthetics; in treatment of the stomatognathic system; in medication treatment; with systemic disease; with diagnosis of IIIb and IIIc TMD, according to RDC/TMD Axis I, and the ones who underwent previous treatment with GPR.
For the treatment, a total of 16 GPR sessions were carried out, twice a week, using postures such as "frog on the floor with arms folded" and "standing posture against the wall", 25 min each, 5 minute interval between them , and 1 min between the sequence of "standing posture against the wall". Previously to that, a diaphragm muscle relation maneuver was performed (Souchard, 1987).
During the "standing posture against the wall", the physiotherapist stabilized the volunteer´s suboccipital region and asked for a maximum lateral deviation of the mandible for 5 s, returning to the initial position. The same procedure was done in the opposite side.
For the electromiographic evaluation, the EMG1000 (Lynx®) was used with 16-bit resolution and input band of ± 2 volt, simple surface electrodes (Lynx®). Amplification in 1000 times, filter with a high-pass of 20-1000 Hz and sampling frequency of 2000 Hz. The electrodes were placed bilaterally on the belly of the anterior temporal and masseter muscles, according to Cram *et al*. (1998). The reference electrode was positioned on the sterna manubrium.
The electromiographic signal was collected during isotonic contraction of the mandible elevator muscles, 5s each, before and after the 16 GPR sessions.
The electromiographic signal was processed in the software Matlab® 6.5 to provide the Root Mean Square values. For normalization, the RMS mean value, which was obtained from the control group during isotonic contraction, was used as reference.
The statistical analysis was determined by the Shapiro-Wilk, followed by Mann-Whitney test, level of significance of 5% ($p< 0.05$).
This study was approved by the Research Ethics Committee, protocol no 03/08.

RESULTS and DISCUSSION

During isotonic contraction of the mandible elevator muscles, agonist phase ,there was a significant difference of the RMS normalized values of the temporal muscles (p=0.0047) and left masseter (p=0.0001), but no difference was observed for the temporal (p=0.5296) and right masseter (p=0.1229), when compared to before and after RPG intervention (Figure 1). However, there was a significant difference in the antagonist phase for the temporal (p=0.0149) and left masseter muscle (p=0.0214), as well as for the temporal (p=0.048) and right masseter (p=0.0001), as shown in Figure 2.
Long muscle stretching promotes accommodation of the nervous fibers, decreasing the transmission of motor impulses to the muscle and causing the deformation of the muscle plastic components and tonus reduction (Achour, 1995). It is also useful for relaxing the muscular tension and increasing blood flow (Trujillo and Zeng, 2006). In addition, the mandible lateralization exercise also promotes relaxation of muscular tension (Carlsson, Magnusson and Guimarães, 1999); consequently, it improves the muscular function.

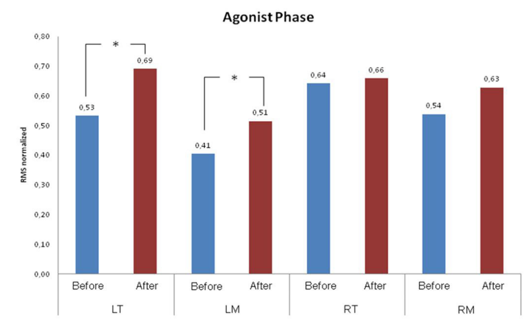

Figure 1 – Mean of the RMS normalized of the chewing cycle (agonist phase) of muscles LT (left temporal), LM (left masseter), RT (right temporal) and RM (right masseter), before and after GPR.

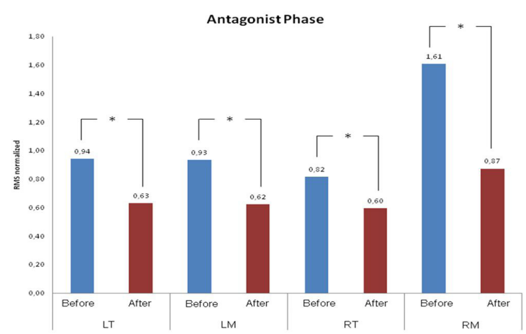

Figure 2 – Mean of the RMS normalized of the chewing cycle (antagonist phase) of muscles LT (left temporal), LM (left masseter), RT (right temporal) and RM (right masseter), before and after GPR.

CONCLUSIONS

GPR was efficient in improving the electromiographic activity of the mandible elevator muscles in women with TMD.

REFERENCES

1. Archour JA. (1995). Revista da Associação dos Professores de Educação Física de Londrina. 10: 50-69.
2. Carlsson GE, Magnusson T, Guimarães AS.(1999). Chicago: Quintessence; 192p.
3. Corrêa ECR, Bérzin F.(2004). Braz J Oral Sci. 3(10): 498-502.
4. Cram JR et al. (1998). Aspen Publication. 408p.
5. Rodrigues-Bigaton, et al. (2008). Rev Bras Fisioter. 12(6): 476-481
6. Sestare THI. [dissertação]. (2009) Piracicaba: UNIMEP.
7. Souchard PE. (1981). Saint Mont: Le Pousoë. 96p.
8. Souchard PE. (1987). Saint Mont: Le Pousoë. 143p.
9. Trujillo L, Zeng X. (2006). Work. 27(2): 111-121.

137 COMPARISON OF FOUR ANATOMIC POSITIONS TO ACQUIRE HOFFMANN REFLEX OPTIMALLY

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INTRODUCTION

Hoffman reflex (H reflex) is a monosynaptic reflex evoked electrically stimulating muscle spindle Ia afferents. Ii is similar to the stretch reflex but without spindle stimulation. It finds many uses in electroneuromyography studies and it allows evaluation of spinal chord α-motoneuron excitability. It can be used: to evaluate nervous system response to various neurological conditions, neuromuscular lesions, pain; in therapeutic applications; in the measurement of the H/M ratio etc. Techniques to acquire this signal must guarantee that the maximum H reflex peak-to-peak amplitude (H_{mpp}) is obtained, to avoid misleading results. If one consider an adequate control of many variables that could interfere in the signal amplitude, the anatomic position chosen to capture the H reflex can change significantly H_{mpp}. Several authors compared maximum H reflex and maximum M response peak-to-peak amplitude in several anatomic positions but, in some cases, it involved some kind of movement of the inferior limb or Achilles tendon vibration (Chalmers e Knutzen, 2002; Al-Jawayed et al., 1999; Koceja et al., 1993). In this work we performed a comparison of four anatomic positions to acquire Hmpp of subjects at rest, in order to avoid interference in the reflex excitability. The objective of this work was to find what is the most appropriate anatomic position to obtain H_{mpp} of the soleus muscle in the dominant inferior limb, among four positions (sitting, standing, prone and supine) in the rest state.

METHODS

Our sample consisted of 40 healthy volunteers (23 ±3,6 years of age) of both genders, Physiotherapy students and employees of University Center of João Pessoa (UNIPÊ). The study was approved by the Ethics Committee of the state of Paraíba Health Secretary and all subjects gave their written informed consent prior to inclusion in the study. Each volunteer was submitted to a single evaluation in the acquisition of H_{mpp} in the four anatomic positions. The posterior tibial nerve was stimulated in the popliteal fossa (cathode, anode in the patella), aiming the optimization of aspects such as right location, direction, cathode pressure applied, always performed by the same researcher. We applied voltage pulses of 0.5 ms duration and adjustable amplitude (0-200 volts). Pulse amplitude was gradually increased finding in this way, for each subject, the anatomic position that provided greatest H_{mpp}. The choice of the sequence of anatomic position for each subject was randomized. Bipolar electrode configuration was used to collect the surface EMG and disposable (Ag-AgCl) electrodes were located: the proximal electrode in the mid-dorsal line of the dominant inferior limb, above the soleus muscle, 4 cm below the gastrocnemius inferior border and, the distal one, 3 cm below the proximal. The reference electrode was placed over the antero-medial face of the tibia. Reflex signals were amplified using a surface EMG amplifier (10 to 490 Hz, high input impedance, low noise, CMR > 95 dB, gain of 350 or 750), digitized with a 2000 Hz sampling frequency with a 12 bits resolution. The signals were collected and processed using the BioMed digital polygraph. (Carvalho et al, 2001).

RESULTS and DISCUSSION

Tables 1 to 3 show mean and standard deviation (SD) for H_{mpp} (in mV), stimulation amplitude (in volts) and latency (in ms), respectively (n= 40).

Table 1. Mean and standard deviation for H_{mpp} (in mV) in the four anatomic positions.

Position	Sitting	Standing	Prone	Supine
Mean	6.2	5.2	6.6	6.8
SD	2.5	1.5	2.5	2.5

Table 2. Mean and standard deviation for stimulation amplitude (in volts) in the four anatomic positions.

Position	Sitting	Standing	Prone	Supine
Mean	37	34	26	29
SD	7.8	13.5	8.7	8.1

Table 3. Mean and standard deviation for latencies (in ms) in the four anatomic positions.

Position	Sitting	Standing	Prone	Supine
Mean	28	28	28	28
SD	1.9	2.0	1.9	2.0

An ANOVA test (one way, related samples, p=0,05, post-hoc Tukey) revealed signifi-cant differences ($p<0.05$) for Hmpp in comparison of positions sitting/standing, standing/prone, standing/supine, with positions prone and supine providing the greatest amplitudes and the standing position the smallest. Comparison of stimulation amplitude to get Hmpp in each position (Friedman ANOVA test, p=0.05) revealed significant differences ($p<0.05$) for positions sitting/prone, sitting/supine, standing/prone and standing/supine, with prone position needing lesser intensities to get Hmpp while the sitting position required the greatest stimulation amplitudes. These combined results show that the prone position stands as the most adequate because even without any significant difference when compared with the supine position, one needs smaller amplitude stimulation in order to get Hmpp, whose values, in the two positions are practically identical. There were no significant differences between the latencies in the four positions (ANOVA, 1 way, related samples, p=0,05).

CONCLUSIONS

This study showed that the most suitable anatomic position for the acquisition of Hmpp is the prone position. It needs the smallest stimulation amplitudes to get Hmpp, it is more suitable to envisage the popliteal fossa and to apply the stimulus allowing for, at the same time, better comfort for the examiner. This is a valuable information to perform the procedure in a more reliable way and with less distress to the volunteer or patient. It was also possible during the curse of the experiments to show that applied cathode pressure on the site of stimulus, direction of application and precise location are absolutely critical to measure Hmpp. Results obtained in our study, with a comparatively bigger sample than other similar works, match results obtained in research work that used similar methodology (Koceja et al, 1993).

REFERENCES

1. Chalmers GR, Knutzen KM. (2002) Soleus H-Reflex Gain in Healthy Elderly and Young Adults When Lying, Standing, and Balancing. Journal of Gerontology: 57(8):B321-B329
2. Al-Jawayed IA, et al. (1999) The H-reflex modulation in lying and a semi-reclining (sitting) position. Clinical Neurophysiology 110:2044-2048.
3. Carvalho LC, et al. (1998), Software em Windows para Processamento, Armaze-namento e Análise de Sinais Obtidos em Experimentos de Fisiologia. Anais do 1er Congreso Latinoamericano de Ingeniería Biomédica (CD-ROM), 207-210.
4. Koceja DM, et al. (1993). Inhibition of the soleus H-reflex in standing man. Brain Research, 629(1):155-8.

138 THE EFFECT OF POSITIONAL RELEASE TECHNIQUE IN PAIN AND EMG ACTIVITY OF THE TRAPEZIUM MUSCLE OF PATIENTS WITH - FIBROMYALGIA

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INTRODUCTION

Positional Release Therapy is an indirect technique, in other words, the application of force is used far from the barrier of resistance, that is, in the direction of greater ease. It is a method of total evaluation of the body and of treatment using sensitive points (SPs) in a position in that the state of tension of the muscular fibers is reduced to the maximum, to solve the associated dysfunction. Tender points are found during palpation and the segment is placed in an ideal position of comfort, which favors the reduction the inappropriate activity.

AIMS: verify the effect of PRT technique in pain and emg activity of trapezium in patients with fibromyalgia during gait.

METHOD

Subjects

The collection of data was accomplished with 18 patients with medical diagnostic of fibromialgy, ages between 32 to 40 years, and presenting pain above 5 in a visual analogical scale after the palpation of the tender point of the descending fibers of the trapezium.

Procedure

All of the samples were analyzed with EMG MIOTEC model miotool 400 of 4 channels with 14 resolution bits, acquisition per channel of 2000 samples per second, 100x, filter Butterworth high pass 1 polo 0,1Hz and buterworth low pass 2 polo 500 Hz, spacing between electrodes fixed in 30mm.

Surface electrodes of Ag/AgCl, round, pre gelded and auto adhesive from MEDITRACE was fixed in trapezium muscle according SENIAM. The data were collected during gait in the wake for 5 minutes before and after the PRT aplication for the Trapezium muscle. The procedure was randomized. Analysis of the data: A level of significance of 0.05 was defined for this work.

All of the confidence intervals built throughout the work were built with 95% of statistical confidence. The RMS signal was considered for the EMG signal.

RESULTS and DISCUSSION

It was possible to observe a statistically significant decrease in the average EMG signal (186.54 µV before -77.31 µV after – $p<0.05$) and the level of pain (8.2 before – 3.5 after – $p<0.05$).

CONCLUSIONS

The PRT has demonstrated effectiveness in the reduction of pain and of muscular tension exercised in the descending fibers of the trapezium.

REFERENCES

1. De Luca CJ. (1997). J Appl Biom. 13, 135-163
2. De Luca CJ, et al. (2009). J.
3. Neurophysiol. 101 (3) 1620-8
4. Herbert S. (2009). Ortopedia e Traumatologia. Artmed

139 ANALYSIS OF CONTENT OF MUSCLE AND LIVER GYCOGEN IN RATS TREATED WITH DIFFERENT STRENGTHS OF LEUCINE

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INTRODUCTION

The use of substances that help gain muscle mass and increase energy reserves, aiming at the improvement in physical performance is very common nowadays. Among the different options have it - used the branched chain amino acids, BCAA (Branched Chain Amino Acids), composed of valine, leucine and isoleucine (Lancha Jr, 2004).
The main effect of BCAA can be attributed mainly to the amino acid leucine, as has been reported that the administration of this alone stimulates muscle protein synthesis as effectively as a whole.
Although numerous studies exist, there is no consensus with regard to effective concentrations of BCAA. In this context, the objective was to analyze the efficacy of different doses of the amino acid leucine, seeking to understand their role and function of the muscle glycogen reserves and liver, and insulin sensitivity in peripheral tissues.

METHODS

Wistar rats with 3 to 4 months, distributed according to table1. Ethics Committee, protocol 011/2006 UFSCar.

Table 1 - Distribution of rats in experimental groups (n = 6).

Experimental groups
Control
The dose of 5mM/100g, 7 days
The dose of 1.25mM/100g, 7 days
The dose of 0.30mM/100g, 7 days

The animals were supplemented with leucine via the orogastrica through a metal cannula attached to a syringe.
For the determination of glycogen (G), soleus (S), white gastrocnemius (WG) and red (RG), and liver (F) was performed using the phenol-sulfuric Siu Lo et al. (1970). Statistical analysis was performed using the normality test of Shapiro - Wilk, followed by ANOVA: one way, and the Tukey test, with significance of $p < 0.05$.

RESULTS

In Table 2 we can verify that the G of F decreased from 30% in L5, and an increase of 26% and 62% in L1, 25, L0, 30 compared with the control. In S there was a significant reduction of G of 43% in L5 compared to the control and 30% L1, 25. Moreover, an increase of 38% in L0, 30. In WB the G decreased from 45% and 33% in L5 and L1, 25, respectively compared to control. The L0, 30 did not differentiate control.
Regarding the G RG observed a reduction of 51% and 23% in L5 and L1, 25 in the control, respectively, with no difference in the control L0, 30.

Table 2: Content of glycogen (mg/100 mg) of the liver (F) and soleus (S), white gastrocnemius (WG) and red (RG) of the control rats and supplemented with leucine (L). Values expressed as mean ± SEM, n = 6.

G	C	L5mM	L1.25mM	L0.30mM
F	2.83±0.30	1.97±0.12	3.57±0.45#	4.60±0.313*.#
S	0.42±0.04	0.24±0.04*	0.28±0.02*	0.58±0.04*.#.**
GB	0.49±0.02	0.27±0.17*	0.33±0.05*	0.50±0.02#.**
GV	0.51±0.03	0.25±0.01*	0.39±0.04*	0.45±0.02#.**

* p <0.05 - compared to the control; # P <0.05 - 5 mM for the other; ** p <0.05 - 1.25 mM compared to 0.30 mM

DISCUSSION

The results presented here may have relations with a multifactorial exerted by leucine, corroborating the suggestion of J. Lancha (2004) which states that BCAAs are encouraged its functionality after intense efforts.
The same author also reiterates that concomitant with intense effort, the amino acids participate in the conversion of pyruvate to alanine, which is routed to the liver for re-formation of pyruvate. With moderate effort, they reach the mitochondria of the exercised muscles, participating in the synthesis of glutamine, glutamate and training. Finally, the consumption of muscle amino aims at maintaining the functionality of the Krebs cycle.
Another factor to consider is that an overdose can cause insulin resistance, leading to a significant decline in reserves of G muscle, as in the L5 and L1,25. In contrast, our study demonstrated that a low dose (L0,30), may exert potentiating action of muscle glycogen stores, helping to maintain the energy substrate in cases of disuse or immobilization and denervation muscle, or it can be a source of energy pra sports practice.
It should be noted that the change in insulin sensitivity resulting from supplementation with high doses of amino acids, may indicate changes in the dynamics of signaling via the insulin reflection along the path of mTOR (Krebs, 2005).
Regarding the doses of 5mM, 1.25mM and 0.30mM, one can see that in the skeletal muscles, the lower dose caused a significant increase in G compared with the others. This profile suggests a dose-dependent, since hat the lower dose may have softened the events activated by the other. Another factor may be related to the percentage of muscle fibers, and S contains 84% type I fibers, the WG 92% type IIB; RG and 51% type I fibers and 35% type IIA fibers (Delp and Duan, 1996) . Knowing that these amino acids act more slow twitch than fast.
It is also suggested that there is an indirect action, since leucine is an amino acid with insulinotropic action and may have promoted the desensitization of target tissues. However, there is no doubt its anabolic action (Lancha, 2004). In compliance with the muscle tissue, F representing the largest reservoir of hexose, also followed the profile of call indicating that there is an expression of responses that occurs in peripheral tissues.

CONCLUSIONS

High doses of leucine may compromise the homeostasis of the formative processes of muscle glycogen reserves and liver, which did not occur in a dose L0,30. Thus, in clinical practice, one can avoid complications, the use of a correct dose of this supplement.

REFERENCES

1. Lancha Jr AH. (2004). Nutrição e metabolismo aplicados à atividade motora. São Paulo: Atheneu.
2. Siu LO, Russeau JC, Taylor AW. (1970). Determination of glycogen in small tissue samples. J. Apll. Physiol. 28, .234-236.
3. Krebs M. (2005). Amino acid-dependent modulation of glucose metabolism in humans. Eur. J. Clin. Invest. 35,351-354.
4. Delp MD, Duan C. (1996). Composition and size of type I, IIA, IID/X, IIB fibers and citrate cinthase activity of rat muscle. J. Appl. Physiol. 80 (1): 261-270.

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BEHAVIORAL CHANGES IN RATS SUPLEMENTED WITH LEUCINE

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INTRODUCTION

Studies related to energy supplementation with BCAA (leucine, valine, isoleucine) has been disseminated widely among practitioners of physical activities. On the other hand, has been reported that these compete with tryptophan in the blood-brain barrier (Newsholme and Blomstrand, 2006). Within this aboradagem, it is suggested that supplementation with different doses of leucine can promote changes in behavior and performance of athletes.

There is consensus in the scientific community and the methods applied in the quantification of displacement and locomotor activity of rats, with emphasis on movement in the open field and elevated plus maze (LCE). In this sense, the proposal was evaluated through the above-mentioned tests, the behavior of rats supplemented with three different doses of leucine.

METHODS

Wistar rats of 3 months, divided into groups n = 6: control (C) and supplemented with leucine (7 days via stomach tube) at doses of 0.30mM/100g (L0.30), 1.25mM/100g (L1.25) and 5mM/100g (L5). (Figure 1).

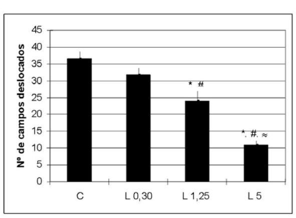
Figure 1: Supplementary via the method of orogastrica gavage

The behavioral assessment protocols were as follows: open fields (CA; a single session of 3 minutes) as Cruz and Graeff (1994) and CSF (one session of 5 minutes as Pellow, et al (1985). In Statistics were used analysis of variance followed by Tukey test, $p < 0.05$. Ethics Committee, protocol 011/2006 UFSCar.

RESULTS

In the evaluation of CA was observed that the group L0,30 did not differ from control, on the other hand, the L1.25, fell by 34%. In the evaluation of L5 was observed the greatest reduction in behavior, reaching 70% lower (see Figure 2).

Figure 2 - CA Campos moved in the control group (C), supplemented with leucine 0.30mM/100g (L0.30), 1.25mM/100g (L1.25) and 5mM/100g (L5).



* p <0.05 compared to control; # p <0.05 compared to L0, 30mM; ≈p<0,05 compared to L1,25mM.

The LCE has been observed that the group C remained 88% of the time in closed arm (BF), 10% open arm (BA) and 2% in the arms of the interface device that determines the risk index (RI). In the other groups was observed that the group L0,30 remained at 82% and 15% BF the BA, which is 13% higher values in BF and 50% higher in BA did not differ from control in the rate of risk. The L1,25 as 79% in BF and 19% for BA, or remained for a time 10% lower in the arm and closed 20% higher in the open arm compared to control, also did not differ in the risk index.

Finally, we evaluated the L5 was observed that remained 6% of the time in BA and despite also being subject to a risk factor for a while 400% higher than the other groups, remained the most time in BF reaching 94% of the time.

DISCUSSION

The consensus is that rats have a crack behavior. The study reiterated the screen description of the literature and points to the existence of innate neural networks that coordinate / provide continuous changes in the environment and topographic independent learning of reward.

The results of the behavior of L5 showed a reduction in CA indicating relations with the behavioral inhibition system, which is represented by the septo-hippocampal formation, prefrontal cortex and cingulate, ventral anterior thalamus and mamillary bodies, which respond to novel stimuli by removing the behavior and inhibiting the activity of the animal. The results suggest increased vigilance and attention to potential hazards, indicating changes of dopaminergic and serotonergic neurotransmission at the expense of reduced availability of tryptophan.

In group L1.25 decreased the exploratory index, however, to a lesser degree compared to L5 and indicates an intermediate effect. Event was not observed in L0.30. Thus, it is suggested that supplementation with leucine at a dose of 0.30mM can provide meaningful results as it seeks to improve the energy profile associated with an anti-catabolic, ie without interference in the homeostasis of the central nervous system.

Regarding the LCE, it was observed that the L5 group stayed longer in the BF, a trend enhanced by anxiogenic stimuli and substances that increase the aversion to open arms, possibly this behavior may indicate an event that accompanies the high doses of leucine (Rohlfs et al., 2005). Since the reduction in the percentage of time the BA indicates anxiety and reflects activation of the cerebral defense triggered in situations of conflict or danger and the behavioral inhibition system, systems related to serotonergic and dopaminergic neurotransmission. Although it may be suggested that such changes in neurotransmission could involve areas related to emotions by modifying the expression of action of the basal ganglia and their relation to motor or behavioral components.

In the groups L1.25 and L0.30, the behavioral components also showed, however, there was further exploration of the open field, which indicates less anxiety.

CONCLUSIONS

High doses of leucine promote behavioral changes as the dose of 0,30mM/100g observed to be effective without interfering with the aspect behavioral / emotional.

REFERENCES

1. Newsolme EA, Blomstrand E. (2006). Branched-Chain Amino Acid and central fatigue. J. Nutr. 136: 274-276.
2. Cruz APM, Graeff FG. (1994). Ethopharmacological analysis of rat behavior on the elevated plus-maze. Pharmacol Biochem Behav. 49:171-176.
3. Pellow S, Chopin P, File S, Briley M. (1985). Validation of open: closed arm entries in an elevated plus-maze as a measure of anxiety in the rats. J. Neurosci. Meth. 14: 49-167.
4. Rohlfs ICPM, Mara LS, Lima WC, Carvalho T. (2005). Relação da síndrome do excesso de treinamento com estresse, fadiga e serotonina. Rev. Bras. Med. Esporte. 11 (6): 367-372.

141 SURFACE ELECTROMYOGRAPHY FOR INSPIRATORY MUSCLES FATIGUE EVALUATION: SYSTEMATIC REVIEW

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INTRODUCTION

Respiratory muscle weakness and fatigue happens in both, acute and chronic respiratory disorders, and also in primary neuromuscular diseases. The fatigue of this muscles can be a physical performance limit, which makes its evaluation important not only for respiratory function but also for functional capacity evaluation.

Studies are using Surface Electromyography (SEMG) for respiratory muscles evaluation. SEMG enable a non invasive evaluation of this muscles, and with it different muscles groups performance during respiratory process can be evaluated during different respiratory phases.

EMG frequency domain analysis has being proposed due the EMG signal frequency spectrum changes for low frequency during fatiguing contractions. Thus, the aim of this study was to analyze the inspiratory muscle fatigue evaluation through SEMG.

METHODS

Sterne et al, 2001 standard was followed in this review. Based on the question "Surface electromyography is adequate to evaluated inspiratory muscle fatigue?", a research in PUBMED, SCOPUS, CINAHL and SCIRUS database were made by two researchers using the follow keywords based on Mesh list: Electromyography AND Respiratory Muscles AND Muscle Fatigue.

Complete articles from the last 10 years in English, Portuguese and French were selected. The studies were limited to cross-sectional studies which had used SEMG to evaluated inspiratory muscles fatigue or endurance in humans.

Agency for Healthcare Research and Quality (AHRQ) scale was used to access the studies quality.

RESULTS and DISCUSSION

From 329 articles found, 9 studies were included, with total sample of 92 subjects (healthy or with respiratory diseases) who were evaluated during body exercise or inspiratory efforts. Most of the studies evaluated sternocleidomastoid muscles (6 studies / 63 samples) and some of them the intercostals (3 studies / 37 samples) and diaphragm muscles (4 studies / 43 samples).

Fatigue analysis using electromyography was validated in 1997, by Potvin & Bent on brachial biceps muscles and, in 2000, Gerdle et al, on femoral quadriceps muscles, whom used Fast Fourier Transform (FFT) for analysis. The signal process in the studies included in this review were miscellaneous, including different frequency process (5 studies / 62 samples) and also power and RMS analysis (5 studies / 62 samples).

The RMS uses for muscle fatigue analysis was evaluated by Gerdle et al, 2000 in their validation work. A grater correlation of fatigue with frequency analysis was found comparing with RMS. According Gerdle et al, 2000, RMS uses divergence is probably caused by the normalization necessity and difficult for this variable. Varied RMS normalization were used in the reviewed studies, including percentage of RMS means, in relation to maximal and rest values.

The studies which used RMS found significant results with higher values at ending maximal inspiratory efforts. The myoelectrical signal amplitude increase during progressive workload can indicate high muscle recruitment necessity which reflects greater muscles synergy during maximal efforts.

There are a lot of frequency signal process, they can be time independents which analyze the global frequency, like FFT, and time dependents, like wavelet, which allows observe different parts of signal with high quality, in which the myoelectric signal has its frequency analyzed at each instant time through short-lived time components and wavelet packets, what enable to evaluate the frequency change during exercise

The SEMG uses on inspiratory muscles is questioned mainly due muscles cross-talk and cardiac interference. The cross-talk is directly related to electrode position and adjacent muscles form evaluated region. A high pass filter of 30Hz has efficacy to eliminated cardiac interference from myoelectric signal. However, the reviewed studies used a lower high pass filter than recommended.

Surface electrodes are being used to measure diaphragm, intercostals, scalene and accessories inspiratory muscles activities. Despite SEMG advantage, electrode position standardization is not available, ie, no consensus or orientation for electrode position according with innervations zone, fiber disposition and control of electrode distance or cross-talk exist.

CONCLUSIONS

The fatigue evaluation through SEMG has shown efficacy in diverse muscles group, nevertheless, the literature for inspiratory muscles is scarce yet. Studies show the technique utility and benefits, however, its diversity makes data interpretation and comparison difficult. Thereby, SEMG validations and standard studies for inspiratory muscles and for normalization and signal process are necessary to improve its use as much in research just as in clinical routine.

ACKNOWLEDGMENTS

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REFERENCES

1. Gerdle B, et al. (2000) Criterion validation of surface EMG variables as fatigue indicators using peak torque A study of repetitive maximum isokinetic knee extensions. Journal of Electromyography and Kinesiology; 10, 225–232.
2. Potvin JR, Bent LR. (1997) Validation of Techniques Using Surface EMG Signals from Dynamic Contractions to Quantify Muscle Fatigue During Repetitive Tasks. Journal of Electromyography and Kinesiology; 7(2), 131-139.
3. Sterne JAC, et al. (2001) Systematic reviews in health care Investigating and dealing with publication and other biases in metaanalysis. BMJ Journal; 323, 101-105.

142 RESPIRATORY MUSCLE FATIGUE EVALUATION USING WAVELET FOR ELECTROMYOGRAPIC SIGNAL PROCESS

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INTRODUCTION

Studies are using Surface Electromyograpy (SEMG) for respiratory muscles evaluation. SEMG enables a non invasive evaluation and also evaluation from different muscles groups performance during respiratory process.
EMG frequency domain analysis has being proposed due the EMG signal spectrum changes for low frequency during fatiguing contractions (Perlovitch et al, 2007). There are a lot of frequency signal process, they can be time independents which analyze the global frequency, like Fast Fourier Transform (FFT), and time dependents, like wavelet, which allows observe different parts of signal with high quality, in which the myoelectric signal has its frequency analyzed at each instant time, what enable to evaluate its change during dynamic activities. Based on this, the aim of this study was to analyze Wavelet signal process for respiratory muscle fatigue evaluation.

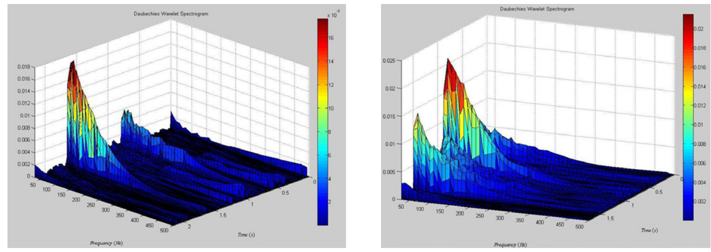
METHODS

Five healthy subject were evaluated (age: 22 ±1.22years, weigh: 64.8 ±11.5Kg, height: 1.69 ±0.11m, Heart Rate: 798 ±7.64bmp, Expiratory Forced Volume/Vital Forced Capacity: 101 ±10%). Right and left sternocleidomastoid (STMD) and diaphragm (DI) SEMG were made. EMG System Electromyography were used for myoelectric signal capture during respiratory muscle fatigue induce with Incremental Muscle Training (IMT).
First clinical evaluation were made, then the subjects were submitted to skin preparation and electrodes were positioned (bipolar technique) STMD: 5 cm down mastoid process; DI: seventh and eighth intercostals space on anterior axillary line. During SEMG, IMT were executed on seated position using mouth piece, nasal clip and Threshold®, an unidirectional valve which makes gradual inspiratory resistance. During IMT the individuals breath during 2 minutes in each level with increment of 5cmH2O, starting with 10cmH2O and finishing in 40cmH2O or the maximal supported by subjects. MATLAB® (R2007) software was used for development of myoelectrical signal analysis program which contains filter, graph plots and frequency analysis.

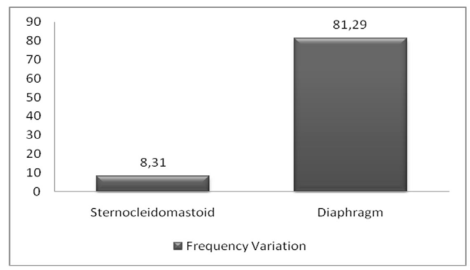
RESULTS and DISCUSSION

Using developed program a 30-500 Hz band pass filter was applied on signal, whereas a 30Hz high pass filter has efficacy to eliminated cardiac interference from myoelectric signal. Then signal plotting was made in which patch could be selected. Based on selected patch the software shows Power density normalized energy based on Wavelet coefficients (Picture 1). Approximations coefficients with third decomposition level using Daubechies mother-wavelet. Different patches analysis were made during initial load and maximal load, which correspond to fatigue moment. The three more prevalent frequencies, with higher density, were analyzed and had their means calculated.
Diaphragm muscles analysis based on Wavelet had significant decrease on activity frequency during fatigue contractions (p=0,015). STMD don´t showed significant difference between initial and maximal load. Picture 2 shows frequency changes which decrease during fatigue.

Picture 1: Tri-dimensional graphic of power density normalized energy from diaphragm based on Wavelet coefficients with third decomposition level using Daubechies mother-wavelet. a) before fatigue (initial load); b) during fatigue (maximal load).



Picture 2: Frequency variation based on Wavelet analysis (V= initial load – maximal load frequency) representi decrease maximal load (fatigue contractions) on sternocleidomastoid and diaphragm muscles.



Results indicate efficacy on Wavelet analysis to fatigue detection on respiratory muscles. According with Perlovitch et al, 2007, EMG signal frequency spectrum changes for low frequency during fatiguing contractions.
Frequency difference behavior in studied muscles indicate DI fatigue on maximal loading without SCMT fatigue. Nobre et al, 2007 corroborates showing higher fatigue level in DI comparing with SCMT during IMT in health elderly subjects. Furthermore, 40cmH2O maximal load could not be enough for to take ECOM fatigue in healthy subjects. ECOM fatigue analysis was studied in patients with Obstructive Pulmonary Chronic Diseases, who use excessively this muscles being more easily fatigue.

CONCLUSIONS

Used signal process application had efficacy on fatigue evaluation and also for different respiratory muscles behavior detection. Literature analyzing signal process on this muscles is scant yet, which makes comparison difficult. To understand respiratory myoelectrical signal behavior during fatigue contractions more studies are necessary.

ACKNOWLEDGMENTS

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REFERENCES

1. Nobre MEP, et al. (2007) Inspiratory muscle endurance testing: Pulmonary ventilation and electromyographic analysis. Respiratory Physiology & Neurobiology; 155, 41-48.
2. Perlovitch R, et al. (2007). Inspiratory muscles experience fatigue faster than the calf muscles during treadmill marching. Respiratory Physiology & Neurobiology; 156, 61-68.

143 EFFECT OF INCREMENTAL TREADMILL RUNNING PROTOCOL ON EMG SIGNALS ANALYZED WITH ISOMETRIC AND DYNAMIC CONTRACTIONS

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INTRODUCTION

Running is one of the most common types of locomotion, therefore many studies adopted the superficial electromyography as a non invasive technique capable of analyze skeletal muscle during these specific movements (FRAGA *et al*., 2009; ABE et al., 2007).
In running incremental protocols on treadmill, the movement pattern and the performance can be influenced by increasing intensity as much as by development of fatigue. As a result of the increasing intensity and fatigue, some neuromuscular changes can be observed (SILVA *et. al*., 2007).
The study of fatigue in exercises realized until exhaustion become important because it makes possible to evaluate the physical condition of athletes and to prescribe individualized training sessions for them (NIGG *et al*., 2003).
The aim of this study is to analyze the effect that a running incremental protocol has on the electromyographic (EMG) behavior analyzed with isometric and dynamic contractions.

METHODS

Thirteen recreational male runners took part in this experiment (20.5±2.3 years; 67.9±7.6 kg; 1.75±0.04 m). The subjects had at least two years of experience in different kinds of sport modalities. They used running as a form of aerobic training for this modalities. The present study was approved by the local Ethics Comity (Protocol 2771/2004).
At first, three maximal isometric voluntary contractions (MIVC) for the extensor muscle group of the knee were made with a duration of five seconds each and an interval of three minutes between them. Three minutes after the maximal contractions, three isometric contractions at 50% of MIVC for collected for five seconds. This submaximal contractions were repeated at every stage of the incremental protocol. The subjects were instructed to maintain this percentage of contraction during the data collection. The running protocol began with 8 km.h-1 and the increments were of 1 km.h-1 at every three minutes until exhaustion. At the end of each stage, there was a pause of two minutes in which blood sample and an isometric contraction at 50% of MIVC was collected. The EMG signals of *Rectus Femoris* (RF) and *Vastus Lateralis* (VL) were obtained by bipolar surface electrodes according to SENIAM (HERMENS et al. 2002). The data were collected in isometric contractions and in the last ten strides of each stage. The EMG was collected at 1000 Hz and they were amplified 2000 times. The signals were filtered with high pass (20Hz) and a low pass (500Hz) filter. The Root Mean Square (RMS) was calculated for the dynamic contractions using the mean value of the ten last strides of each stage of running. In isometric contraction, the RMS was calculated windows of 1s with an overlap of 0.5s. The mean values corresponding to the intervals of 1 to 4s were analyzed. The RMS values of 60%, 80% and 100% of the maximal running speed. A one-way repeated measures ANOVA for repeated measures and *post hoc* of Bonferroni ($p < 0.05$) was used for statistical analysis.

RESULTS and DISCUSSION

The running incremental protocol used in this study caused an increase only on RMS values for the dynamic contractions (Figure1). On the other hand, the increase in running velocity, at each stage, did not influence the RMS values when normalized by the subsequent isometric contractions (Figure2).

Figure1: RMS values (mean e standard deviation) of VL and RF muscles. * $p<0.05$ to 60 and 80% and Δ to 60% ($p<0.05$).

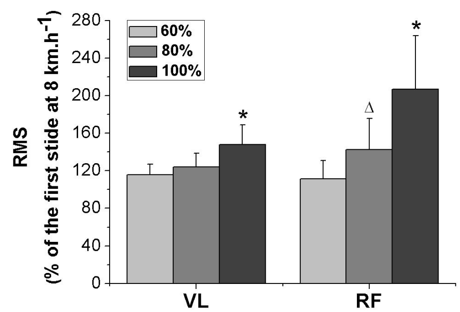
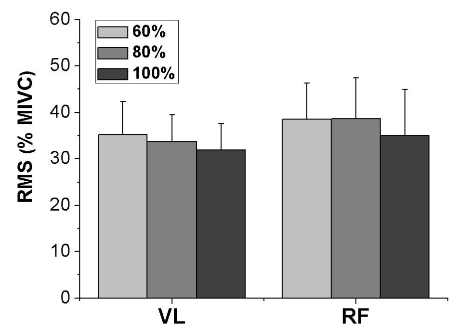


Figure2: RMS values (mean e standard deviation) of VL and RF muscles.



Hanon et al. (1998) observed that the EMG isometric contractions remained unchanged between the stages of the incremental protocol until 18 km.h-1. Only after this speed, significant alterations were observed.
On the other hand, higher EMG signal amplitudes were observed in dynamic contractions during running incremental protocols. These studies are in accordance with the results observed in this experiment (SILVA et. al., 2007). This increase can be related to the recruitment of new motor units because of the increasing running intensity (HANON et al., 1998).

CONCLUSIONS

The results indicate that the increase on RMS values in dynamic contractions can be more precisely determined by the increase in running intensity than the by the fatigue process that will occur.

REFERENCES

1. Fraga CHW, et al. (2009). Motriz. 15, 911-918.
2. Hanon C, et al. (1998). Eur J Appl Physiol Occup Physiol. 78, 315-323.
3. Hermens HJ, et al. (2002) ISEK Congress, [CD-ROM].
4. Nigg BM, et al. (2003). J. Biomech. 36, 569-575.
5. Silva PB, et al. (2007). Braz J Biomech. 8,10-15.

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144 DETERMINATION OF TIME THRESHOLD FATIGUE IN WHOLE BODY VIBRATION TRAINING

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INTRODUCTION

Research from around the world have shown that the stimuli on whole body vibration training are extremely effective in producing benefits in the tissues and structure of the human body, providing important neurohormonal adaptations and physiological. It is known that prolonged exposure to vibration causes neuromuscular fatigue, negating the potential benefits of vibratory stimuli on platforms in the neuromuscular performance. The achievement of this scientific work was triggered by the difficulty in finding scientific literature that have categorized the changes in electromyographic activity in relation to muscle fatigue in subjects barefoot stimuli during a whole body vibration training. The purpose of this study was to evaluate changes in the electromyographic signal in relation to muscle fatigue in the muscles stabilizing the ankle during acute exposure whole body vibration training in sedentary barefoot and on how long this phenomenon happen.

METHODS

It included 13 volunteers (22.5 ± 2.8 years, 58.1 ± 9.2 kg and 1.64 ± 0.1 m) healthy, sedentary and without damage to lower limbs in the last six months. For the EMG analysis was used equipment EMG SYSTEM 16 channels and the electrodes were placed on the tibialis anterior, peroneus longus and gastrocnemius lateralis dominant (SENIAM). We used a vibrating platform type oscillatory (Dream Healther MM 500 - Human Medextec) at a frequency of 30 Hz and amplitude of 10 mm and the volunteers remained in standing position for five minutes.

RESULTS and DISCUSSION

The tibialis anterior, peroneus longus and gastrocnemius lateralis showed neuromuscular fatigue in 3.4 minutes, 2.3 minutes and 3 minutes on average, respectively, with no statistical difference between the groups ($P <0.05$). It is known that there exists a direct relationship between the non-use of footwear and peripheral neuromuscular fatigue, because the use of the shoe provides stability and motion control during exercise, with particular significance in relation to neuromuscular fatigue and prevent injuries. In the vast majority of previous research methodologies related to whole body vibration training, is not mentioned if subjects use some kind of footwear, which would be directly linked to muscle fatigue.

CONCLUSIONS

There neuromuscular fatigue in the muscles stabilizing the ankle from the second minute barefoot individuals exposed to vibratory stimuli, and the results of this research are consistent with other studies where volunteers were barefoot during the whole body vibration training and the result was fatigue peripheral neuromuscular, but none of these involved the stabilizing muscles of the ankle.

Keywords: whole body vibration training, neuromuscular fatigue; barefoot.

REFERENCES

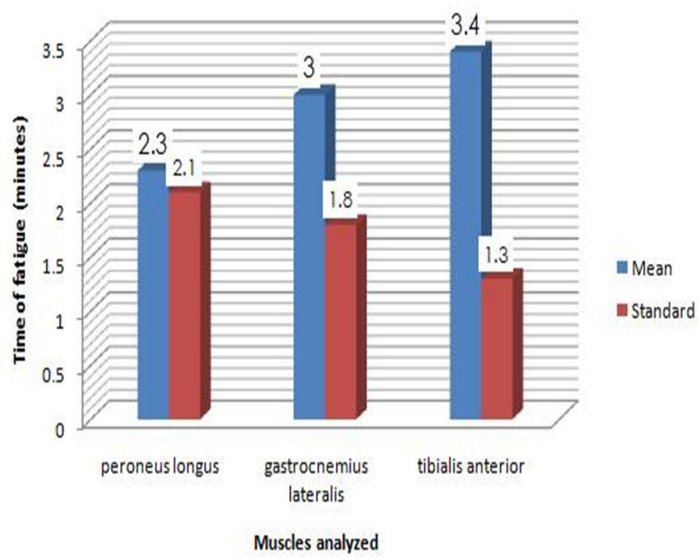
1. Silva BARS, et al. Efeitos da fadiga muscular induzida por exercícios no tempo de reação muscular dos fibulares em indivíduos sadios (2006). Revista Brasileira de Medicina do Esporte. v.12, n. 2, 85-89
2. Rittweger J, Beller G, Felsenberg D. (2000). Acute physiological effects of exhaustive whole body vibration exercise in man. Clinical Physiology. v. 20, n.2, p. 134-142
3. Mello RGT, Oliveira LF, Nadal J. (2007). Anticipation mechanism in body sway control and effect of muscle fatigue. Journal of Electromyography and Kinesiology. v. 17, p. 739–746
4. Kurz MJ, Stergiou N. (2004). Does footwear affect ankle coordination strategies? Journal of the American Podiatric Medical Association. v. 94, n. 1, p. 53-58
5. Erskine J, et al. Neuromuscular and hormonal responses to a single session of whole body vibration exercise in healthy young men (2007). Clinical Physiology Function Imaging. v. 27, n.4 p. 242–248

Table 1 Shows the demographics of the research volunteers.

Table 1. Demographics of the research volunteers

Body mass (Kg)	Age (years)	Stature (m)
Mean= 58.1	Mean= 22.5	Mean= 1.64
Standard deviation = 9.2	Standard deviation = 2.8	Standard deviation = 0.1

Figure 1 Shows the average time to fatigue between the muscles analyzed.



145 FATIGUE EFFECT ON THE FREE WALKING: PRELIMINARY RESULTS

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INTRODUCTION

Walking is the human most effective locomotion pattern. Several factors were analyzed in the past to understand their effects on walking control. Fatigue, which influences the walking movement control (Helbostad et al., 2007) and is associated with increased falling risk (Parijat and Lockhart, 2008a, b; Bellew, Fenter, 2006). However its effects on walking parameters was not fully studied (Katsiavas et al., 2005; Parijat, Lockhart, 2008a,b). To keep the motor performance, new organization intrasegmentary in the presence of fatigue is required. However, other factors such as time for recovery of function remain unclear (Parijat, Lockhart, 2008a, b). Thus, the aim of this study was to analyze the fatigue effect on the free walking of young women immediately and after 5 minutes of recovery.

METHODS

Three healthy young females participated of this study (age - 22±3.4 years, body mass - 60.6±6.3 kg, height - 1.62±0.06 m). The study was approved by local Ethics Committee (Protocol 2055/2008). For analysis of free walking, each participant walked, in their preferred walking speed, a distance of 8m. Each subject performed 6 trials of this task before, immediately after and 5 minutes after fatigue. Fatigue was inducted through the sitting and rising task from a chair without arms (Helbostad et al., 2007) with frequency (0.4 Hz) controlled by means of a metronome. Fatigue was determined by the volunteers inability to perform the proposed movement or to maintain the desired cadence. Electromyographic sinal of the vastus laterallis, biceps femoralis and medial gastrocnemius of both lower limbs was reordered during the free walking was recorded by an biological conditioner (sample rate - 2000Hz) with eight channels (EMG System do Brazil Ltda.). The signals acquisition followed the ISEK/SENIAM recommendations. The data were filtered with high pass Buttherworth 4th-order and bandpass filter 20-500Hz (Barela, Duarte, 2008). The two central strides were considered for the data analysis. It was determined the two stride mean values for each stride. The following variables were analyzed: RMS of the cycle, peak EMG activity and muscle activation latency (time of onset of muscle activation to the peak). The Shapiro Wilk did not verify data normal distribution and therefore, Friedman test was performed to verify the fatigue induction effect ($p < 0.05$). If a significant effect was detected, the Wilcoxon test was performed to indicate the differences.

RESULTS and DISCUSSION

Statistical analysis did not reveal significant difference for the muscle activation latency between conditions (Table 1). For the entire cycle RMS value (Table 1) it was observed a significant difference in the vastus lateralis and gastrocnemius of both legs between before and after fatigue and before fatigue and 5 minutes after fatigue. For the peak EMG activation (Table 1), statistical analysis showed significant difference for the vastus lateralis of both legs and gastrocnemius of the left leg. The results show that muscle recruitment during free walking is influenced by muscle fatigue in young women. The RMS and peak values increase indicate an elevation of muscle recruitment level (increase in the number of active motor units and/or higher activation level of the fibers already activated), in order to maintain the same muscular tension. These results were maintained at 5 minutes after fatigue, indicating that this period was insufficient for full recovery. The muscle activity increase and the activation of other muscles in the free walking can affect the task functionality. This might increase the tripping and falling risk. However, there was no change in the muscle latency, indicating that these individuals did not change their muscle recruitment strategy. Further studies are needed to assess whether this strategy influences the gait spatial and temporal parameters.

CONCLUSIONS

It can be concluded, preliminarily, that there was no muscle recruitment level changes in the free walking for young women after fatigue induction. Moreover, the period of 5 minutes was not sufficient for the muscle function recovery during free walking.

REFERENCES

1. Barela AMF, Duarte M. (2008) J Electromyogr Kinesiol, 18, 446-454.
2. Bellew JW, Fenter PC. (2006) Arch Phys Med Rehabil, 87, 1486-1489.
3. Helbostad JL, et al. (2007) J Gerontol A Biol Sci Med, 62, 1010-1015.
4. Katsiaras A, et al. (2005) J Appl Physiol, 99, 210-216.
5. Parijat P, Lockhart TE. (2008a) Gait Post, 28, 568-573.
6. Parijat P, Lockhart TE. (2008b) Ergonomics, 51, 1873-1884b.

Table 1. Mean and standard error of the full cycle RMS, EMG peak value and muscle activation latency of the interest muscles of both limbs. * Pre ≠ post; ● pre ≠ 5' post ($p < 0.05$). LV – vastus lateralis, BF - biceps femoris; GM - medial gastrocnemius.

		Right limb		
		LV	BF	GM
PRE	RMS (µv)	26.9±1.3*●	940.7±1.35	141.2±11.9*●
	Peak (µv)	111.3±6.3*●	3984.8±1381.7	584.9±46.0
	Latency (ms)	151.8±11.9	104.1±9.7	125.5±12.6
POST	RMS (µv)	37.6±4.3	1058.9±393.6	160.2±14.8
	Peak (µv)	144.3±17.5	4669.6±1649.3	683.0±67.5
	Latency (ms)	130.0±12.6	123.3±8.3	144.9±14.1
5'	RMS (µv)	34.8±1.9	1109.7±380.3	170.9±12.6
	Peak (µv)	148.5±9.7	4854.7±1666.4	683.5±46.5
	Latency (ms)	150.0±9.3	107.0±11.6	153.6±17.9
		Left limb		
		LV	BF	GM
PRE	RMS (µv)	25.8±1.2*●	947.1±315.7	160.4±14.8*●
	Peak (µv)	109.6±6.2*●	4342.7±1632.8	625.0±62.4*●
	Latency (ms)	136.5±13.7	106.2±11.9	156.9±19.7
POST	RMS (µv)	38.2±4.3	976.2±370.2	177.2±18.9
	Peak (µv)	148.9±18.4	4376.5±1720.6	715.1±76.1
	Latency (ms)	142.6±11.2	122.7±10.9	145.8±19.8
5'	RMS (µv)	39.1±2.9	1177.1±549.4	189.0±17.3
	Peak (µv)	161.1±10.8	4560.9±2074.7	733.1±66.8
	Latency (ms)	168.0±10.1	117.0±13.7	133.6±13.1

146 ELECTROMYOGRAPHIC SIGNAL BEHAVIOR IN DIFFERENT TREADMILL RUNNING VELOCITIES

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INTRODUCTION

Running is one of the most popular physical activities performed for health maintenance, training prescription, leisure and physical testes. The number of practitioners of this modality has increased each year, which implies a greater need to understand the factors that can influence the performance and causes of injuries resulting from this practice, particularly those related to muscle fatigue (SILVA et al., 2007).
This phenomenon associated with overloading and insufficient recovery periods can damage the functioning of the musculoskeletal system. Thus, the surface electromyography has been used for analysis of muscle fatigue during the running, which can contribute to understanding this complex phenomenon.
The aim of this study was to analyze the electromyographic signal of muscles of lower limbs in different intensities of running related to maximum speed (Vmáx) of an incremental protocol of treadmill running.

METHODS

Nine runners (age: 25.13 ± 6.3 years old; height: 1.78 ± 0.04 m; body mass: 71.6 ± 3.1 kg) male subjects took part of this study. All of them had experience in running and triathlon, with at least six months of experience in competitive running and with a performance time for 10 kilometers less than 45 minutes. This study was approved by Local Research Ethics Committee.
After familiarization with treadmill running, the volunteers performed the incremental running protocol, which consisted of 5 minutes of running at a speed of 9 km.h-1. After, the run protocol was performed with initial speed of 10 km.h-1, with increments of 1 km.h-1 every three minutes up to voluntary exhaustion.
The EMG data was obtained by Telemyo 900 system (Noraxon USA Inc., Scottsdale, AZ), by bipolar surface electrodes of Ag/AgCl (Meditrace), with pickup surface of 1cm in diameter and inter-eletrode distance of 2cm, placed on iliocostalis lumborum (ICL), rectus femoris (RF), vastus lateralis (VL), vastus medialis (VM), tibialis anterior (TA), biceps femuris caput longum (BFCL) and gastrocnemius lateralis (GL) muscles, according to SENIAM (HERMENS et al. 1999).
The skin was prepared (shaved and cleaned with alcohol) for electrode placement to reduce skin impedance. The signal was recorded at 1000Hz sample frequency, gain of 2000 times, 20Hz low pass filter, and 500Hz high pass filter. The EMG data were filtered with 60Hz filter (notch).
The EMG signal amplitude (full wave retificated) was expressed by the RMS value (Root Mean Square) obtained by mean of ten last strides, and compared in the three velocities: 60%, 80% and 100% of the maximal speed (Vmax).
To obtain data concerning the last ten strides, was used a reflective marker at the right calcaneus, and the images of sagittal plane motion were captured simultaneously with the EMG signal using a digital camera (NV-GS320 - Panasonic), and scanned by software Peak Motus 9.0 (ViconPeak).
This RMS values to each muscle were normalized using the first stride of the ten last strides in the initial speed on incremental test (10 km.h-1).
A one-way repeated measures (ANOVA) and Bonferroni post hoc test was used to determine differences among velocities of the running, and the level of significance was set at $p < 0.05$.

RESULTS and DISCUSSION

The RMS values of RF and GL muscles at velocity of 80% were significantly greater than 60% (p=0.001 e p=0.004, respectively) and the velocity of 100% were greater than 60% (p=0.002 e 0.004, respectively) of Vmáx. For the VM and VL muscles the values to 100% were greater than 60% ($p = 0.004$ and $p = 0.002$, respectively) of Vmáx.
These results can be explained by the recruitment of new motor units that increase their firing rates by the need to provide greater joint stability with increases intensity of the running well as the process of development of fatigue (WAKELING et al., 2001).
The pattern of activation between different muscles of the lower limb, at fatigue conditions, has been reported to be dependent on several factors, among which stand out the specific neuromuscular adaptations of muscles analyzed; intensity of the running; classification muscle mono or bi-articular; and kinematic adjustments promoted in the stride cicle at different velocities (HANON et al., 2005; KARAMANIDIS et al., 2004).
The incremental protocol of treadmill running caused an increase in muscle activation for wall muscles studied (RF and GL). However, bi-articular muscles were more sensitive to changes in velocity.

CONCLUSIONS

In conclusion, when comparing different intensities (60%, 80% and 100% of Vmáx) of an incremental running protocol, the EMG signal increases simultaneously with the increment of speed as a possible cause of the installation process of fatigue.

REFERENCES

1. Hanon C, et al. (2005). European Journal Applied Physiology. 94, 118-125.
2. Hermens HJ, et al. (1999). SENIAM 8: European recommendations for surface electromyography. Roessingh Research and Development b.v. ISBN 90-75452-15-2.
3. Karamanidis K, et al. (2004). Gait and Posture. 19, 115-123.
4. Silva SRD, et al. (2007). Motriz. 13, 225-235.
5. Wakeling JM, et al. (2001). European Journal of Applied Physiology, 86, 40-47.

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147 COMPARISON OF TWO PROTOCOLS FOR ASSESSING OF THE ELECTROMYOGRAPHIC FATIGUE THRESHOLD

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INTRODUCTION

Neuromuscular fatigue can be defined as any exercise-induced reduction in maximal voluntary force (Bigland-Ritchie et al 1995). The surface electromyography (EMG) is a common instrument used to analyze the neuromuscular fatigue. Using the amplitude of the electromyographic signal is possible to determinate the electromyographic fatigue threshold (EMF_{FT}), which is defined as the greatest muscular electric activity that could be sustained without fatigue (Moritani & Yoshitake, 1998).
To calculate the EMF_{FT} it is necessary to use at least three different test loads (de Vries et al 1982). Due to the recovery time needed in activities of long-term, tests are usually performed on different days. When the activity to be tested is of short duration, could be made all tests to determine the EMF_{FT} in a single day.
Therefore, the objective of this study was to verify the reliability between protocols that use four days or one day to determine the EMF_{FT}.

METHODS

Subjects

24 subjects, with mean age of 22 years-old (SD= 2.1), mean weight: 71.8 kg (SD=11.2), mean height: 176.7cm (SD=6.8), apparently healthy, without history of muscular injury who did not practice specific training for upper limbs were included in the study.

Electromyography

A 16 channels surface electromyography (EMG System do Brasil) was used to register the data. The signals were adjusted to 2000 samples/s and band-pass filtered between 20 to 450 Hz; The electrodes silver/silver chloride (Ag/AgCl) were located on each deltoid portions (anterior, medium, posterior) and the upper trapezius muscles of the dominant limb following the SENIAM (*Surface EMG for a non invasive assessment of muscles*) project recommendations.

Procedures

The isometric arm abduction test until exhaustion on the scapular plan, with the subject standing, was used to determine the EMF_{FT}. A strain gauge (traction/compression – 200 kg) fixed on the floor was also used. To normalize the EMG signal, three tests of voluntary maximum isometric contraction (MVIC) of 5 seconds were performed; the highest value was used as reference.

Procedures to determine the EMF_{FT}

Four loads (20, 30, 40, and 50% of MVIC) were used to determine the EMFFT. The slope from each equations of the Root Mean Square (RMS) over time was obtained by simple regression for each muscle. Two protocols were used to evaluate the EMF_{FT}, in the first protocol each load was evaluated in distinct days (minimum of 2 and maximum of 20 days) and in the second protocol all loads were assessed in the same day (10 min of recovery between the loads).

Statistical Analysis

The EMF_{FT} values were presented in median, 1º and 3º quartiles. To verify the difference between the EMF_{FT} between muscles it was utilized the repeated measures analysis of variance; the sphericity test was applied and if necessary technical corrections would be performed through the Greenhouse-Geisser test. If the *F test* were significant, the Tukey's Posthoc test would be applied.
To determine the reliability between the protocols it was used the Intraclass Correlation Coefficient (ICC) (one way random) and the Bland and Altman plots. The significance was set in 5% ($P < 0.05$).

RESULTS and DISCUSSION

No differences were found on EMF_{FT} between muscles, independent of the protocol used.
There was a large limit of agreement (LA) between the protocols and the ICC values were low, except for the posterior deltoid that presented the highest value (ICC=0.80). The ICC value of the anterior deltoid was -0.99, the medium deltoid and upper trapezius were respectively 0.50 and -0.47.
The Bland and Altman plots for the anterior deltoid was: d = 1.28; LA= 22.38; 38.01, medium deltoid: d = 1; LA= 3.01; 3.01, posterior deltoid: d = 1.09; LA= 0.31; 3.80; and upper trapezius: d = 6.76; LA= 0.10; 6.91.

CONCLUSIONS

The EMF_{FT} presented in a protocol that evaluates the loads in one day may not be same of a protocol that evaluates loads on different days.

REFERENCES

1. Bigland-Ritchie B. et al. (1995). *Taskdependent factors in fatigue of human voluntary contractions*. New York: Plenum Press. Moritani T., Yoshitake Y. (1998). *J Electromyogr Kinesiol*. **8**:363-81.
2. deVries H.A. et al. (1982). *Ergonomics*. **25**:783-91.
3. Nicolas A. et al. (2008). *J Electromyogr Kinesiol*. **18**:284-90.

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148 INFLUENCE OF DIFFERENT TIME OF THE DAY IN MEDIAN FREQUENCY DURING ACTIVITY TO EXHAUSTION OF VASTUS MEDIALIS OBLIQUE

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INTRODUCTION

Neuromuscular fatigue can be defined as any exercise-induced reduction in maximal voluntary force (Bigland-Ritchie et al 1995). The analysis of muscle fatigue can be studied in a noninvasive way, using surface electromyography during submaximal sustained isometric contractions.
Recently, there are some evidences that physical performance can be affected by body oscillations during 24 hours of the day. Therefore, measures of the electromyographic signals on different time hours may be different.
Therefore, the objective of this study was to evaluate whether there are differences in the electromyographic signal of the vastus medialis oblique (VMO) in three different hours during a test until exhaustion.

METHODS

Procedures

8 subjects with a mean age of 23.5 years (SD= 2.77), body mass index (BMI) of 25.4 kg/m² (SD= 4,1). All volunteers were apparently healthy and do not perform any regular physical activity.
The subjects performed tests on three
different hours (8, 13 and 18 hours). The tests consisted of three maximal voluntary isometric contractions (MVIC) of five seconds (the greatest value was used as reference) with a recovery time of one minute. After five minutes of recovery, volunteers should perform a submaximal effort (40% of MVIC) until task failure.

Electromyography

An 8-channel electromyography system was used (model MP150, BIOPAC System, USA). This system has an analog-digital converter of 16-bits, with an input range of -10 to +10 volts. Bipolar active electrodes (TDS 150) with 13.5 mm in diameter were connected to a preamplifier (impedance 1 MOhm). The common mode rejection ratio was greater than 100 dB. The frequency was adjusted to 2000 samples/second. Data were filtered between 20 to 450 Hz. The *AcqKnowledge 3.9.1* software was used for the analysis.
The active electrodes of silver/silver chloride (Ag/AgCl) were placed on the VMO. All procedures of the electrodes position followed the recommendations of SENIAM (Surface-EMG for the Non-Invasive Assessment of Muscle).

Signal Processing

To determine the median frequency (MF), the data were processed by the Fast Fourier Transform algorithm in a specific routine of Matlab. The values of MF were analyzed in windows of two seconds. For each time were created three moments of analysis (at the beginning, during, and the end of collection) with 10 points each.

Statistical Analysis

To identify the differences between and within the hours it was used the repeated measures of analysis of variance. The sphericity test was applied and if necessary technical corrections would be performed through the Greenhouse-Geisser test. If the F test were significant, the Tukey's Posthoc test would be applied. The significance was set in 5% ($P < 0.05$).

RESULTS and DISCUSSION

All evaluated hour presented nonsignificant decreased of MF. There was a reduction of 9.7%, 10.7% and 8% on 8; 13 and 18 h respectively. There were no differences in MF between each hour (Figure 1). The low number of evaluated subject may have influenced the results.

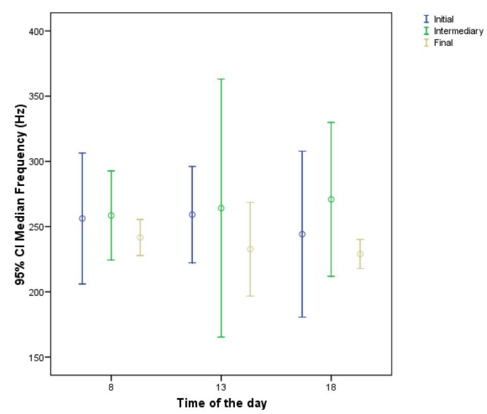

Figure 1. Mean and CI 95% of median frequency (Hz) split by time and moments.

These results are different from those found by Nicolas et al (2005), which pointed out a decrease in strength on the afternoon.

CONCLUSIONS

The results of the present study suggest that there was no difference in EMG activity in VMO among hours and moments during the test of isometric knee extension until exhaustion at 40% MVIC.

REFERENCES

1. Bigland-Ritchie B et al (1995). *Taskdependent factors in fatigue of human voluntary contractions*. New York: Plenum Press.
2. Marques N., Menna-Barreto L. (2003). *Cronobiologia: princípios e aplicações*. Editora da Universidade Estadual de São Paulo.
3. Nicolas et al (2008) *J Electromyogr Kinesiol*. **18**, 284-90.

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INFLUENCE OF THE CONTRACTION INTENSITY ON ELETROMYOGRAPHIC ACTIVITY AND THE PERCEIVED EXERTION DURING SHOLDER ABDUCTION

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INTRODUCTION

The shoulder has a great range of motion, however, to maintain its stability it is necessary a complex muscular system (Ludewig & Borstead 2005). Any lack of control in these muscles can result in injuries and reduced shoulder's range of motion.

To maintain physical activity during a contraction until exhaustion there are changes in the firing of motor units that are detected by frequency and amplitude of the electromyography (EMG) signals (Merletti et al 2004). Furthermore, there is evidence that the electromyographic parameters are dependent on exercise intensity. Thus, changes in muscle involvement can be used for better understanding of fatigue mechanisms.

Some authors have proposed that the fatigue mechanisms and the consequent task failure are influenced by the central and peripheral systems. The identification of central factors could be verified by an increase in the rating of perceived exertion (RPE) (Noakes et al 2004). Therefore, central and peripheral mechanisms should be considered to a better understanding of the maintenance of exercise.

The objective of this study was to evaluate any changes in muscle activation and PSE during shoulder abduction depending on the intensity of the exercise.

METHODS

Subjects

24 men (mean age of 22 years old (SD=2.1), mean weight: 71.8 kg (SD= 11.2), mean height: 176.7cm); healthy with no history of musculoskeletal injury and who did not perform specific training for deltoid and trapezius was recruited.

Electromyography

A 16 channels surface electromyography (EMG System do Brasil) was used to register the data. The signals were adjusted to 2000 samples/s and band-pass filtered between 20 to 450 Hz; The electrodes silver/silver chloride (Ag/AgCl) were located on each deltoid portions (anterior, medium, posterior) and the upper trapezius muscles of the dominant limb following the SENIAM (Surface EMG for a non invasive assessment of muscles) project recommendations.

Procedures

The 90° isometric arm abduction test until exhaustion on the scapular plan, with the subject standing, was used as a model test.

The protocol consisted of three trials of maximal voluntary isometric contraction (MVIC) and the greatest value was used as reference. Four loads (50%, 40%, 30% and 20%) were random evaluated in different days. During each test to exhaustion, the subject was instructed to report the RPE using the 15 points scale without predetermined time.

Signal Processing

The EMG signals values V_{rms} [Volts] (RMS - *Root Mean Square*) and median frequency (MF) [*Hz*], was normalized by the maximum value during the contraction. Furthermore, because there were different times to task failure, the signals were normalized by the time in windows of 10% of time end.

Statistical Analysis

Repeated measures analysis of variance was used to verify the influence intensity on muscular electrical activity. If the F test were significant, the Tukey's Post-hoc test would be applied. The significance was set in 5% ($P < 0.05$).

RESULTS and DISCUSSION

There is a significant difference between the higher intensities in relation to lower intensities for the RPE.

Table 1. RPE slopes according to intensity.

	20%	30%	40%	50%
RPE	0.13 (0.08)	0.13 (0.04)	0.18 (0.07)$^{\$}$	0.22 (0.07)$^{*\$\#}$

* P<0.05 compared to 20%; $^{\$}$ P<0.05 compared to 30%; $^{\#}$ P<0.05 compared to 40%

Table 2. RMS slopes according to intensity.

	20%	30%	40%	50%	
Ant. Delt.	3.91 (1.99)	3.58 (1.80)	3.12 (1.92)	1.76 (1.95)	> 0.05
Mid. Delt.	1.40 (2.41)	1.45 (2.02)	0.65 (1.94)	-0.27 (2.51)	> 0.05
Post. Delt.	4.69 (2.15)	4.79 (1.91)	4.45 (2.08)	3.40 (1.59)	> 0.05

Table 3. MF slopes according to intensity.

	20%	30%	40%	50%	
Ant. Delt.	-3.51 (1.33)	-3.16 (1.20)	-3.66 (1.10)	-3.78 (1.61)	> 0.05
Mid. Delt.	-3.23 (1.17)	-3.14 (1.27)	-3.57 (0.97)	-3.64 (1.36)	> 0.05
Post. Delt	-1.85 (1.49)	-1.74 (1.14)	-1.96 (1.14)	-2.14 (1.13)	> 0.05
Up. Trap	-1.44 (1.19)	-2.37 (1.20)	-2.78 (1.01)	-3.00 (1.14)	> 0.05

Taylor & Gandevia (2008) suggested that a disproportional increase on RPE could represent the participation of the central nervous system in a submaximal task.

CONCLUSIONS

Increasing the intensity of isometric shoulder abduction in the scapular plane do not increase the slope of RMS values and MF, however, the RPE presents significant changes in the slope with increasing exercise intensity.

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REFERENCES

1. Ludewig PM, Borstead JD. (2005). *The shoulder complex. In: Joint Structure and Function*. Davies Company.
2. Merletti R, Rainoldi A, Farina D. (2004). *Myoeletric manifestations of muscle fatigue*. John Wiley & Sons, Inc.
3. Noakes, TD, ST Clair Gibson, A. (2004). *J Sports Med*. 38:1-30.
4. Taylor JL, Gandevia SC. (2008). *J Appl Physiol*. 104:542-50.

150 PROLONGED GAIT EFFECT ON ELECTROMYOGRAPHIC ACTIVATION LEVEL OF ELDERLY ON FALLS RISK

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INTRODUCTION

Between those factors related to risk of falling increase on elderly it is include the muscular fatigue (Helbostad et al. 2007) and coactivation around knee and ankle (Goncalves et al. 2008).
On this way, many propose have been indicated to reduce the risk of falling in this population, as gait training programs (Cakit et al. 2007), which advises training periods superior than twenty minutes; this period is also used during evaluation tests (Mangione et al. 2005).
However, the effect of this period over the neuromuscular recruitment level still unknown, mainly on elderly subjects on risk of falling. On this way, the objective of this study is to investigate the influence of a gait protocol on treadmill hold for twenty minutes over the Root Mean Square (RMS) values and the coactivation level over knee and ankle on elderly subjects at risk of falling.

METHODS

After the local Ethics Committee approve the study (Protocol n. 0930/2007), eight women aged 72.63+6.55 years, 1.53+0.05m height and 63.43+7.98kg weight, considered as potential fallers (score equal to 43.38+2.26 in the Berg Balance Scale), walked for twenty minutes on a treadmill on their preferred walking speed (2.64+0.2km/h).
The procedures adopted to acquisition of electromyographic signal from right vastus-lateralis (VL), bíceps femoris (BF), tibialis anterior (TA) and lateral gastrocnemius (GL) followed the SENIAM recommendations. The EMG capture was conducted by a biological signal conditioner (Telemyo 900 - Noraxon®) with a 1000Hz sample rate. For analyzes, it was considered the last 10 strides of the first (M1) and last minute (M20) of data collection. Each step was normalized by time (0-100%) with intervals of 1%. The following gait events were analyzed: Loading Response (0-10%) and Terminal Stance (30-60%) (Schmitz et al. 2009).
The electromyographic signal was normalized on amplitude by the mean value of each stride. The RMS and coactivation index (CCI) around VL-BF and TA-GL (according to Falconer and Winter, 1985) was determined for each stride for both M1 and M20. After data normal distribution test (Shapiro-Wilk) the effect of period (M1 vs. M20) over the RMS and CCI values was determined by the Student t test.

RESULTS and DISCUSSION

The results expressed on table 1 indicate the fatigue presence in all muscles (increase of RMS values), except for GL on Loading Response and TA on Terminal Stance. The difficult to maintain the muscular tension (RMS increase) at the end of the protocol indicate, in example, that knee extensor muscles lose their capacity to reduce ground reaction forces impact during heel strike on Loading Response, a critical moment to falls occurrence (Lockhart e Kim, 2006). In the same way, the GL RMS increase during Terminal Stance indicate a lower capacity to generate muscular tension during lower limb impulsion, reducing the gait performance (Watelain et al. 2000).
However, the CCI values around ankle was lower on M20 in comparison to M1, indicating a lower stiffness around this joint. During the heel strike and during Terminal Stance, ankle should act as a block, to ensure enough sustain to the ground reaction force propagation to whole body and to ensure a satisfactory lower limb impulsion. However, at the end of the protocol, on these subjects, the ankle, presented lower stiffness, and therefore lower capacity to react to forces which it is submitted.

CONCLUSIONS

On subjects at risk of falling, walk for twenty minutes, a period normally used during evaluation and exercises prescriptions can induce fatigue and reduce stiffness around the ankle, increasing this risk.

REFERENCES

1. Cakit BD, et al. (2007). Clin Rehabil, 21, 698-705.
2. Falconer K, Winter DA. (1985). Electromyogr Clin Neurophysiol, 25, 135-49.
3. Goncalves M, et al. (2008). XVIIth Congress of the International Society of Electrophysiology and Kinesiology. Ontario, Canada.
4. Helbostad JL, et al. (2007). J Gerontol A Biol Sci Med Sci, 62, 1010-5.
5. Lockhart TE, Kim S. (2006). Gait Posture, 24, 23-34.
6. Mangione K, et al. (2005). Phys Ther, 85, 727-739.
7. Schmitz A, et al. (2009). J Electromyogr Kinesiol, 19, 1085-91.
8. Watelain E, et al. (2000). Arch Phys Med Rehabil, 81, 579-86.

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Table 1: RMS values from muscles: vastus lateralis (VL), bíceps femoris (BF), tibialis anterior (TA) and lateral gastrocnemius (GL) and coactivation índex around knee (CCI K) and ankle (CCI A).

Loading Response	VL (%)	BF (%)	TA (%)	GL (%)	CCI K (%)	CCI A (%)
Minute 1	225.45 (58.94)	171.66 (88.09)	131.91 (63.13)	112.797 (55.93)	73.22 (13.16)	72.06 (19.99)
Minute 20	252.84 (59.29)	189.72 (65.90)	169.90 (63.38)	99.13 (62.00)	76.42 (13.63)	63.03 (22.14)
P	**0.002**	**0.006**	**< 0.001**	**0.780**	**0.076**	**0.004**
Terminal Stance	**VL**	**BF**	**TA**	**GL**	**IC J**	**IC T**
Minute 1	38.84 (21.86)	52.28 (34.63)	76.17 (33.81)	123.21 (40.32)	77.01 (12.41)	66.17 (18.21)
Minute 20	51.01 (27.91)	58.37 (44.33)	60.92 (35.67)	146.51 (38.55)	79.72 (14.02)	53.76 (19.86)
P	**< 0.001**	**0.024**	**< 0.001**	**< 0.001**	0.195	**< 0.001**

151 ELECTROMYOGRAPHIC ASSESSMENT OF THE FATIGUE OF CHEWING MUSCLES IN WOMEN WITH TMD

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INTRODUCTION

Temporomandibular disorders (TMD) includes all the functional disorders that compromise the temporomandibular joint (TMJ), chewing muscles and associated structures. The signs and symptoms of TMD are pain in muscles and TMJ, limitation in jaw opening and joint sounds (De Leeuw, 2008). Another symptom commonly observed in patients with TMD is the muscle fatigue, which can be defined "as the reduction in the muscle ability to produce strenght during prolonged activity (Svensson et al, 2001). Surface electromyography is a widely used appeal and well documented in the muscle activity analysis (Berzin, 2004). The median frequency (MF) is one form of electromyographic signal analysis that can indicates muscle fatigue and abnormalities in the neuromuscular system (Lindstrom et al. 1970).

The aim of this study was to evaluate the masseter and temporal muscles fatigue, using surface electromyography in women with TMD.

METHODS

This study included four women, mean age of 21.33 ± 2.34 years. The volunteers classification as with TMD was performed applying the questionnaire in accordance with the European Academy of Craniomandibular Disorders (De Bover, 2007), that consist of four questions, and only one positive response gave an TMD indication and included the volunteer in this study.

The electromyographic record were performed with the patient sitting in a chair without headrest on a wooden platform with a rubber coverage, using the electromyograph model Myosystem Br-I_P84, from DataHominis Technology Ltd. ®. The band-pass filter used was of 20-1000Hz and sampling frequency of 2000 Hz.

Before the electrodes placement the skin was cleaned with alcohol 70%. The electrodes were placed in the belly of the masseter and the anterior part of the temporal muscles bilaterally, according Cram et al. (1998). The reference electrode was placed on the sternal notch.

The electromyographic signals were obtained during ten seconds on two conditions: rest and isometric contraction of jaw elevator muscles, for the latter condition were used two materials parafilm M ®, similar to a chewing gum, placed between the first upper and lower molars of the volunteers. Each condition was recorded three times.

The electromyographic signal processing was performed in the software Myosystem I, version 2.12, using a specific function to calculate the median frequency (Hz) in the first, fifth and tenth second of record for each condition. The comparison between muscles median frequency values was evaluated among each evaluated second. For statistical analysis the Wilcoxon test was used, with critical level of 5% ($p < 0.05$).

RESULTS and DISCUSSION

According results, no significant difference was observed in the median frequency values at rest (Figure 1), for all tested muscles. During isometric contraction of the jaw elevator muscles was observed a decrease in the median frequency values (Figure 2) between the first and tenth second, and between the fifth and tenth second recorded, for all tested muscles.

Svensson et al, in 2001, show that changes in the frequency domain may indicate electrophysiological fatigue.

According to Christensen (1979) the isometric contraction may trigger local ischemia, which may be one reason for the fatigue.

These results disagree with Caria et al. (2009) that have examined the masseter and temporal of TMD symptomatic and asymptomatic volunteers and no significant difference in MF during chewing was found, indicating the absence of muscle fatigue in their muscles.

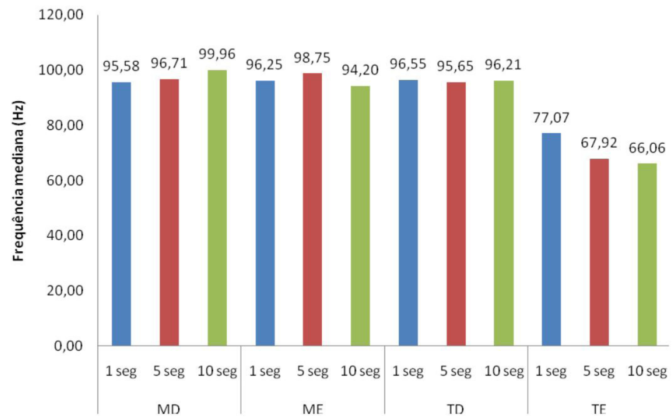

Figure 1: Comparison of the average values from median frequency (Hz) of the right masseter (MD) and left (ME), right temporal (TD) and left (TE) in the first, fifth and tenth seconds recorded at rest.

CONCLUSIONS

The results of this study confirm that the fatigue of chewing muscles is a characteristic of patients with TMD. We highlight, however, the need for further research with larger samples.

REFERENCES

1. Bérzin F. Braz J Oral Sci. 2004; 3 (10): 484-491.
2. Caria et al, 2009. Acta Odontol Latinoam. 2009;22(2):87-91.
3. Cram et al. J. Aspen Publication, 1998.
4. Christensen. J. Oral Rehabil, Oxford,1979;6:119-36.
5. Lindstrom et al. Electromyography, 4:341, 1970.
6. De Leeuw R. 4ª ed. Quintessence Co, Inc. 2008.
7. Svensson P et al. Arch Oral Biol. 2001; 46: 773-777.
8. De Bover JA et al. General Assembly of the EACD. 2007.

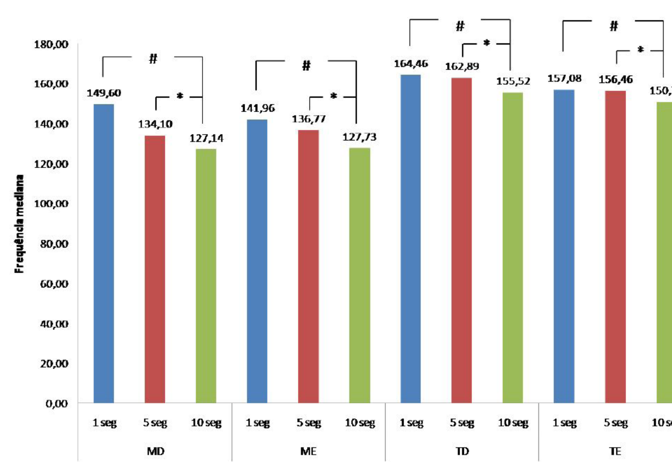

Figure 2: Comparison of the average values from median frequency (Hz) of the right masseter (MD) and left (ME), right temporal (TD) and left (TE) in the first, fifth and tenth seconds recorded during isometric contraction of the jaw elevator muscles.

152 EMG SPECTRAL ANALYSIS OF SUPERFICIAL QUADRICEPS MUSCLES DURING SUPRAMAXIMAL EFFORT IN CYCLING

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INTRODUCTION

Surface electromyography (EMG) is widely used as a tool in the analysis of muscle fatigue. Thus, different methods of spectral analysis of the EMG signal have been used (ENOKA; STUART, 1992). One of the most used tools for evaluating changes in the power spectrum from the median frequency (MF) is the Fast Fourier Transform (FFT). However, this method may not be as effective for dynamic contractions, since it considers the EMG signal to be stationary (SPARTO et al., 1999; BONATO et al., 2001).
Another method that has been used in an attempt to minimize this problem is the Wavelet Transform. This takes into account the dynamic nature of the EMG signal over time (BECK et al., 2005). However, there are several Wavelet families and their behavior during spectral analysis is not fully known, and how these differ from FFT.
Therefore, the aim of this study was to analyze the behavior of the EMG signal, using two Wavelet families (Daubechies 5 and Morlet) and compare them with the responses obtained by applying the FFT during supramaximal exercise.

METHODS

Twenty-five college students (13 men, 28.2 ± 2.7 years and 12 women, 23.2 ± 2.7 years) participated in this study, after signing informed consent form. All participants performed the Wingate Test (WT) which was chosen as the supramaximal exercise. The protocol consisted of a warming up of four minutes in the cycloergometer (MONARK® 324E, SWEDEN) with a load of 50 W and pedaling cadence of 70 rpm. After warming up, the participants started the WT, with a load corresponding to 7.5% of the participant's body mass.
The EMG signals were recorded according to ISEK guidelines. The active bipolar electrodes (TSD 150™, Biopac System®, USA), with inter-electrode distance of two cm, were placed over the superficial muscles of the quadriceps femoris (QF), vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF), integrated (VL + VM + RF / 3). The electrodes were placed according to SENIAM recommendations.
The EMG activity was recorded with a 16-channel electromiograph model MP150™ (Biopac System®, USA) with sampling frequency of 2000 Hz and common-mode rejection rate of 95 dB. The raw EMG signals were filtered (band-pass filter of 20 Hz and 500 Hz). For the spectral analyzes, we used the values of MF obtained using the short time FFT and Wavelet (Daubechies: db5 and Morlet) techniques. Through the techniques the following parameters were obtained: MF, slope of MF – EMG index of fatigue (*NFI*), and MF variance during exercise. The *NFI* was determined by the use of linear regression between the MF and duration of exercise (30 s).
The statistical analysis was performed using the *Shapiro-Wilk* test to verify data distribution, followed by the one-way ANOVA with Tuckey's *post-hoc* (P<0.05). The Bland-Altman plot was used to analyze the agreement between techniques.

RESULTS and DISCUSSION

Table 1 shows the comparison of the values from the methods. Regarding the MF and *NFI* variables, no significant differences were found between the methods employed. However, it was observed that the variance values obtained by the FFT method were significantly higher than the values obtained by db5 and Morlet wavelets. These data are in accordance with the findings of Da Silva et al. (2008) that have shown that Wavelet has less variation compared to FFT.
Figure 1 shows the Bland-Altman plot values between the different methods of analysis. Note that between the two wavelet families and FFT there was less agreement than with the wavelet families compared alone. These results show that during high intensity dynamic contractions, the Wavelet analysis shows less variability and therefore more precise information when compared to FFT (BECK et al., 2005).

CONCLUSIONS

The results show that both methods display similar physiological values. However, the variability results were lower for both wavelet families. This is demonstrated with the Bland-Altman plot that showed more accurate values for the Wavelet families.

REFERENCES

1. Beck TW, et al. (2005). J Electromyogr Kinesiol. 15,190-199.
2. Bonato P, et al. (2001). IEEE Trans Biomed Eng. 48, 745-753.
3. Da Silva RA., et al. (2008). Electromyogr Clin Neurophysiol. 48, 147-162.
4. Enoka RM, Stuart DG. (1992). J Appl Physiol. 72, 1631-1648.
5. Sparto PJ, et al. (1999). Spine. 24, 1791-8.

Table 1: Mean and standard deviation of the values obtained with the different methods.

	FFT	Morlet	Db5
MF	38.2	41.6	41.7
(Hz)	± 5.3	± 9.1	± 8.9
NFI	-0.001	-0.002	-0.002
(Hz/s)	± 0.001	± 0.001	± 0.001
Variance	56.6	42.4	37.3
(Hz)	± 37.5	± 20.2*	± 20.4*

* P< 0,05 compared to FFT.

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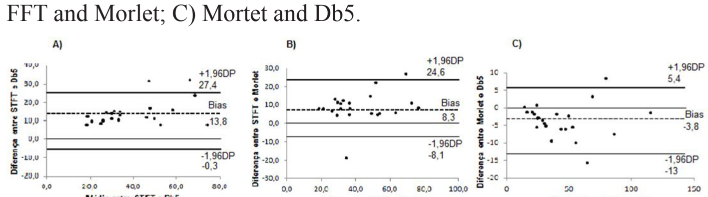
Figure 1: Bland-Altman plot for the variance values. A) FFT and Db5; B) FFT and Morlet; C) Mortet and Db5.



153 STUDY OF THE BITE FORCE, ELECTROMYOGRAPHY AND MANDIBULAR MOBILITY IN PATIENTS SUBMITTED TO SURGICAL TREATMENT OF ISOLATED MANDIBLE FRACTURES

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INTRODUCTION

Facial traumas resulting in fractures present high incidence, being the mandible the most affected bone. Researches evaluating the masticatory muscles behavior in patients with surgical treatment of mandible fractures are rare. *Tate et al.* (1994) and *Gerlach & Schwarz* (2002) evaluating patients with mandible angle fractures are some special references on literature. This study evaluated the bite force, electromyography and mandible mobility in patients submitted to a surgery for treatment of isolated mandible fractures.

METHODS

The bite force was recorded by gnathodynamometer in the region of the molars on the side of the fracture and contralateral side and between the central incisors. The electromyographic signals were captured of masseter and temporal. Evaluation of muscle activity was performed by means of electromyographic masticatory muscle register during rest and activities involving active participation of these muscles. EMG activity was normalized by the CVM.

We used electromyography Myosystem-I, coupled to computer. The mandibular mobility was assessed by measuring with a digital caliper, mouth opening, right and left laterality, and protruding jaw, all in the maximum amplitude. The sample consisted of two groups: Group 1 - Control (without fracture - ranking only) with 12 subjects, Group 2 - mandibular fracture, with 8 individuals. The fractures were treated surgically by means of IRF (internal fixation) in all cases, using access and intra or extraoral. The patients selected for labor service should have all the teeth. The follow up was 2 months for the patients. The electromyographic signals were processed in the program Myosystem - Br1 version 3.50. After scanning, the analog signals were amplified (with a gain of 1000x), filtered (band-pass filter of 0,01-1,5 kHz) and sampled by a board A / D converter of 12 bites with an acquisition frequency of 2 KHz . The raw electromyographic signal was used to derive values of EMG amplitude, obtained by calculating the root mean square (RMS). The RMS values obtained during maximal voluntary contraction were used for the normalization of values in clinical situations postural (rest, right and left laterality, protrusion and tooth clenching with parafilm).

The data from Group 2, with the values of bite force values and normalized EMG data of mandibular mobility were tabulated and subjected to statistical analysis (Repeated Measurements) using SPSS version 17.0 for Windows (SPS Inc. Chicago, IL, USA). Data Group 1, control, were used only as reference values and are in all the graphics to check the evolution of patients operated after facial trauma.

RESULTS

In the assessments, there was reduction in bite force and mandible mobility and increased EMG activity in the early postoperative period. These findings corroborate to *Gerlach & Schwarz* (2002) and *Tate et al*. (1994), as the normal function range was achieved from 2 months postoperatively. It seems obvious that mandible fractures tend to present important mandibular mobility restriction during the postoperative period, since the most important masticatory muscles are inserted to the mandible. Another important issue, as cited by *Tate et al*. (1994) and *Gerlach & Scwarz* (2002), is that it is necessary to transpose muscle fibers to surgically treat some mandible fractures (mainly masseter muscle fibers) in order to correctly align and fix the fractures with internal fixation devices. External approaches, as the retromandibular approach that transposes all the masseteric muscle, are prompters to this mandible mobility restriction in the postoperative period. *Talwar et al*. (1998) affirm that this restriction on mandible mobility can persist up to 1 year for bilateral condyle process fractures with closed or open treatment. Previously, in 1977, while evaluating unilateral condyle process fractures, Lindhal affirmed that there was great reduction on mandible mobility in post trauma.

CONCLUSIONS

Patients with isolated mandible fractures present alteration in bite force, eletromyography and mandibular mobility within postoperative period.

REFERENCES

1. Gerlach KL, Schwarz A. (2002). Int J oral Maxillofac Surg. 31, 345-348.
2. Lindahl, L, Hollender L. (1977). Int J Oral and Maxillofac Surg. 6, 153.
3. Prein J, et al. (1998). Manual of internal fixation in the cranio-facial skeleton. Berlin, Germany. 1998. 3-93.
4. Tate GS, et al. (1994).J Oral Maxillofac Surg. 52, 734-736.

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Table 1: Root mean square (RMS) of fractured mandible individuals during 2 months.

Time	1 week	2 week	3 week	4 week	2 month	Sig.
			REST			
MD	0.46±0.13	0.19±0.04	0.16±0.06	0.18±0.04	0.10±0.03	*
ME	0.43±0.10	0.26±0.05	0.26±0.05	0.28±0.06	0.12±0.04	*
TD	0.36±0.05	0.26±0.07	0.20±0.06	0.16±0.02	0.13±0.02	NS
TE	0.36±0.05	0.26±0.07	0.20±0.06	0.16±0.02	0.13±0.02	NS
			OPENING AND CLOSING			
MD	0.49±0.14	0.32±0.07	0.25±0.05	0.27±0.05	0.28±0.07	*
ME	0.50±0.11	0.39±0.09	0.30±0.06	0.38±0.07	0.27±0.06	NS
TD	0.49±0.09	0.53±0.10	0.35±0.08	0.38±0.07	0.32±0.06	NS
TE	0.27±0.05	0.34±0.15	0.27±0.06	0.27±0.06	0.27±0.05	NS
			RIGHT LATERALITY			
MD	0.45±0.12	0.32±0.06	0.21±0.09	0.24±0.16	0.09±0.04	*
ME	0.51±0.08	0.34±0.09	0.28±0.09	0.23±0.04	0.18±0.07	NS
TD	0.51±0.10	0.54±0.12	0.34±0.10	0.33±0.08	0.41±0.13	NS
TE	0.34±0.05	0.27±0.06	0.18±0.06	0.14±0.03	0.13±0.08	NS
			LEFT LATERALITY			
MD	0.48±0.12	0.23±0.04	0.19±0.05	0.19±0.04	0.16±0.05	*
ME	0.45±0.12	0.32±0.09	0.28±0.09	0.23±0.04	0.18±0.07	*
TD	0.50±0.10	0.67±0.12	0.28±0.09	0.28±0.07	0.22±0.08	*
TE	0.44±0.06	0.42±0.12	0.26±0.07	0.21±0.05	0.22±0.05	*
			PROTRUSION			
MD	0.43±0.10	0.28±0.04	0.33±0.07	0.23±0.05	0.20±0.05	*
ME	0.44±0.23	0.40±0.08	0.35±0.05	0.40±0.07	0.31±0.12	NS
TD	0.48±0.07	0.56±0.10	0.30±0.06	0.25±0.04	0.23±0.06	*
TE	0.40±0.05	0.27±0.06	0.19±0.06	0.15±0.03	0.14±0.02	*
			TOOTH CLENCHING WITH PARAFILM			
MD	1.52±0.13	1.42±0.17	1.50±0.13	1.27±0.15	1.28±0.12	NS
ME	2.11±0.34	1.60±0.17	1.82±0.26	1.35±0.14	1.35±0.15	NS
TD	1.46±0.19	1.40±0.19	1.48±0.16	1.15±0.13	1.19±0.43	NS
TE	2.13±0.37	1.58±0.25	1.55±0.20	1.27±0.13	1.14±0.12	NS

Sig * = significance; MD= right masseter muscle; ME= left masseter muscle; TD= right temporal muscle; TE= left temporal muscle; ± = standard error; NS = not significant.

154 ALTERATIONS OF THE QUADRICEPS MUSCLE POST NEUROMUSCULAR ELECTRICAL STIMULATION IN HEALTHY INDIVIDUALS AND INDIVIDUALS WITH PATELLOFEMORAL DYSFUNCTION

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INTRODUCTION

A muscle-skeletal destruction involving the knee joint is called the patellofemoral syndrome (PFS). There are orthopedic diagnoses that say 25% of these destructions are related to this pathology (POWERS et al., 1995) and, it usually affects athletes and sedentary female individuals, mainly young adults (BAKER et al., 2002; SWENSON et al., 1987 and TANG et al., 2001).

The preliminary symptom is insidious (HILYARD, 1990) and is characterized by diffuse pain in the anterior region or retropatellar of the knee (COWAN et al., 2001). The etiology of PFD is not well established, however, it suggests that the main factor results in a misalignment of the knee extensor mechanism (COWAN et al., 2001). This misalignment affects the normal joint biomechanics, causing an imbalance between the lateral and medial compartment of the quadriceps due mainly to a weak portion of the vatus medialis oblique muscle (VMO) which is considered the dynamic medial stabilizer of the knee joint (SOUZA & GROSS, 1991). Literature has suggested different techniques for the treatment of PFS, and has always emphasized the strengthening of selective VMO muscles to promote a balance in the extensor mechanism of the knee joint.

Thus, the purpose of this study was to evaluate the effect of training by means of NMES (neuromuscular electrical stimulation) in healthy individuals and patients of PFD, considering: a cross-sectional area of the quadriceps muscle, vastus medialis and adductor group by means of nuclear magnetic resonance imaging, the maximum voluntary isometric muscle force of the quadriceps muscle and electromyographic activity of the following portions of the quadriceps muscle: muscle portion of the vastus medialis oblique (VMO) and oblique portion of vast lateral muscle (VLO).

METHODS

The experiment consisted of 28 sedentary adult volunteers (14 clinically normal volunteers and 14 volunteers carrying the PFD). Two training sessions were held: one by NMES alone and another using the NMES associated with the exercise of voluntary isometric contraction of the quadriceps muscle on a leg curl machine. With this, there was a subdivision in the control (referred to as GC I and GC II) and PFD (referred to as GD I and GD II) groups.

For the selective strengthening of the vastus medialis oblique and adductor magnus muscles with an average current rate for a period of 24 days was used. The electromyographic analysis using the isometric protocol was performed with a Myosystem-BR1 of the DataHominis Technology® brand. The cell load of 100 Kgf attached to the module allowed the quadriceps muscle to be analyzed. The examination of magnetic resonance imaging enabled the calculation of the cross-sectional area of the quadriceps muscle. All evaluations were performed pre-and post-training. The Wilcoxon test was used to check the result after training and the Mann-Whitney test for intergroup analysis pre and post-training, both with a significance level of $p \leq 0.05$.

RESULTS and DISCUSSION

Cross-Sectional Area

The cross-sectional area of quadriceps muscle showed significant increase in groups GC II, with 4 and 16 cm above the upper edge of the patella and GD I, with 12 cm above the upper edge of the patella, post-training.

GD II group presented a greater section area than group GD I with 16 cm above the upper edge of the patella and 12 and 16 cm in relation to group GC I, pre-training. After the training, the groups GD I and GD II remained at a significant difference, with 12 and 16 cm of the upper edge of the patella. VM muscle increased significantly in groups GC I, with 8 cm, GC II, with 4 and 8 cm, GD I with 4 cm from the upper edge of the patella, post-training.

The thigh adductor muscle group showed a significant increase in GC II, GD I and GD II groups. Only GC I group did not present any significant difference after the proposed training.

Muscle Strength

The values of the muscular strength of the quadriceps group showed a significant increase in all groups in different positions of the knee joint after the proposed training.

Electromyographic activity

In different positions of the knee joint in all groups evaluated, the values of EMG activity in RMS of the VMO and VLO showed no statistical significant difference post-training. The group GD II and the GC I group showed higher values of the electrical signal amplitude (RMS) to the VMO muscle at 90° of knee joint flexion, pre-training.

The average frequency of the EMG signal decreased significantly in group GD I at 45° and 90°, of the knee joint flexion in the VMO muscle after training. The GD I group had a higher average value of frequency than the GD II group, at 90° of knee joint flexion to the VLO muscle, pre-training.

In relation to the variable of median frequency of the EMG signal, the GC II group showed a decrease for the VLO muscle at 60° of knee joint flexion, post-training. The same occurred with the GD I group with the VMO muscles, at 90° and the VLO 45°.

CONCLUSIONS

The therapy by means of NMES alone and its association with voluntary isometric contraction was shown to be feasible and satisfactory. Since the results showed an increase in isometric torque of the extensor group of the knee joint and muscle hypertrophy in the region of the VM muscle and adductor group. These findings are very favorable for the physical rehabilitation of patients with PFD. However, no significant results were found that prove the effectiveness of NMES in the recruitment of motor units.

REFERENCES

1. Baker V, Bennel K, Stilman B, Cowan S; Crossley, K. Abnormal knee joint position sense individuals with patellofemoral pain syndrome. J. Orthop. Res. 2002; 20:208-214.
2. Cowan SM, Bennell KL, Hodges PW, Crossley KM, McConnell L. Delayed onset of electromyographic activity of vastus medialis obliquus relative to vastus lateralis in subjetics with patellofemoral pain syndrome. Arch. Phy.Med.Rehab. 2001; 82:83-189.
3. Powers CM, Maffucci R, Hampton S. Rearfoot porture in subjetcs with patellofemoral pain. J.Orthop.Sports Phys.Ther. 1995; 22:155-160.
4. Souza DR, Gross MT. Comparison of vastus medialis obliquus: vastus lateralis muscle integrated electromyographic ratios between healthy subjects and patients with patellofemoral pain. Physical Therapy 1991; 71:310-320.
5. Swenson EJ, Hough DO, McKeag DB. Patellofemoral dysfunction. How to treat when to refer patients with problematic knees. Postgrad Med. 1987;82:125-129.
6. Tang SFT, Chen CK, Hsu R, Shih-Wei C, Wei-Hsen, H.; Lew, H.L.Vastus medialis obliquus and vastus lateralis activity in open and closed kinetic chain exercise in patients with patellofemoral syndrome: an electromyographic study. Arch. Phy.Med. Rehabil. 2001;82:1441-45.

155 EFFECT OF KINESIO TAPING ON PATELLOFEMORAL PAIN SYNDROME

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INTRODUCTION

The abnormal lateral traction of the patella is the most accepted hypothesis for the development of patellofemoral pain syndrome (PFPS), due to a neuromuscular imbalance between the vastus medialis oblique (VMO) and vastus lateralis (VL), resulting in a decrease in muscle activation of VMO. Thus, the failure or hypotrophy of the VMO muscle can lead to patella misalignment resulting in pain[1].
The techniques of functional kinesio taping are used in a clinical area in order to restore muscle function by exteroceptive stimuli, facilitating the efferent to the VMO muscle, improving neuromuscular balance, patelar alignment, resulting in improvement of pain symptoms and functional capacity[2,3].
Many studies have analysed the effect of rigid knee taping, however, there are a few studies using kinesio taping.

METHODS

Sample: 10 subjects, both genders (23.9 ± 5.4 years) with PFPS. Were excluded from this study subjects. Who showed signs and symptoms of an other pathology in the knee.
Procedures: before placing the kinesio taping evaluations were made on the variables of analysis, such as: a) pain through a numerical scale (Visual Analogue Scale – VAS), b) values of the Q angle by measurement of the longitudinal axes of the femur and tibia (Q angle) and c) functional capacity through questions with alternative closed answers (Lysholm Knee Scale). After the application of kinesio taping technique was performed in “Y” and the application area shaved. The point of origin to place the taping was in the VMO in the midline of the femur, passing through the muscle and then the tape was divided surrounding the patella and pulling it medially.
The functional taping used was Kinesio Taping, elastic adhesive tape, 5 cm in width and length determined by the therapist, depending the size of the patient. The technique aimed patellar medialization remaining the patient with his muscles of the lower limb elongated at the time of placing the kinesio taping. The subject kept with the tape for 48 hours, returning to remove the tape and re-evaluation of the same variables.
Data analysis: T – test for 2 paired samples when data showed normal. As for the data that did not follow the curve of normality the Wilcoxon test was used to determine possible significant differences ($p \leq 0.05$) between the pre and post-treatment with a kinesio taping.

RESULTS and DISCUSSION

The findings about the mean and standard error of VAS after placement functional taping was 2.0 ± 2.6 and before 0.6 ± 0.9, showing no significant difference in the reduction of pain symptoms ($p = 0.078$) [Figure 1]. Maybe it was not found significant difference because most of the subjects studied arrived for placing the elastic band with low functional scores of pain.

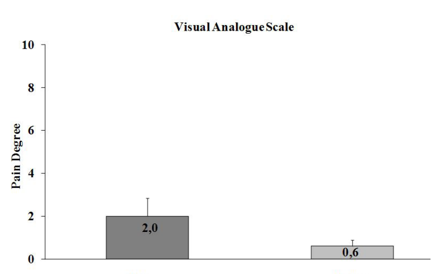

Figure 1: Values of Visual Analogue Scale (mean and standard error) after and before treatment with the kinesio taping.

As for the results of comparing pre and post-treatment as a measure of the angle Q, the mean and standard error were 19.5 ± 2.8 and 15.7 ± 2.9, showing significant difference ($p = 0.001$), [Figure 2]. The repositioning of the patella with consequent facilitation of contraction of the VMO may perhaps explain the improvement of the Q angle[3,4].

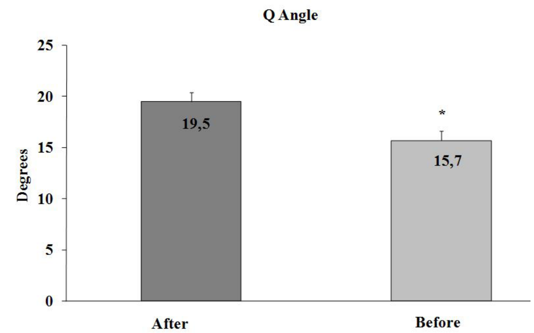

Figure 2: Values for the Q angle (mean and standard error) after and before treatment with the kinesio taping (*$p \leq 0.05$).

For Scale Knee Lysholm values closer to 100, are benefits to functional capacity. Returned results of average and deviation pre-treatment of 70.4 ± 8.2 and post 88.1 ± 6.7 , resulting in a significant improvement in functional capacity ($p = 0.000$), [Figure 3]. The improvement in functional capacity may perhaps be associated with increased proprioception through increased stimulation of cutaneous mechanoreceptors that play an important role in the detection of movement and common position[5].

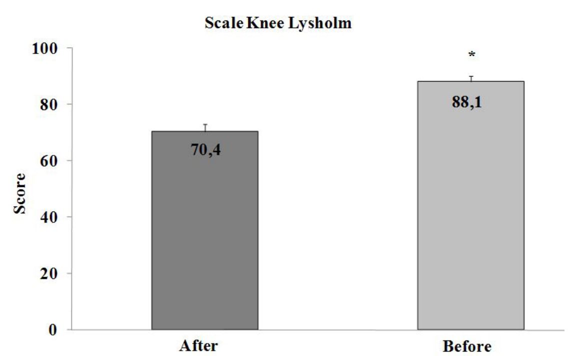

Figure 3: Values for the Scale Knee Lysholm (mean and standard error) after and before treatment with the kinesio taping (*$p \leq 0.05$).

CONCLUSIONS

The kinesio taping seems to be safe and effective in patellar realignment and improvement in functional capacity. However, despite the result of improvement in pain was not significant, the results showed a reduction of pain symptoms.

REFERENCES

1. Fonseca F, Alegre C. (2004). Rev. Port. Ortop. Traum. 12: 125-130.
2. Slupik A, Dwornik M, Bialoszewski D. (2007). Preliminary Report.
3. Sacco ICK, et al. (2006). J Electromyogr Kinesiol. 16(2), 167-74.
4. Fu TC. (2007). Journal of Sports Science and Medicine. 11, 198-201.
5. Halseth T, Mcchesney JW, Debeliso M. (2004). Journal of Sports Science and Medicine. 3, 1-7.

156 ASSESSMENT OF MASSETER AND TEMPORAL MUSCLES IN TENSIONAL TYPE HEADACHE PATIENTS – AN ELECTROMYOGRAPHIC STUDY

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INTRODUCTION

Tensional type headache is characterized by tension in the head and neck musculature, usually bilateral, leading to pain described as a pressure type of pain of mild to moderate intensity Millea and Brodie(2002); Peterson et al (1995).

Tensional type headache is known to present a difficult diagnosis. Electromyography, a tool that allows the record of muscle's electrical activity when analyzed under contraction, is an important exam to assist in the diagnosis of headaches, permitting the analysis of muscle behavior in a non-invasive manner (Biasotto-Gonzalez and Berzin, 2004; Jordy, 1995) This type of headache can be triggered by tension or unbalance of the head-neck musculature.

The aim of this present study was to assess the electromyographic activity of masseter and temporal muscles in rest position of patients presenting tensional type headache.

MATERIALS and METHODS

A screening was performed based on a selected questionnaire to select 60 volunteers, aging 18 to 26 years old who presented tensional type headache, and such volunteers were further submitted to the electromyographic exam.

RESULTS

It was observed a significant correlation between the studied muscles through the Pearson's Coefficient of Correlation, with an increase in temporal muscle activity whenever an increase in the masseter muscle electromyographic activity was observed patients presented an abnormal pattern in mandibular resting posture, and that the side of the headache was consistent with the side of increased electromyographic activity Peterson et al.,2005, reported that the main etiology of tensional type headache is the excessive muscular tension in the head and neck region. Observing the electromyographic signals from the muscles utilized in this present study, a special attention is draw to the relationship between the masticatory muscles masseter and temporal.

CONCLUSIONS

It was possible to conclude with the results that the analyzed tensional type headache volunteers presented an abnormal pattern (disharmonic unbalance) of the electromyographic activity of the masseter and temporal muscles during mandibular resting posture.

REFERENCES

1. Millea PJ, Brodie JJ. (2002). Tension-type headache. Am Fam Physician; 66(5):797-804.
2. Peterson AL, Talcott GW, Kelleher WJ, Haddock CK. (1995). Site specificity of pain and tension in tension-type headache. Headache;35(2):89-92.
3. Biasotto-Gonzalez DA; Berzin, F (2004). Electromyographic study of patients with masticatory muscles disorders, physiotherapeutic treatment (massage). Braz J Oral Sci;3(10):516-21.
4. Jordy CS. (1995). Surface Electromyograph during experimental stress as subsidy in the diagnosis of tension headache. Arq Neuropsiquiat;53(3):437-40.

Table 1 – Correlation between masseter and temporal muscles.

	Right Temporal	Left Temporal	Result
Right Masseter	0.47	0.46	Significant Correlation
Left Masseter	0.41	0.55	Significant Correlation

157 HISTOCHEMISTRY AND MORPHOMETRY MUSCLE FIBERS OF RATS SUBMITTED TO USE OF LOW POWER LASER IN REPAIR OF PERIPHERAL NERVE IN TUBULIZATION TECHNIQUE

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INTRODUCTION

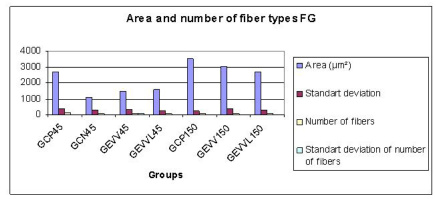
Peripheral nerves injuries with morphofunctional alterations have great clinical importance, committing the sensibility and/or the motricity. Severe researchers have come back yours attentions to search solutions for repair lesioner peripheral nerves, being tested several for such recovery. The method of tubulization, or entubulization is one of the techniques that has been widely used in research on nerve repair.In this surgical procedure the nerves stumps sectioned are intoduced and fixed in a tubular restoration, leaving a gap between the nervous termination (OLIVEIRA, *et al*. 2004). The functional diversity of muscular fibers of a muscle are directly linkage to your inervation standard, thus na histochemistry and morphometric analysis could be used for determine the effects on a muscle interventions and on nerve recovery.
The therapeutical potential of low power laser, Galium Arsenide (GaAs), is one of the resources used for the recovery of deep demages, as the muscular types, nervous injuries, and others (VEÇOSO, 1993).
As the use of vein graft for nerve repair have been great results on regenerative capacity of fiber nervous, and as they are found in abundance and in easier surgical places, it was considered verify if the low power laser (GaAs) modify the results of reinnervation, by tubulization, in extensor digitorum longus muscle (EDL).

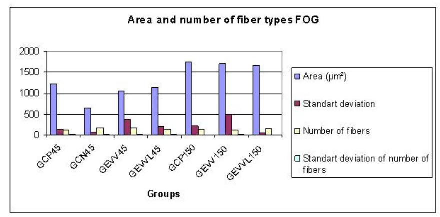
METHODS

Was used 56 rats (*Rattus norvegicus*) wistar, male, provided of Central Biothery of Bauru Dental School, São Paulo of University, the animals recieves watter and food "*ad libitum*".
The animals was separed in eight groups, with seven animals each one, being four experimental groups and four controls. All the groups had yours animals sacrified in two periods, 45 and 150 days, after beginning the experiment. In experimental groups was used the vein empty like tubulization (GEVV), and with laser tratment (GEVVL). The controls groups was called positives (GCP) when the animals will not suffer chirurgic intervation, and negatives (GCN) when the animals was submitted to sciatic nerve dennervation.
For the chirurgic, the animals were anesthetised, with intramuscular injection of ketamin and xilaszin (50mg/kg). After anesthetised, the external jugular vein was removed. In the tubulization technique was performed to remove a segment of the sciatic nerve, about 1.5 centimeters, and your site was placed in the normal vein. And in the dennervation the stumps of sciatic nerve was opposing sutured.
The laser treatment it was effected in different points of the surgey during 90 seconds, with 820-830nm of wave lenght. The aplications was realized in the post-chirurgic, and three times a week, during six weeks. After the treatment the animals was sacrificed with extreme dose of anaesthetic, for withdrawal of the EDL samples. These was congealed in liquid nitrogen and stored in freezer by -80ºC. For the histological treatment the samples was cut in a chryochamber (Leica CM1850) with a thickness of 10µm.
For the histochemistry reaction the blades was submitted to the myosin Adenosine Triphosphate reactions (m-ATPase) in pH 9.4 according to PADYKULA & HERMAN (1955), with alacline pre incubation in pH 10,3 and acid in pH 4.35 and pH 4.55 according to BROOKE & KAISER (1970), and Nicotinamide Adenin Tetrazolium Reductase (NADH-Tr) reactions, following DUBOWITZ (1973) methods. For classification of FG, FOG and SO fibers, counting and morphometry (A²), 220 muscle fibers of each animal analyzed. The analyses of the data of morphometry was submitted to the statistical test one-way ANOVA, followed for the test of Tukey.

RESULTS

The reactions of the group GCN150 could not be classified as FG, FOG and SO (Graph 1) as being characterized. In studies by histochemistry faced the difficulty of finding the type SO fibers, because the EDL muscle is composed predominantly of fast twitch fibers.





Graph 1: Area in µm² and the total number of fiber types FG and FOG. Comply with standard variance of $P < 0.05$.

The results of this research show that area of FG fibers GCN45 groups, GEVV45 and GEVVL45 no significant difference between them, but no difference for these groups GEVV150, GEVVL150, GCP45 and GCP150. The area of FOG fibers of groups GEVVL 150, GEVV150, GCP150 no difference between them, but these differences were for the group GCN45. In relation to the total fiber FG groups GCN45, GEVV45 and GEVVL150 no difference between them, but these differences were significant for the group GCP45. The total fiber FOG is a significant difference between groups GCP45 and GEVV45.
The interference of denervation in the percentage of different types of fibers, the percentage of fiber type FG decreased and the percentage of fiber FOG has increased. In relation to the average fiber area and percentage of total loss of the different types of fibers, showed that the experimental groups was close to the GCP.

CONCLUSIONS

Based in the data gotten in this research it can be concluded that the use of low power laser on the tubulization in the sciatic nerve interfere positively in the morphological characteristics of regenerating EDL muscle.

REFERENCES

1. Brooke MH, Kaiser KK. (1970). Muscle fiber types: how many and what kind? Arch Neurol,23: 369-379.
2. DubowitzV, Neerunjun J. (1973). Muscle transplantation in normal and dystrophic animals. J.Physiol,231–(2):61.
3. Oliveira EF, Mazze RN, Barbieri CH, Delbel EA. (2004). The use of a muscle graft to repair a segmentary nerve defect. An experimental study using the sciatic nerve of rats as model. J. Neurosc. Methods. 133 (1-2): 19-26.
4. Padykula HA, Herman E. (1955). The specificity of the histochemical method for adenosine triphosphatase. J Histochem Cytochem.3: 170-195.
5. Veçoso MC. (1993). Laser em fisioterapia. São Paulo: Lovise Cientifica.

158 FUNCTIONAL ANALYSIS AND MORPHOMETRY MUSCLE FIBERS OF RATS SUBMITTED TO USE OF LOW POWER LASER IN REPAIR OF PERIPHERAL NERVE IN TUBULIZATION TECHNIQUE

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INTRODUCTION

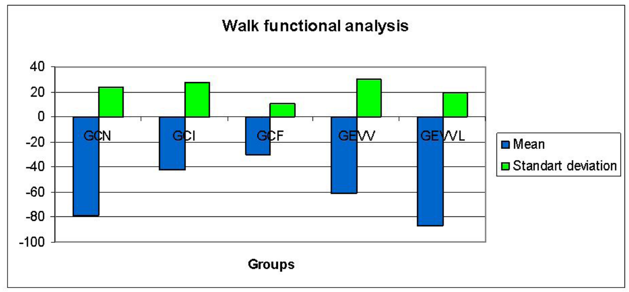
Peripheral nerve injuries followed by neurotmesis are usually repaired by suturing the two ends. This technique, however, is only possible if the injured nerve segment is a small extension. In more extensive lesions, such sutures create situations of tension, undermining the local irrigation (SUNDERLAND, 1978), necessitating the use of grafts with a technique called tubing. The method of tubulization, or entubulization is one of the techniques suggested and that has been widely used in research on nerve repair. In this surgical procedure the stumps of severed nerves are introduced and fixed in a tubular graft, leaving a space (gap) between the nerve endings (OLIVEIRA, 2004). The therapeutic potential of low-power laser, gallium arsenide (GaAs) is one of the resources used for the recovery of deep lesions, such as types of muscle, nerve, among others (VEÇOSO, 1993).
DE MEDINACELI *et al*. 1982, developed a method with the aim of developing functional assessments of nerve regeneration from the impressions of movement of the legs of animals. The objective of this study was to assess whether the laser (GaAs) alter the results of reinnervation by tubing of muscles extensor digitorum longus (EDL), assessment by means of histological and functional.

METHODS

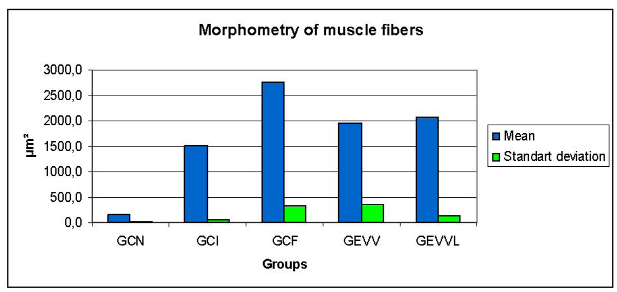
We used 35 rats (Rattus norvegicus) of Wistar strain, were obtained from the Central Biothery of Bauru Dental School, São Paulo of University, the animals recieves watter and food "*ad libitum*".
The animals were divided into five groups, consisting of seven animals each, and two experimental groups and three controls. The experimental groups had their animals slaughtered at 150 days after the start of the experiment. In the experimental groups was used tubing vein empty (gevve), and laser treatment (GEVVL). The control groups received the names of the original (GCI) when sacrificed at the beginning of the experiment, and the final group (GCF), when sacrificed at the end of the experiment, both non-surgical intervention, and negative (GCN) when the animals were underwent denervation of the sciatic nerve.
For the chirurgic, the animals were anesthetised, with intramuscular injection of ketamin and xilaszin (50mg/kg). After anesthetised, the external jugular vein was removed. In the tubulization technique was performed to remove a segment of the sciatic nerve, about 1.5 centimeters, and your site was placed in the normal vein. And in the dennervation the stumps of sciatic nerve was opposing sutured.
The laser treatment it was effected in different points of the surgey during 90 seconds, with 820-830nm of wave lenght. The aplications was realized in the post-chirurgic, and three times a week, during six weeks. For the functional analysis of the sciatic nerve were obtained from the impressions of movement of the legs of animals, following the method BAIN, et al. (1989) based on MEDINACELI DE (1982). Armed with the impressions were made the following measurements: distance to opposite foot (TOF); footprint length (PL), distance between the footprint and the midline of movement (PA), distance from first to fifth toes (TS), distance between the second and fourth toes (IT). These measures were made to the footprints of the hind limbs left and right of the same animal. Next, the authors generated a factor, since each measure running through the subtraction of values of the legs and feet normal experimental and dividing this difference by the standard measure. In the analysis, the authors used a regression to the deficit of the nerve, sciatic functional index, with a value of -100 (one hundred) in animals with sciatic nerve sectioned and zero in the control group.
After the treatment the animals was sacrificed with extreme dose of anaesthetic, for withdrawal of the EDL samples. These was congealed in liquid nitrogen and stored in freezer by -80ºC. For the histological treatment the samples was cut in a chryochamber (Leica CM1850) with a thickness of 10µm. For reaction to staining technique was performed with hematoxylin and eosin (HE), and later morphometry (A2), 220 muscle fibers from each animal were analyzed. The analysis of morphometric data was submitted to statistical test one-way ANOVA followed by Tukey test, with all the following tests $P < 0.05$.

RESULTS

The statistical analysis of data on the functional analysis of peripheral nerve (Graph 1) shows the mean values were different, statistically significant difference only between the GEVVL150 and GCF.



Graph 1. Data the functional analysis of the sciatic nerve.



Graph 2. Morphometry data of muscle fibers.

Data on the morphometry of muscle fibers (Graph 2) showed that all experimental groups compared with the group GCF, were statistically significant. And all groups showed a significant difference to the GCN. The comparison between the experimental groups did not achieve statistical significance.

CONCLUSIONS

Based in the data gotten in this research it can be concluded that the use of low power laser on the tubulization in the sciatic nerve interfere positively in the morphological characteristics of regenerating EDL muscle, but were not obtained significant data on the functional analysis of the sciatic nerve.

REFERENCES

1. Bain JR, Mackinnon SE, Hunter DA. (1989). Functional evaluation of complete sciatic, peroneal and posterior tibial nerve lesions in the rat. Plast Reconst. Surg.83: 129-138.
2. De Medinaceli L, Freed WJ, Wyatt RJ. (1982). An index of the functional condition of rat sciatic nerve based on measurements made from walking. Tracks. Exp. Neural. 77: 634-643.
3. Oliveira EF, Mazzer N, Barbieri CH, Delbel EA. (2004). The use of a muscle graft to repair a segmentary nerve defect. An experimental study using the sciatic nerve of rats as model. J. Neurosc. Methods. 133 (1-2): 19-26.
4. Sunderland S. (1978).Nerves and nerves injuries. Edinburg, Churchill Livingstone. p.483-650.
5. Veçoso MC. (1993). Laser em fisioterapia. São Paulo: Lovise Cientifica.

159 INFLUENCE OF MULLIGAN TECHNIQUE ON MUSCULAR ACTIVITY OF LUMBAR ERECTOR SPINAL MUSCLES

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INTRODUCTION

Several factors as sedentary behavior and inappropriate posture during functional activities lead most part of population to develop limitation of range of motion in the spine which can produce other limitations. Mulligan's technique aims joint arrangement as therapeutic resource for musculoskeletal disorders. The goal of this study was to evaluate the effects of Mulligan technique on muscular activity of lumbar erector spinae muscles in subjects with restriction of range of motion.

METHODS

13 male subjects with restriction of mobility in spine were assessed in the Wells chair for flexion test and the muscular activity was measured during walking on plane surface for five minutes by an electromyography tool from MIOTEC model MIOTOOL 400 of 4 channels with Miograph analysis program. Subjects underwent a Mulligan session for mobility of lumbar flexion, glide at L4, and series of 6 complete repetitions. Round and pre gelded surface electrodes from MEDITRACE were placed on lumbar erector spinae muscle according to SENIAM recommendation. After the application of the technique, subjects submitted to a new data collection as described previously. It was considered significance level of 5% and values are represented in RMS.

RESULTS

The media of muscular activity before the performance of Mulligan technique was 188.34µV for the right side and 177.65µV for the left side; and it was 179µV for the right side and 173µV for the left side after the application of the technique, with $p=0.08$. Nevertheless, it was possible to observe an important difference in the gain measured by Wells chair.

CONCLUSIONS

According to the methodological conditions utilized, this study suggests for the analyzed sample, although the subjects showed an increase lumbar mobility with Mulligan, that the technique did not modify the muscular activity during gait.

REFERENCES

1. De Luca, et al. Decomposition of surface EMG signals. Journal of Neurophysiology 2006;
2. Brian Mulligan. NAGS, SNAGS and MWM. 2002.

160 INFLUENCE OF POSITIONAL RELEASE THERAPY ON MUSCULAR ACTIVITY OF LUMBAR ERECTOR SPINAE MUSCLES IN PATIENTS WITH LOW BACK PAIN

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INTRODUCTION

Low back pain can be produced by many nosological agents and modified by psychosocial perturbation. Epidemiological studies demonstrate that 80% of adults complain about low back pain in some moment of their lives, establishing the main cause of abstention from work in the individuals on productive age group. For that reason, innumerable therapeutic resources are developed and studied focused on softening low back pain symptom and facilitating the treatment of musculoskeletal disorders involved. Among these possibilities, there is a myofascial therapy PRT (Positional Release Therapy), performed by the placement of involved tissues in the greatest position of comfort, intending the maximum reduction of tension of the muscle fibers involved. The goal of this study was to verify the influence of manual therapy technique Positional Release Therapy in erector spinal muscles during gait in patients with low back pain.

METHODS

Ten subjects (five women and five men) underwent an assessment of sensibility points of lumbar erector spinal muscles, which the most sensitive was treated with PRT technique during 90 seconds, just once each point. The analysis of muscular recruitment was evaluated through electromyography from MIOTEC model MIOTOOL 400 of 4 channels. Round and pre gelded surface electrodes of Ag/ClAg from MEDITRACE were placed on erector spinal muscle according to SENIAM recommendation. The subjects walked on a plane surface randomly for five minutes, before and after receiving the technique. It was considered significance level of 0.05% and values in RMS.

RESULTS and DISCUSSION

Before the performance of PRT technique, the media muscular activity of erector spinal was 145.33 µV for the right side and 135.33 µV for the left side; after the application of this technique, the media was 89.99 µV for the right side and 91.22 µV for the left side, with $p<0.05$.

CONCLUSIONS

Methodological conditions of this study suggest for the analyzed sample that Positional Release Therapy technique reduced the muscular activity of lumbar erector spinal muscles during gait in patients with low back pain.

REFERENCES

1. D`Ambrogio K. (1997). Terapia de Liberação Posicional. Manole
2. De Luca CJ. (1997). J Appl Biom. 13, 135-163
3. De Luca CJ, et al. (2009). J.
4. Neurophysiol. 101(3) 1620-8

161 MECHANICAL CHARACTERISTICS ANALYSIS OF THE CONTUSION INJURED RAT'S MUSCLE

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INTRODUCTION

The muscular contusion injury happens when the tissue is exposed to a high and fast compression force (JÄRVINEN et al, 2007).
The contusion injury presents high incidence between the sports injuries, especially in team sports (JÄRVINEN et al, 2007) and it's characterized by necrosis in structures as myofibrils and the basal membrane rupture, tissue hemorrhage and an inflammatory process development (MINAMOTO et al, 1999; GREFTE et al, 2007).
Related to the muscular tissue functionality there are losses in passive extension ability, as well as to generate active contractions (ALMEKINDERS, 1999), what can be related to damages in the contractile and elastic structures, reflecting in changes in the injured tissue mechanical characteristics. The present study intends to evaluate the mechanical characteristics of the contusion injured rat's muscle.

METHODS

Twenty-five male Wistar rats aged seventy days were used for the study. The animals were anesthetized and to cause the contusion injury a load was applied on the posterior region of the left paw (200 g or 300 g of weight and 30 cm of height) through an instrument created and described previously (MINAMOTO et al, 1999). The animals were divided in five groups: G1 – 200 g injured animals sacrificed 24 hours after; G2 – 300 g injured animals sacrificed 24 hours after; G3 – 200 g injured animals sacrificed three days after; G4 – 200 g injured animals sacrificed seven days after; G5 – non injured control animals.
After anesthetized the left posterior paw soleus muscle were removed, maintaining the bone origin and insertion (fibula and calcaneus). The muscle length and thickness were measured with a paquimeter (Mitutoyo, 150 mm, resolution of 0,05 mm). To the mechanical characteristics evaluation the muscle bone ends were fixed to pressure claws and there was used a mechanical machine EMIC model DL 2000 with a 50 N load cell and 2 $mm.min^{-1}$ extension velocity.
The mechanical tests force-length curves were used to reconstruct the stress-strain curves in Matlab. There were analyzed the maximum passive stress and the tissue stiffness for each muscle.
The data were analyzed through descriptive statistics with mean and standard deviation. To verify the differences between groups the non parametric Kruskal-Wallis test was applied considering the small number of individuals for group.

RESULTS AND DISCUSSION

The contusion injured muscle passive stress and stiffness were evaluated in this study. Table 1 presents mean and standard deviation to the mechanical characteristics.
There were not found significant statistically differences between the groups (p = 0.877), in other words, it seems that the protocol adopted hasn't caused any injury in the soleus muscle of the evaluated animals.
However, the results may have been influenced by the high standard deviation and the small number of individuals. Furthermore, the described contusion protocol was applied in studies that analyzed only the histological characteristics and not the mechanical ones (MINAMOTO et al, 1999). Therefore, by considering the several tissues that form the skeletal muscle (ALMEKINDERS, 1999), we can suppose that even though the injury happened, it didn't significantly damage the elastic structures responsible for the passive tension.
We should also consider that the muscle is one of the body's soft tissues and specifically the soleus muscle is a deep one (MINAMOTO et al, 1999). So, the gastrocnemius and all the connective tissues around may have just strained and spread the load, avoiding the soleus injury. For example, a study that adopted the same contusion injury protocol of the present one observed a decrease in gastrocnemius passive stress. The comented results agreed with the described (MATHEUS et al, 2008).
Even though we can highlight a smaller passive stress mean for G2. This is the only group where had been used the 300 g load for contusion injury. It presents an approximate 10% decrease comparing to the control group and between 5-10% decreases comparing to the other experimental groups. However, using the 300 g load caused bone fractures and it prevents its use, especially when the study intention is only the muscular tissue.

Table 1: Soleus muscle passive stress and stiffness mean and standard deviation for group.

Groups	Stress ($kN.m^{-2}$)		Stiffness ($kN.m^{-2}$)	
	Mean	**SD**	**Mean**	**SD**
G1	73.95	7.99	244	36
G2	68.73	4.50	240	93
G3	78.17	8.06	296	29
G4	72.39	5.49	227	98
G5	76.10	5.01	288	41

CONCLUSIONS

The adopted contusion injury protocol, even if suitable for demaging structures as myiofibrils and plasma membranes by muscle contusion injury, hasn't modified the soleus muscle mechanical characteristics evaluated.
However, the small number of individuals in each group may be a limiting factor in this study.

REFERENCES

1. Järvinen T.A.H., et al (2007). Beste Practice & Research Clinical Rheumathology, 21, 2, 317-331.
2. Minamoto V.B., et al (1999). The anatomical Record, 254, 281-287.
3. Grefte S., et al (2007). Stem cells and development, 16, 857-868.
4. Almekinders L.C. (1999). Sports Med, 28, 6, 383-388.
5. Matheus J.P.C., et al (2008). Rev Bras Med Esporte, 14, 4, 372-375.

162 ELECTROMYOGRAPHIC E AND DYNAMOMETRY OF ILIOCOSTALIS LUMBORUM MUSCLE IN INDIVIDUALS WITH RETRACTION OF THE POSTERIOR MUSCLE CHAIN AFTER GLOBAL STRETCHING

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INTRODUCTION

Stretching exercises are frequently used in rehabilitation programs and physical training sessions aiming to gain flexibility, increase movement amplitude and improve muscle performance. Among several stretching techniques, global stretching has been used to promote muscle rebalance and, thus, treat lumbalgy and postural problems caused by muscle shortening (MARQUES, 1996). Global shortening is a treatment method based on the principle of muscle chains, which involves the practice of elongation postures in which muscle groups are stretched for a prolonged period (SOUCHARD, 1986). This technique has presented positive clinical results, nevertheless, its effectiveness still lacks scientific proof.

Aiming to use EMG and dynamometry as evaluation methods for the effects of global stretching over muscle performance, the present study experiments electromyographic analysis of the iliocostalis lumborum muscle and the dynamometry of the trunk extension in patients with posterior muscle chain retraction after global stretching.

METHODS

Sixteen volunteers (8 males and 8 females), of an average age of 23.13 (±2.19) years, had their postures evaluated and went through electromyographic and dynamometric procedures before and soon after a global stretching session, where the posture was practiced while standing up and while closing the coxofemural angle, for a period of 11.69 (±3.02) minutes.

For the posture evaluation, articular angles (tibiotarsic and coxofemural) and hand-floor distance were measured to check posterior muscle chain flexibility.

For the dynamometry and electromyographic evaluation, an electromyograph EMG-800C (EMG Systems do Brasil®), composed of 4 channels, analogical to digital signal conversion plate with 12 bits resolution, sampling frequency of 2000 Hz, common mode rejection ratio greater than 100dB, signal noise level less than 3µV RMS and system impedance of 109 Ohms. The channels of the electromyograph were composed of *Butterworth* type filters with frequency bands between 20Hz (High Pass Filter) and 500Hz (Low Pass Filter). The conditioner gain was configured at 100 times, along with the 20 times gain of the active electrodes, for a total gain of 2000 times in the electromyograph channels. One of the channels was enabled for a load cell of 200Kgf. Active bipolar surface electrodes, type Ag-AgCl, circular (20mm in diameter), were bilaterally attached over the iliocostalis lumborum muscle at the level of L2, about 1 cm. from a line draw between the upper-posterior iliac spine and the lowermost point of the last rib. The reference electrode was positioned at the right lateral malleolus.

The electromyographic evaluation tests consisted of maximum voluntary isometric contraction (MVIC) of the extensor muscles of the trunk, in a decumbent prone position and in an orthostatic position. The tests in the orthostatic position were performed utilizing an exertion platform where the individuals were positioned with their trunk in an erect position, knees flexed at 10°, feet juxtaposed and upper limbs crossed in front and across the trunk. In this position, maximum and sub-maximum exertions of 30% and 60% of MVIC were carried out (KOUMANTAKIS et al., 2001; KRAMER et al., 2005; SILVA JUNIOR et al., 2005). All the samples were registered for a period of 5 seconds and, between each exercise, there was a two-minute rest. The statistical analysis of the data was carried out using the bi-caudal Wilcoxon non-parametric test at a 0.05 significance level.

RESULTS and DISCUSSION

As an immediate effect of the global stretching, posture evaluation revealed an improvement in the flexibility of the posterior muscle chain, indicated by the statistically significant reduction of the coxfemural angle (p=0.011 for males and p=0.028 for females) and the decrease of the hand-to-floor distance (p=0.012 for males and females). This results have been attributed were attributed to increased exercise tolerance and the relaxation of the viscoelastic stress of muscle tissue and, consequently, altered sarcomers length.

The dynamometry revealed a significant reduction in the torque of the extensor muscles of the trunk (Table 1), considered a signal of fatigue of muscles.

The electromyographic evaluation showed a increase the values of RMS in the MVIC as well as in the sub-maximum exertion of 30 and 60% of MVIC (Table 1). This increase of electromyographic signal amplitude after muscle stretching could be attributed to an attempt to compensate the loss of muscle force. We could also infer that the paravertebral muscle stretching favored the viscoelastic stress relaxation and, thus, modified the length of sarcometers, harming the production of muscle force.

CONCLUSIONS

As an immediate effect of the global stretching, was observed an improvement in the flexibility, the reduction of the torque of trunk extensors paravertebral muscles and to increase the amplitude of electromyographic signal of iliocostalis lumborum muscle.

REFERENCES

1. Marques AP. (1996). Escoliose tratada com Reeducação Postural Global. Revista de Fisioterapia da University from São Paulo, 3, ½, 65-68.
2. Souchard PE. (1986). Reeducação postural global: um método do campo fechado. Ícone, São Paulo.
3. Kramer M, et al. (2005). Surface electromyography of the paravertebral muscles in patients with chronic low back pain. Arch. Phys. Med. Rehabil., 68, 31-36.
4. Koumantakis GA, et al. (2001). Paraspinal muscle EMG fatigue testing with two methods in healthy volunteers. Reliability in the context of clinical applications. Clinical Biomechanics 16, 263-266.
5. Silva Jr RA, et al. (2005). Back muscle strength and fatigue in healthy and chronic low back pain subjects: a comparative study of 3 assessment protocols. Arch. Phys. Med. Rehabil., 86, 722-729.

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Table 1: Electromyographic evaluation and dynamometry of males and females (pre and post-stretching)

	Average and standard deviation		
Variables of males	Pre-stretching	Post-stretching	p value
Load (Kgf.)	83.70 (± 16.43)	76.20 (± 12.14)	0.036*
30% of MVIC LICL	26.09 (± 5.35)	38.37 (± 9.47)	0.012*
	Average and standard deviation		
Variable of females	Pre-stretching	Post-stretching	p value
30% of MVIC LICL	30.38 (± 14.59)	40.59 (± 14.75)	0.012*

*Significance level $p< 0.05$
MVIC - Maximum Voluntary Isometric Contraction
RICL - Right Iliocostalis Lumborum
LICL - Left Iliocostalis Lumbarorum

163 FACIAL HERPES ZOSTER: DIAGNOSIS AND TREATMENT

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INTRODUCTION

The majority of patients, who develop a Facial Herpes Zoster, is immunocompromised or are over 60 years old (DONAHUE *et al*., 1995) .The Herpes Zoster may affects several cranial nerves. The most affected is the seventh one followed by the eighth one and, in some cases, branches of superficial cervical plexus (ASNIS *et al*., 1996).

Clinically, it might be possible to observe some manifestations such as pre auricular facial pain, paresis or facial palsy followed or not by deafness, vertigo and occipital pain (MUELLER *et al*., 2008). The chosen treatment is the antiviral associated, in most of cases, with corticosteroids (USCATEGUI *et al*., 2008).

Objective: Describe the clinical aspects, diagnosis and therapy for a case of Facial Herpes Zoster.

METHODS

A patient, male, 72 years old, sought care due to a degree 10 of facial pain defined by Visual Analogic scale (VAS=10) that his pain has been presented for 15 days. The pain quality was an electrical shock type, short duration, evolving the auriculotemporal branch of trigeminal nerve and the auricular major nerve of superficial cervical plexus on the right side.

Hemifacial palsy was seen on the same side associated to this pain condition. The same manifestations were evaluated by a neurologist and otorhinologist who asked, respectively, for tomography of a cranial base and ear examination, audiometry, impedanciometry and other exams without detecting any alterations on those. These professionals recommended an ophthalmic solution for 3 times a day and the use of ocular dressing during the night.

Considering the location, quality, duration, and clinical manifestations of pain, it was applied a treatment based on acyclovir 800mg, 5 times per day for 10 days. When the patient came back for a follow up, it was recommended a physiotherapy treatment as an additional therapy.

RESULTS and DISCUSSION

The treatment based on antiviral associated with a physiotherapy program has been used for 2 years. Combination of clinical therapy and medicines resulted in a dramatic improvement of a facial pain (AVS=0), but asymmetry of bucal branch of facial nerve on the right side was still present.

CONCLUSIONS

- The facial Herpes Zoster is pathology of disabling character and in some cases leads to a blindness and starts a social avoidance caused by a person who has this condition.
- The diagnosis and early treatment seems to be directly related to a successful treatment.

REFERENCES

1. Asnis DS, et al. (1996). Cutis. 57, 421- 424.
2. Donahue JG, et al. (1995) Arch Intern Med. 155, 1605–1609.
3. Mueller NH, et al. (2008). Neurol Clin. 26, 675.
4. Uscategui T, et al. (2008). Cochrane Database of Systematic Reviews. 3, CD006852.

164 ELECTROMYOGRAPHIC ACTIVITY OF THE STERNOCLEIDOMASTOID MUSCLE IN INDIVIDUALS WITH DENTOFACIAL DEFORMITIES

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INTRODUCTION

Dentofacial deformity is characterized by a change in dental occlusion associated with an alteration of the facial skeleton, with important consequences for stomatognathic system function.
According to Angle, malocclusions can be divided into skeletal classes I, II and III. They refer to the relative position of the mandible and the maxilla on the sagittal plane, with predetermined cephalometric points being used as reference (BIASOTTO-GONZALEZ, 2005).
An intimate relation exists between the masticatory system and the cervical region. In the presence of poor mandibular posture (malocclusion), the position of the head and neck is also altered. Thus, disequilibrium at the level of the occlusal support provokes changes in the activity of the sternocleidomastoid (SCM) muscle which is an important positioner of the head, as well as of other muscles that influence head and neck posture (GRADE et al., 2008).
On this basis, the objective of the present study was to determine whether dentofacial deformities influence the electromyographic activity of the ECM muscle.

METHODS

The present study was approved by the Research Ethics Committee of the University Hospital, Faculty of Medicine of Ribeirão Preto, University of São Paulo (Protocol HCRP n° 2513/2007). Twenty-five patients of the Craniomaxillofacial Surgery Outpatient Clinic, Integrated Center of Study of Facial Deformities, HCFMRP-USP, participated in the study as the group with dentofacial deformities. Ten patients with a diagnosis of class II dentofacial deformity were assigned to deformity group (DG)-II and 15 patients with a diagnosis of class III dentofacial deformity were assigned to DG-III. Fifteen volunteers with no changes in facial morphology or in dental occlusion were assigned to the control group (CG).
All subjects were submitted to bilateral electromyographic evaluation of the SCM muscle during right and left head rotation with a Myosystem-Br1 eight-channel computerized electromyograph. Two channels of the system were used for the electromyographic recording. After the volunteer was positioned in each clinical condition, the electromyographic recording was fired for a period of 5 seconds. *The Myosystem* I program, version 3.5 was used for signal visualization and processing.
After all the recordings were obtained, the root men square (RMS) values were calculated in µV for each muscle individually in the two situations. The nonparametric Kruskal-Wallis test was used to analyze statistically the differences between groups.

RESULTS and DISCUSSION

A significant difference was detected in the right SCM muscle in the situation of right head rotation, with significantly higher values in DG-III compared to CG and DG-II ($p = 0.04$). However, according to the literature, the right SCM muscle should not have presented higher electromyographic activity during right rotation since its greater muscular activity should occur on the muscle opposite to the movement (MOORE; DALLEY, 2007).
Taking into consideration the muscular actions of the SCM muscle and the postural changes of head and neck suggested in patients with dentofacial deformities, it would be logical to state that class II and III individuals should have higher SCM muscle activity. However, Tecco, Caputi, Festa (2007) and Ferrario et al. (2006) did not detect a relation between the presence of dentofacial deformity and changes in the electrical activity of the SCM muscle. Nevertheless, class I individuals presented a more homogeneous electromyographic activity than class II and III individuals.
Although Ferrario et al. (2006) performed electromyographic analysis with maximal head rotation, they did not use these values to associate malocclusion with electrical activity of the SCM muscle, but rather to compare the electrical activity of the SCM muscle in head rotation to electrical activity during maximal tooth clenching. On this basis, no literature studies have compared the association of malocclusion with electrical activity of the SCM muscle in head rotation.

CONCLUSIONS

We may state that class III dentofacial deformity influenced the electromyographic activity of the right SCM muscle in the situation of right head rotation but not in the situation of left head rotation. The deformity also did not influence the electromyographic activity of the left SCM muscle on right or left head rotation.

REFERENCES

1. Biasotto-Gonzalez DAB. (2005). Abordagem Interdisciplinar das Disfunções Temporomandibulares. São Paulo: Manole. 34, 41, 62, 63 and 109.
2. Ferrario VF, et al. (2006). The influence of occlusion on jaw and neck muscle activity: a surface EMG study in healthy young adults. J Oral Rehabil, v. 33, n. 5, 341-348.
3. Grade R, et al. (2008). Postura e disfunção temporomandibular: controvérsias atuais. Rev Port Estomatol Cir Maxilofac, v. 49, n. 2, 111-117.
4. Moore KL, Dalley AF. (2007). Anatomia orientada para a clínica. 5. ed. Rio de Janeiro: Guanabara Koogan, 972-973.
5. Tecco S, et al. (2007). Electromyographic activity of masticatory, neck and trunk muscles of subjects with different skeletal facial morphology – a cross-sectional evaluation. J Oral Rehabil, v. 34, n.7, 478-486.
6. Svensson P, et al. (2004). Associations between pain and neuromuscular activity in the human jaw and neck muscles. Pain, v. 109, n. 3, 225-232.

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165 INFLUENCE OF MUSCLE PAIN ON THE ELECTROMYOGRAPHIC ACTIVITY OF THE STERNOCLEIDOMASTOID MUSCLE IN INDIVIDUALS WITH AND WITHOUT DENTOFACIAL DEFORMITIES

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INTRODUCTION

Severe malocclusion problems, denoted dentofacial deformities, require combined orthodontic and orthognatic surgical treatment, as well as work directed at the functions of the stomatognathic system. According to Angle, malocclusions can be divided into skeletal classes I, II and III. They refer to the relative position of the mandible and the maxilla on the sagittal plane, with predetermined cephalometric points being used as reference (BIASOTTO-GONZALEZ, 2005).
An intimate relation exists between the masticatory system and the cervical region. In the presence of poor mandibular posture (malocclusion), the position of the head and neck is also altered.
Thus, we may assume that individuals with dentofacial deformities (class II or III) are prone to the development of cervical spine dysfunction and consequently to muscle pain upon palpation.
There are two main theories explaining the effect of pain on muscle activity: the vicious cycle theory and the model of adaptation to pain. The former states that pain leads to increased muscle activity and the latter proposes that this change in muscle activity limits the movements and protects the sensorimotor system from other lesions (MURRAL; PECK, 2007).
On this basis, the objective of the present study was to determine whether the presence of pain influences the electromyographic activity of the sternocleidomastoid (SCM) muscle in individuals with and without dentofacial deformities.

METHODS

The present study was approved by the Research Ethics Committee of the University Hospital, Faculty of Medicine of Ribeirão Preto, University of São Paulo (Protocol HCRP n° 2513/2007). Forty volunteers participated in the study. Twenty-five of them were patients of the Craniomaxillofacial Surgery Outpatient Clinic, Integrated Center of Study of Facial Deformities, HCFMRP-USP, with a diagnosis of class II (N = 10) and class III (N = 15) dentofacial deformity. Fifteen volunteers with no changes in facial morphology or in dental occlusion were assigned to the control group.
The study subjects were divided into two groups: with muscle pain (N = 26) and without muscle pain (N = 14).
All subjects were submitted to bilateral electromyographic evaluation of the SCM muscle during right and left head rotation with a Myosystem-Br1 eight-channel computerized electromyograph. Two channels of the system were used for the electromyographic recording. After the volunteer was positioned in each clinical condition, the electromyographic recording was fired for a period of 5 seconds. The Myosystem I program, version 3.5 was used for signal visualization and processing.
After all the recordings were obtained, the root mean square (RMS) values were calculated in µV for each muscle individually in the two situations.
The SCM muscle was palpated bilaterally. The patient, wearing clothing that would permit access to the muscles analyzed, sat on a chair and was instructed by the examiner to raise his hand when he felt pain at the site that was being palpated. The nonparametric Mann-Whitney test was used for statistical analysis of the data.

RESULTS and DISCUSSION

The electromyographic activity of the right SCM muscle was found to be higher in individuals with muscle pain in the situation of eccentric muscle contraction (right head rotation), with significantly higher values being observed in the group with muscle pain compared to the asymptomatic group ($p = 0.01$).
Previous studies have stated that hyperactive muscles are associated with pain symptoms. Thus, we may assume that symptomatic individuals have a higher electromyographic activity than asymptomatic individuals (MAJEWSKI; GALE, 1984). However, Majewski and Gale (1984) did not detect differences in electromyographic activity of the anterior temporal muscle between symptomatic and asymptomatic subjects.
Svensson et al. (2004) observed that the induction of pain in the right masseter was associated with increased electromyographic activity of the right masseter, SCM muscle and splenius with the head in the resting position. The induction of pain in the splenius was associated with increased electromyographic activity of this muscle with the head in the resting position and with reduced electrical activity of the SCM muscle with the head in right rotation.
It can be seen that different methodologies are used to analyze the relation between pain and muscle activity. Also, the results obtained in the various studies are contradictory or heterogeneous, i.e., pain affects muscle activity in some muscles and in some clinical conditions, but not in others.

CONCLUSIONS

On the basis of the results obtained, we may state that the presence of pain influenced the electromyographic activity of the SCM muscle, with significantly higher values for the group with muscle pain compared to the asymptomatic group.

REFERENCES

1. Biasotto-Gonzalez DAB. (2005). Abordagem Interdisciplinar das Disfunções Temporomandibulares. São Paulo: Manole. 34, 41, 62, 63 e 109.
2. Majewski RF, Gale EN. (1984). Electromyographic activity of anterior temporal area pain patients and non-pain subjects. J Dent Res, v. 63, n. 10, 1228-1231.
3. Murray GM, Peck CC. (2007). Orofacial pain and jaw muscle activity: a new model. J Orofacial Pain, v. 21, n. 4, 263-288.
4. Svensson P, et al. (2004). Associations between pain and neuromuscular activity in the human jaw and neck muscles. Pain, v. 109, n. 3, 225-232.

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166 STATIC BALANCE ASSESSMENT IN ELDERLY WOMEN WITH KNEE OSTEOARTRHITIS

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INTRODUCTION

Functional decline of the musculoskeletal system and the central and peripheral nervous system, which impairs the postural control, is a common condition in the aging process. Also, the sway could be more affected in many disabilities, increasing the risk of falls and medical complications. (Shumway-Cook and Woollacott, 2003).
People with osteoarthritis (OA) might present loss of the range of motion, decrease of muscular strength and muscular power and proprioception alterations, all these factors interfere negatively in the sway maintenance (Hammerman, 1995).
Therefore, the objectives of this pilot study were to answer the following questions: Is the static balance impaired by the OA? Is there any correlation between the postural instability in elderly women and history of falls?

METHODS

We evaluated the static balance in 15 elderly women with age between 65 and 85 years. The study was divided into two groups: Group 1 (n=9) consisting of women without knee OA (control group) and Group 2 (n=6) included women with knee OA. These groups were subdivided into: 1A (n=5) and 2A (n=3) including elderly women with history of fall and also 1B (n=4) and 2B (n=3) including elderly women without history of falls.
Exclusion criteria were clinical conditions that can interfere to the postural control, such as cardiorrespiratory and neurological diseases, vestibulopathies, diabetes mellitus, bone fracture history, history of hip, knee or ankle surgery, a body mass index bigger than 40, use of walking aid, implants or prosthesis in the lower limbs, use of corticosteroids in the knee in the last 3 months and use of drugs to the Central Nervous System. The control group did not present any sign or symptom of OA in the lower limbs.
Static balance was evaluated in four upright postural situations, using a force platform (EMG System, Brazil): on stable platform and on unstable platform (a foam surface: density of $30g/dm^3$, measuring 5 cm height, 50 cm width, and 50 cm length) with closed and opened eyes. The patients stayed up in the force platform barefooted and with their foots separates at shoulder level and with the arms along the body. The evaluations were performed twice in each posture.
Data from the static balance were processed and analyzed by the same manufacturer's software. The variables analyzed were the following: mean antero-posterior oscillation amplitude (APOA), consisting of mean oscillation of centre of pressure (CoP) towards the antero-posterior direction and mean medio-lateral oscillation amplitude (MLOA), consisting of mean oscillation of CoP towards the medio-lateral direction.
Shapiro-Wilk and Levene tests were used for checking the normality of the distributions and for checking the homogeneity of variance, respectively. Six analysis by the ANOVA test were used. Two ANOVA had control group and OA group as factor. The first and the second had APOA and MLOA as dependent variables, respectively. The third (control group) and fourth (OA group) ANOVA had falls (with and without) as factor and APOA as dependent variable. The fifth (control group) and sixth (OA group) had falls (with and without) as factor and MLOA as dependent variable. Analyses were conducted by using SPSS statistical software (SPSS for Windows, version 10.0 – SPSS Inc) and the significance level was set at 0.05.

RESULTS AND DISCUSSION

The first ANOVA showed difference between groups in the fixed platform with eyes opened [$F(1.13) = 20.56$, $p<0.05$] and unstable platform with eyes opened [$F(1.13) = 5.79$, $p < 0.05$]. The OA group presents greater APOA values when compared to the control group.
The second ANOVA showed no differences in the MLOA between groups 1 and 2.
The third and fifth ANOVA showed no differences in the APOA and MLOA between groups 1A and 1B, respectively.
The fourth and sixth ANOVA showed no differences in the APOA and MLOA between groups 2A and 2B, respectively.
In the study performed by Hinman et al. (2002) the static balance was analyzed in elderly women with and without knee OA using a SwayMeter and it was observed that the knee OA group presents a greater antero-posterior body sway when standing on a stable surface with closed eyes (P=0.04). Also, they observed a greater sway in the medio-lateral direction on the stable floor with eyes opened (P = 0.01) in the OA group.
The APOA and MLOA with closed and opened eyes might be useful in order to identify women with risk of falls (Piirtola & Era, 2006). However, in the present study there were no differences in the static balance when compared women with and without history of fall.
Pajala et al (2008) observed in their study that the APOA analysis was capable of predict risk of falls. In our study, we also observed a significant difference between the group with and without knee OA in the APOA situation.

CONCLUSION

The elderly women with knee OA had a greater APOA values when compared to the control group, which suggests that the presence of knee OA increases the risk of falls
The limitation of this study is the small number of participants, due to the fact that this study has not finished yet. The increase of the number of participants is necessary to confirm this finding.

REFERENCES

1. Hammerman D. (1995). Ann Rheum Dis 54:82–85.
2. Hinman, et al. (2002). Rheumatology 41:1388–1394
3. Pajala S, et al. (2008). J Gerontol A Biol Sci Med Sci 63 (2): 171–178.
4. Piirtola M, Era P. (2006). Gerontology 52: 1 16.
5. Shumway-Cook A, Woollacott MH. (2003). Controle Motor- Teoria e aplicações práticas. 2 Edição.
6. Van Baar ME, et al. (1999). Arthritis Rheum 42: 1361–9.

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167 INFLUENCE OF TAPPING IN ELECTROMYOGRAPHIC ACTIVITY OF THE VMO IN PATIENTS WITH PATELLOFEMORAL PAIN SYNDROME

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INTRODUCTION

The patellofemoral pain syndrome (PFPS) is one of the most common clinical conditions in the knee, whose symptoms are usually diffuse pain in the anterior and / or retropatellar. Despite its multifactorial etiology is known that among many other factors, there is a change in the activation of the vastus medialis oblique (VMO) relative to vastus lateralis (VL). Thus, with the aim of achieving a better recruitment of the VMO muscle, several studies have been done and many techniques are being proprostas, among them, tapping the patellar. However, the effects of this technique in the activation of the VMO and VL in those subjects are not yet conclusive. Considering the lack of consensus in the literature and the scarcity of studies on the effect of the patellar tapping the purpose of this study was to assess by evaluating electromyographic (EMG) the effect of the medial patellar tapping amplitude and time early activation (onset) of VMO relative to VL in patients with the PPS.

METHODS

This is a quasi-experimental study in which women were selected, with a mean age of 22 years. These were divided into two groups based on the absence or presence of the syndrome, namely: control group of 10 asymptomatic volunteers and experimental group composed of 10 patients with PPS. This study was conducted at the Laboratory of Neuromuscular Performance Analysis, Department of Physical Therapy, Federal University of Rio Grande do Norte. For the analysis of variables onset and magnitude of activation (RMS), we used a conditioner module, 8 channels (EMG System do Brazil Ltda), interfaced with a microcomputer, and software for digital signal analysis, AqDados (version 5.0). The signals were picked up by surface electrodes simple differential active (EMGSystem of Brazil Ltda), formed by two rectangular parallel bars of Ag / AgCl, separated by a distance of 1 cm and a reference electrode oval claw type was used. Active electrodes were placed over the muscle belly of the VMO and VL following the criteria of SENIAM and the reference electrode on the back of the hand of the volunteers. In addition, we used a universal goniometer, isokinetic dynamometer for normalization of the EMG signal during isometric activity of the quadriceps muscle, fiximul hypoallergenic bandage (5.0 cm wide) and a rigid (3.8 cm wide) for the brand Vulkan completion of patellar tapping and a step. During data collection, participants from both groups underwent an EMG evaluation before and during application of patellar tapping, the activity increase in step. The medial patellar tapping was applied using the technique of McConnell, seeking to correct the sliding of the patella (glide). It was initially applied to bandage hypoallergenic across front knee directly over the skin, making a little traction in the medial patella. Soon after the bandage was applied to rigid and fixed the edge of the patella to the medial knee, holding a sharp pull of the patella.

RESULTS and DISCUSSION

The study showed that during the application of medial patellar tapping in individuals with PPS, a significant increase of the ratio of electrical activity in VMO: VL ($p = 0.005$) (Figure 02) and the relative onset of VMO-VL ($p = 0.026$), to perform the exercise of stepping-up, compared with the performance of the same year before the application of tapping. This shows that there was an increase in the intensity and anticipation of the start time of activation of the VMO relative to VL in the application of patellar tapping in subjects with PFPS.

CONCLUSIONS

The results of this study suggest that medial patellar tapping would be appointed to assist in the treatment of PPS, and can contribute positively in the rehabilitation of these patients

REFERENCES

1. [1] Aminaka, Naok Gribble, Phillip A. A Systematic Review of the Effects of Therapeutic Taping on Patellofemoral Pain Syndrome. Journal of Athletic Training 2005;40(4):341–351
2. [2] Crossley, Kay; Bennel, Kim; Green, Sally; Cowan, Sallie; Macconnel, Jenny. Physical Therapy for Patellofemoral Pain a Randomized Double-Blinded Placebo-Controlled Trial. American Journal of Sports Medicine, Vol. 30, No. 6, 2002.
3. [3] Gramani-Say K; Pulzatto, F; Santos, G.M; Vassimon-Barroso, V., Siriani, Oliveira A.; BevilaquA-Grossi, D.; Monteiro-Pedro, V. Efeito da rotação do quadril na síndrome da dor femoropatelar. Rev. bras. fisioter. Vol. 10, No. 1 (2006), 75-81.
4. Laprade, Judi; Culhan, Elsie. Radiographic Measures in Subjects Who Are Asymptomatic and Subjects With Patellofemoral Pain Syndrome. Clinical Orthopaedics and related research, 414, pp. 172–182. 2008
5. Yoon, K.; Fredericson, M. Physical examination and patellofemoral pain syndrome. Am J Phys Med Rehabil 2006;85:234–243.

168 THE EFFECT OF ANTIDEPRESSIVE AND ANTIPSYCHOTIC DRUGS ON MASTICATORY FUNCTION IN INDIVIDUALS WITH SCHIZOPHRENIA AND AFFECTIVE DISORDERS

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INTRODUCTION

The masticatory function occurs due to the interrelationship between various organs of the stomatognathic system, proprioception, brain centers and occlusal function. Any change in the occlusion information or masticatory muscles can affect the pattern of their movements and the masticatory efficiency. Drugs used in psychiatric disorders treatment are influent on muscular system as a whole. The use of antidepressant and antipsychotic medications causes chronic and acute motor collateral effects that appear on around 20% treated patients (Marchese et al., 2002).

METHODS

The aim of this study was to compare the sEMG activity of the masticatory muscles during habitual mastication between 20 individuals with schizophrenia (GI), 20 individuals with affective disorders (GII) and 40 controls (GIII). The sEMG analysis was performed using a EMG MyoSystem-BR1 with differential active electrodes (silver bars 10 mm apart, 10 mm long, 2 mm wide, 20x gain, input impedance 10 GΩ and 130 dB common mode rejection ratio). Surface differential active electrodes were placed on the skin, bilaterally on both masseter and temporal muscles. A ground electrode was also used and fixed on the skin over the sternum region. The sEMG signals were analogically amplified with a gain of 1000x, filtered by a pass-band of 0.01-1.5KHz and sampled by a 12-bit A/D converter with a 2 KHz sampling rate. The habitual chewing was verified through the sEMG signal obtained during chewing of five peanuts and five raisins. The electromyographic signals of all the masticatory cycles were collected in three replicates of ten seconds, intercalated by two minutes of rest and, after this process, it was used the mean value. The masticatory efficiency of cycles between individuals was evaluated by the ensemble average of the electromyographic signal, and this value was obtained in microvolts/second, during the time. The values of ensemble average were normalized by the value of the electromyographic signal of maximum dental clenching, harvested by four seconds. The electromyographic means were tabulated and subjected to statistical analysis using ANOVA (SPSS 17.0).

RESULTS

The psychiatric individuals presented higher EMG activity than control individuals with a statistical significance between groups (Table 1) ($p<0.05$).

CONCLUSIONS

The data allow us to conclude that the mental health medication had a stronger influence on the masticatory muscles activity, causing an exaggerated recruitment of muscle fibers to perform a dynamic activity. The results may provide valuable data to be considered when choosing one of these treatments for psychiatric patients, which will improve their quality of life.

REFERENCES

1. Marchese G, Casu MA, Bartholini F, Roiu S, Saba P, Gessa GL, Pani L. (2002). Sub-chronic treatment with classical but not atypical antiphsychotics produces morphological changes in rat nigro-striatel dopaminergic neurons directlyrelated to “early onset” vacuous chewing. Eur J Neurosc, 15(7): 1187-96.

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Table1: Normalized sEMG activity of the masseter and temporalis muscles according the mastication task. All data presented statistical significance between the groups ($p<0.05$).

Group	Masseter		Temporalis	
	Right	Left	Right	Left
Raisins GI	2.23	2.66	1.78	1.54
Raisins GII	2.14	2.07	2.72	1.71
Raisins GIII	1.41	1.19	1.18	1.32
Peanuts GI	2.94	2.75	2.14	1.78
Peanuts GII	3.37	3.2	2.62	2.2
Peanuts GIII	2.4	2.03	1.72	2.02

169 ANALYSIS OF ELECTROMYOGRAPHIC RESPONSE AFTER THE APPLICATION OF CRYOTHERAPY ON THE ANKLE: PRELIMINARY DATA

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INTRODUCTION

Cryotherapy is considered one of the most common techniques for the treatment of skeletal muscle lesions. However, it is known that its use can cause nervous alterations, such as the reduction of the nerve conduction velocity (ALGAFLY & GEORGE, 2007) and the inhibition of nociceptors (SAEKI, 2002).
These alterations could have a negative effect on the neuromuscular control, and consequently, predispose some lesions. In this respect, Uchio et al. (2003) observed the need for caution when someone returns to practicing exercises after the use of cryotherapy.
Thus, the objective of this study was to evaluate the electric response of the tibialis anterior (TA) and the medium gluteus (MG) muscles after the application of ice on the ankle articulation of healthy women.

METHODS

A total of 6 healthy, sedentary women with no history of sensitive and/ or osteomioarticular disease in the lower limbs participated in the study. This project was approved by the Research Ethics Committee of the College of Medicine of Ribeirão Preto – USP (protocol 635/2009).
The responses of the TA and MG muscles were collected through the EMG-1000 (Lynx® Tecnologia Eletrônica) signal acquisition module connected to a desktop computer through optical fiber (GUIRRO ET AL., 2006). The system was connected to a battery isolated from the electric power to cancel out interferences.
To collect the muscular signal, differential surface electrodes (Lynx® Tecnologia Eletrônica), pure silver, were used. The electrodes presented a pre-amplifier circuit with gain of 20 times (±1%), IRMC > 100 dB and signal noise ratio < 3 μV RMS, a total gain of 1000.
The signal acquisition of TA and MG muscles of the non-dominant limb was carried out while the volunteer kept her balance in unipodal position with the contralateral limb flexed at 90º, for 6 seconds. This procedure was performed pre, immediately (PO), and 30 minutes (P30) after the ice application. At the same time period, the ankle temperature was taken by a digital infrared thermometer with LASER (Incoterm®) sight. To do so, the temperature of the malleolus and the median points was measured between them (anterior and posterior) using the median values obtained as results. For the cryotherapy application, 1.5 kg of crushed ice was used. It was positioned around the ankle for 30 minutes.
After collecting data, they were processed in routines implemented on the *Matlab® 6.5.1.* software by means of median frequency in hertz (Hz) and the RMS (*Root Mean Square*) in micro volts (μV). Data were normalized by the maximum volunteer isometric contraction (MVIC) with values presented as percentage (%MVIC).
For the data analysis, the Shapiro-Wilk normality and the t-student tests were used for the related samples.

RESULTS and DISCUSSION

The volunteers´ anthropometric data are shown in Table 1:

Table 1: Mean values ± standard deviation of the anthropometric data

	Mean	SD
Age (years)	22.83	1.72
Height (m)	1.68	0.1
Weight (kg)	60.93	8.26
BMI (kg/m2)	21.62	2.17
Adipometry (mm)	13.3	4.34

BMI: body mass index; SD: standard deviation

The initial average temperature of the ankle (pre) was 29.39±1.22°C, decreasing significantly ($p<0.0001$) to 8.39±0.65°C immediately after the application (p0). After 30 minutes (p30), the temperature increased substantially when compared to p0 ($p<0.0001$), reaching 21.41±0.82°C, although still above the pre one ($p<0.0001$).
With regard to the electromyographic signal of the TA and MG muscles, Table 2 shows the results obtained in this study.

Table 2: Mean value of the median frequency (MF) and the normalized root mean square (RMS) of the tibialis anterior (TA) and gastrocnemic-medial portion (MG) muscles, pre, immediately (P0) and 30 minutes after (P30) the cryotherapy application.

		RMS	MF
TA	PRE	18.78±10.04	71.27±25.91
	P0	24.39±8.25*	70.75±15.33
	P30	18.19±8.48	71.29±22.19
MG	PRE	25.82±9.02	117.54±22.86
	P0	20.78±8.14	109.20±13.45
	P30	16.65±7.49*	113.98±32.28

*significant difference compared with the pre ($p<0.05$).

This study showed a significant increase ($p<0.05$) in the electromyographic signal amplitude of the TA muscle immediately after the cryotherapy application, in unipodal position in women. This result suggested that the decrease of temperature in the ankle was enough to alter the sensory-motor control of this articulation.
This decrease of neuromuscular control was due to the effects created by the reduction of the nerve conduction velocity (ALGAFLY & GEORGE, 2007) and the loss of sensation of the ankle position (HOPPER, 1997). Thus, with the reduction of the articular feed-back, the TA presented an increase in its activation amplitude in an attempt to maintain the balance in the unipodal position. After 30 minutes, with an increase in temperature, the TA electric signal amplitude went back to normal, suggesting neuromuscular control normalization.
With regard to MG, a significant reduction was observed ($p<0.05$) of its RMS 30 minutes after the cryotherapy application, when compared to the pre one. This result suggested a sensory-motor improvement of this muscle along the repetitions, demonstrating that the instability created in the ankle articulation by the reduction of temperature was not sufficient to reduce the MG motor control.
Contrary to what occurred with the RMS, the MG did not present any alterations after the cryotherapy application on any of the muscles and periods of time observed.

CONCLUSIONS

The present study showed a RMS alteration of the TA and MG muscles after the cryotherapy application on the ankle, dependently from the muscular function.

REFERENCES

1. Algafly AA, George KP. (2007). Br J Sports Med, 41, 365-369.
2. Saeki Y. (2002).. Nurs Health Sci, 4, 97-105.
3. Uchio Y, et al. (2003). Arch. Phys. Med. Rehabil. 84, 131-135.
4. Hopper D, et al. (1997). Physiotherapy Residents International, 223-236.
5. Guirro RRJ, et al. (2006). Electromyographic neurophysiol, 46(6), 355-363.

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170 IMMEDIATE EFFECT OF NEUROMUSCULAR ELECTRICAL STIMULATION ON ONSET OF ACTIVITY OF THE VMO E VL MUSCLES ON PATELLOFEMORAL PAIN SYNDROME

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INTRODUCTION

Patellofemoral pain syndrome (PFPS) is described as an anterior or retro-patellar knee pain. Among the biomechanical factors related to the development of PFPS, stands the dynamic imbalance (Cowan et al., 2002).

Several studies have suggested an imbalance in the time of activation of the vastus medialis oblique (VMO) and vastus lateralis (VL) in subjects with PFPS (Cowan et al., 2002). However, some studies showed an beginning of simultaneous activity between the VMO and VL, dismissing the idea that asynchrony could be an etiological factor for PFPS (Bevilaqua-Grossi, et al., 2009).

In addition to therapeutic exercises, some authors has studied the effect of neuromuscular electrical stimulation in the treatment of patients with PFPS (Callaghan et al., 2004). The neuromuscular electrical stimulation could be used in order to encourage a anticipatory response of VMO relative to VL.

Thus, the aim of study was check if there is any effect of selective electrical stimulation of the VMO on onset of this vastus, comparing a control group and a SDFP group.

METHODS

Thirty eight women were evaluated; twenty women without complaints of anterior knee pain (control group, average age of 24.15 ± 2.60 years) and eighteen subjects with PFPS (PFPS group, average age of 25.56 ± 3.55). To perform electromyography (EMG), the skin where the electrodes were placed was shaved and cleaned with alcohol at 70%. The electrodes were placed in the VMO and VL. The electrodes were positioned so that the surfaces of detection were oriented perpendicular to the length of the muscle fibers. The electromyographic signals were captured at a frequency of acquisition of 1000 Hz and filtered at a frequency between 20 and 500 Hz. To capture the electrical activity of muscles, were used differential active surface electrodes (EMG System from Brazil Ltda.), composed of two parallel bars of Ag/AgCl and a reference oval claw type electrode. The electrodes have a rejection rate greater than 80 dB and an internal gain of 20 times. As the gain programmed into the A/D converter is 50 times the signal was amplified 1000 times. The volunteers were asked to make a series of 5 squats. After this assessment, a selective electrical stimulation of the vastus medialis oblique was performed. The protocol of electrical stimulation was performed in a single session, characterized by 30 contractions. After this moment, a new assessment was made, equal to the first. Data analysis was done comparing the muscle onset between the control group and PFPS prior to electrical stimulation by a *t Student* test for independent samples and comparing the onset of muscle activity between the moments before and after electrical stimulation in the two groups through a *t Student* test paired.

RESULTS and DISCUSSION

The results are shown in table 01. It was not found difference between the onset of VMO and VL among the control and PFPS, in agreement with other studies, which were not found asynchrony between these muscles in patients with this syndrome (Bevilaqua-Grossi et al., 2009). However, the intragroup analysis, in both groups showed an anticipatory action of the VMO after electrical stimulation, showing a possible effect of this technique in the onset of VMO. That our result did not agree with the findings of Garcia et al., 2008, however, it was used a treatment protocol with electrical stimulation of twelve weeks.

CONCLUSIONS

We found electrical stimulation reverses the neuromuscular pattern of activation, favoring an early action of the VMO in relation to VL in both groups.

REFERENCES

1. Cowan, S.M., et al. (2002). Recruitment Altered vastii when People with Patellofemoral Pain Syndrome Complete Postural Task. Arch Phys Med Rehabil. 83, 989-995.
2. Bevilaqua-Grossi, D., Felicio, L.R., Silvério, G.W.P. (2009). Início da Atividade Elétrica dos Músculos Estabilizadores da Patela em Indivíduos com SDFP. Acta Ortop Bras. 17 (5), 297-299.
3. Callaghan, M.J, Oldham, J.A, Winstanley, J. (2004). A comparison of two types of electrical stimulation of the quadriceps in the treatment of patellofemoral pain syndrome. A pilot study. Clinical Rehabilitation. 15, 637-646.
4. Garcia, F.R., Lorente D.A.G., and Negrao R.F. (2006). Análise eletromiográfica dos músculos vasto medial oblíquo e vasto lateral após eletroestimulação em indivíduos com síndrome de dor fêmoropatelar. Trabalho de Monografia. Presidente Prudente.

Table 01 - Average (± SD) of the difference of onset (in milliseconds) of the vastus lateralis (VL) and vastus medialis oblique (VMO) muscles before and after electrical stimulation, in control group and with patellofemoral pain syndrome (PFPS) group. $p \leq 0.05$. Negative onset means later VMO activation than VL.

	VL-VMO BEFORE ms	**VL-VMO AFTER ms**	***p***
CONTROL (n=20)	-0.001 ± 0.04	-0.223 ± 0.07	0.004*
SDFP (n=18)	-0.069 ± 0.05	-0.167 ± 0.04	0.001*
p	0.322	0.872	

171 FUNCTIONAL MAXILLARY ORTHOPEDICS AND ITS SCIENTIFIC EVIDENCE BY SURFACE ELECTROMYOGRAPHY (SEMG)

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INTRODUCTION

In Brazilian Dentistry, actually there are recognized 19 specialties and all of them need scientific support;Functional Maxillary Orthopedics is in this situation, and Surface Electromyography (sEMG) could be an adequate method to reach this objective. This research used sEMG data collected before, during and after determined treatment step, and there was registered for 3 times from all of 19 selected volunteers. This work is based on doctoral thesis defended by author on Piracicaba Dental College/ UNICAMP.

Purpose of this research is verify if sEMG is a tool that can be used in research involving different malocclusion treatment stages with Functional Maxillary Orthopedic evaluation and if Determined Area (D.A.) is an important treatment objective in FMO.

METHODS

There was made sEMG registration from superficial masseter, anterior temporalis and suprahiyoids muscles, bilaterally, using Ag-AgCl bipolar passives electrodes (NORAXON-USA), reference electrode from Kendall Meditrace (Canada), in 3 times(diagnosis, 8 minutes after 1st appliance installation, and just after reached D.A), in19 patients with age between 6 and 8 years old, selected from 164 individuals sample.These registrations were obtained in Dentistry Clinic from UNIARARAS Dental College, following ISEK and SENIAM orientations. Data were collected by 8 channels electromyography, model EMG1000; convert plate A/D, model CAD 12/32 with 16 bits; AqDAnalysis 4,18 software; Lynx BioInspector 1,8r software, all from Lynx Electronics Ltda. SAS system analyzed these data by qualified professional, used to work with biological signals.

RESULTS and DISCUSSION

Based on results gained its possible conclude that sEMG data in DA phase homogeneidity in this experiment suggests conditions to have bilateral and equilibrated deglutition function.

Signals of differences between true media and media parameter found only on Diagnosis phase comparing to FOA phase suggests that treatments were upright, once all volunteers presented one side as preferential to masticatory function checked at Diagnosis phase; these signs are corroborated by publications from Ingervall&Thilander (1975); Palomari et al(2002). Amplitude reductions for suprahiyoids muscles can indicate small solicitation of them on phase 3, as a minor pattern deviation were found , and this result could give support to establish DA as treatment objective (Fig.2). Amplitude reduction is in accordance to Takahashi et al (2005) paper, where reported relationship between mastication muscle activity with tongue position Souza (2004), and with Sessle et al (1990) publication, for whom mandibular advancement does not obstructed a postural EMG activity decrease.

CONCLUSIONS

Results obtained by this research permit conclude that:

1. Surface Electromyography is a tool that can be used in research involving malocclusion treatment by Functional Maxillary Orthopedics in different stages evaluation;
2. Determined Area (D.A.) is an important treatment goal for Functional Maxillary Orthopedics, evaluated by Surface Electromyography. (fig.1)

REFERENCES

1. Ingervall B, Thilander B. Activity of temporal and masseter muscles in children with lateral forced bite. Angle Orthod.,v.45,n4,p249-258,Oct 1975
2. Palomari, et al. Electromyographic study of the masseter muscle in individuals with class II malocclusion. Electromyogr Clin Neurophysiol ,42.71-77,2002
3. Takahashi S, et al. Modulation of masticatory muscle activity by tongue position. Angle Orthod.Jan;75(1):35-9,2205.
4. Sousa MA. Estudo eletromiográfico comparativo dos músculos masseter, temporal e orbicular da boca entre jovens com maloclusão ClasseII, 1ª.divisão e com normalidade oclusal, [Tese] Piracicaba ; UNICAMP/ FOP;2004
5. Sessle BJ, et al . Effect of functional appliances on jaw muscle activity. Am J Orthod Dentofac. Orthop. 98(3):222-30,1990 Sep.

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Marcelo C. Alves, Tatiana R. Azeredo, Luciano W. Ribeiro, Murilo B. Corsi, Sergio P. Terçarolli, Jaime Ono, Wilma A. Simões.

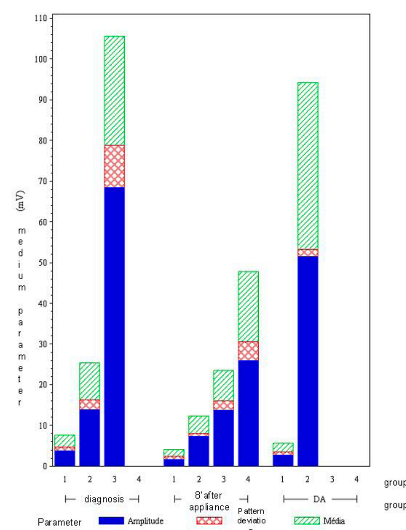

Figure 1: Histogram for masseter in Isometrics.

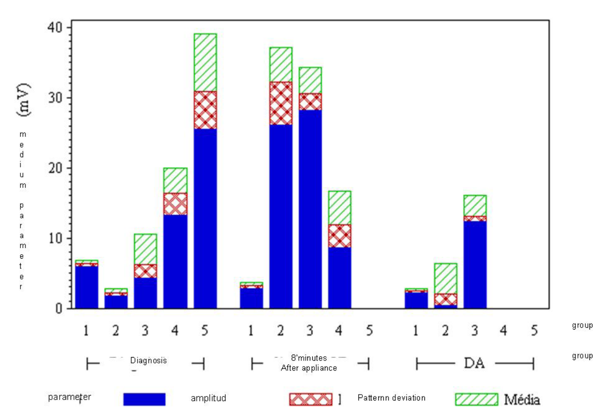

Figure 2: Medium Characteristics from grouping determinants factors in each group formed inside diferent treatment phases. (supra-hiyoidis in deglutition)

172 ELECTROMYOGRAPHIC ANALISYS OF MASTICATORY MUSCLES AND POSTURAL MUSCLES IN INDIVIDUALS SUBMENTAL TO STRESS PREPARATORY COURSES

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INTRODUCTION

Studies have shown that emotional stress can modify the characteristics of the kinesiology of the masticatory muscles and increase muscle activity in postural position, facilitating the beginning of para-functional habits. According MONGINI4, the stomatognathic system can also be affected under stress, its function is directly influenced by the central nervous system (CNS). An example of this principle is the fact that para-functional habits such as clenching and teeth grinding, occur more frequently in patients suffering from high tension and emotional stress. The dysfunctions of the stomatognathic system can be enhanced by para-functional habits of central and emotional. Electromyographic studies were performed to evaluate the activation of masticatory muscles and postural muscles in patients subjected to emotional stress (LUNDBERG et al. [3]; SCHLEIFER et al.[5]). However, studies on the activity of this muscle group in subjects subjected to emotional stress pre-entrance exam is scarce. The objective of this study was to analyze the electrical activity of masticatory muscles and posture in patients who underwent the stress preparatory courses.

METHODS

Sixteen students, aged between 18 and 25 years, students in 3rd year of high school and 1st year preparatory courses for this study. The electromyographic signals were recorded before and after the university exam, using a computerized electromyography surface electrodes. The electrodes were placed on the trapezius muscle, temporal and masseter and the volunteers made chewing movements (mastication, chewing right, left chewing, chewing bilateral circumduction and isometric) and shoulder movements (abduction and circumambulating). Each EMG signal obtained from each static and dynamic contraction was subjected to a high pass filter of 20 Hz and low pass 500 Hz, in order to eliminate possible mechanical interference, since frequencies below 20 Hz are stochastic and above 500 Hz motor units not depolarize (KONRAD[2]). The EMG signals were analyzed in relation to the values of root mean square (RMS - root mean square), an algorithm that is able to reflect the average signal strength over the course of study (KONRAD[2]). Subsequently, they were subjected to statistical analysis using the ANOVA table to verify the normality of distribution, including calculations of mean, standard deviation and variance as a test of the hypotheses of the research. The target level of significance of 5% in standard statistics.

Figure 1 - Placement of surface electrodes. 1) Temporal earlier. 2) Masseter 3) Trapeze.

RESULTS AND DISCUSSION

The results of this study, obtained with the data processing of electromyographic examination revealed a large discrepancy between the samples before and after the university exam. The anterior temporal and masseter muscles because they are directly related to the process of chewing, presented the greatest change since most of the movements analyzed were related to mastication. The postural muscles (trapezius) also presented this discrepancy, albeit on a smaller scale, because they are indirectly related to chewing. There was also a difference in values between the volunteers, but persisting in the discrepancy between before and after the electromyographic examination.

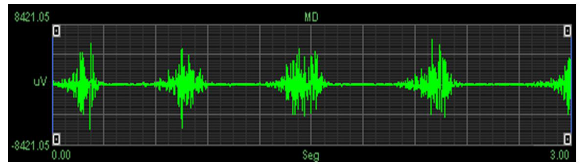

Figure 2 - EMG signal during chewing right, the right masseter muscle of a volunteer, collected before the university exam.

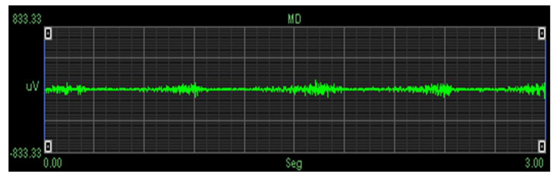

Figure 3 - EMG signal during chewing right, the right masseter muscle of the same volunteer, collected after the university exam.

Table 1 - Relationship between the mean values of RMS and the envelope of a volunteer, before and after the exam, during the chewing motion right.

Before	TD	MD	TRAPD	TE	ME	TRAPE
RMS mean values	2918,6	2895,7	36,7	3109,5	1730,9	68,5
ENV mean values	4678,2	4762,6	87,1	5174,8	2677,7	140,5
After	**TD**	**MD**	**TRAPD**	**TE**	**ME**	**TRAPE**
RMS mean values	105,6	128,9	3,5	95,6	67,8	20,5
ENV mean values	153,2	204,3	8,9	132,5	96	48,3

CONCLUSIONS

Based on the methodology and the results can be concluded that the stress caused by university exam suggests great influence on the electrical behavior of the masticatory muscles and posture. Electromyographic analysis showed an increase in muscle activity in the tests before the university exam, compared to samples taken after these tests.

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REFERENCES

1. Bérzin F.(1999). An electromyographic study of hyperactivity of masticatory muscles in patients with craniomandibular disorder. In: 4th Brazilian Symposium and International Meeting on Pain; Sao Paulo. Anais. São Paulo: SIMBIDOR, 1999. p.405.
2. Konrad P. (2005) A pratical Introduction to kinesiology Eletromyography. The ABC of EMG. Noraxon Inc. USA. p.25-27.
3. Lundberg ULF, et. al., (1994), Psychophysiological stress and EMG activity of the trapezius muscle. International Journal of Behavioral Medicine. V.1, N. 4.p. 354-370.
4. Mongini F. (1988). The Stomatognatic Quintessence Editora Ltda. 1st edition. p.19-65.
5. Schleifer LM, et. al. (2008). Mental stress and trapezius muscle activation under psychomotor challenge: A focus on EMG gaps during computer work. Psychophysiology. V. 45, Issue 3. p.356-365.

173 COMPARISON OF THE ELECTROMYOGRAPHIC FATIGUE INDEX OF HEALTHY INDIVIDUALS AND PATIENTS AFTER RECONSTRUCTION OF ANTERIOR CRUCIATE LIGAMENT

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INTRODUCTION

Patients after reconstruction of anterior cruciate ligament (ACL) have muscle dysfunction that can persist even after more than six months after surgery with aggressive rehabilitation (Beynnon et al., 2005).
The effects of ACL reconstruction in muscle strength are already well understood, however, there are still disagreements about the behavior of resistance to fatigue of these patients.
Thus, this study is to compare the electromyographic fatigue index of the rectus femoris (RF), vastus lateralis (VL) and vastus medialis (VM) of healthy individuals and after ACL reconstruction.

METHODS

The present work was attended by twenty men, ten healthy (36.90 ± 6.29 years old) and ten after ACL reconstruction (29.75 ± 7.01 years old).
Were included in the reconstruction group (GR), the subjects underwent ACL reconstruction with a graft of semitendinosus and gracilis tendons, between 4 and 6 months postoperatively, which were in physical therapy rehabilitation, and showed no other disorders of the lower limbs (LL), except for arthroscopic repair of meniscus, concomitant ACL reconstruction. The control group (CG) had inclusion criteria, that were amateur physical activity (2 to 5 times a week) and not having any cardiac disease, neurological and orthopedic trauma on LL in the last 6 months. Were excluded from the study, subjects who experienced pain during the procedure and not bore the fatigue protocol.
The experiment was approved by the local Ethics Committee under number 007/10 and consisted in the evaluation of the electromyographic activity concomitant with the protocol of muscle fatigue. The evaluated member was the reconstructed one for GR and non-dominant or dominant for the GC, and the choice was in accordance with the amount of the dominance on the GR.
The procedure was performed with the patient properly positioned on the isokinetic dynamometer (Biodex Multi-Joint System 3 Pro, USA), completing the fatigue protocol of 100 replications in flexion-extension of the knee at a constant speed of 90°/s.
During the procedure, the electromyographic activity of the RF, VL and VM was captured, with their electrodes properly positioned as recommended by Surface Electromyography for Non-Invasive Assessment of Muscle - SENIAM (Hermes et al., 1999).
For acquisition and processing of electromyographic signals, was used a conditioner module (MCS 1000), 4 channels (EMG System, Brazil), an analog-digital converter - A / D (CAD 12/36-60K) with a resolution 12 bits. The equipment has a ratio of common mode rejection (CMRR)> 80 dB, sample the signal at a frequency of 1000 Hz and a frequency range between 20 and 500 Hz. As the gain was set to 50 times, the signals were amplified 2000 times . The software used was EMGLab (EMG System do Brasil, Brazil), which calculates the median frequency by Fast Fourier Transform. It was made using active surface electrodes, simple differential (two self-adhesive electrodes, separated by a standardized distance of 2 cm), with an internal gain of 20 times, and a reference electrode oval.
Initially, boundaries were made for placement of the electrodes and then the preparation of the skin (shaving and cleaning with alcohol) in the local coupling of the electrodes. The reference electrode was placed on the medial malleolus of the contralateral leg examined.
The variable analyzed was the electromyographic fatigue index as the percentage decrease in median frequency, calculated by the ratio between the initial and final third of the hundred contractions.
Statistical analysis was performed in SPSS 15.0. At first, we applied the Kolmogorov-Sminorv test and found that the data had normal distribution. Next, we used the Student t test independent, considering the significance level of 5%.

RESULTS and DISCUSSION

According to the data presented, there was no statistically significant differences between the control and after ACL reconstruction, both in RF ($p = 0.44$), VL ($p = 0.48$) and VM ($p = 0.98$) (Figure 1).
This result may be due to the fact that the ACL injury promotes selective atrophy of the muscle fibers of type II (Mchugh et al., 2001), reducing the strength, but without interfering with the fatigue resistance of these patients.

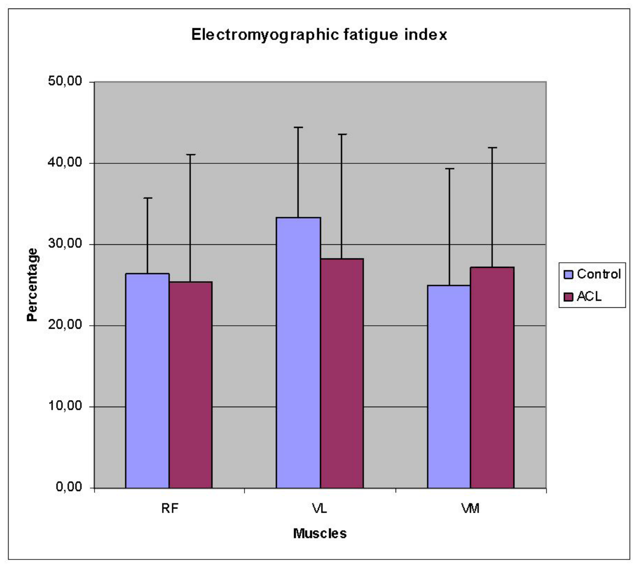

Figure 1 - Electromyographic fatigue index of the rectus femoris, vastus lateralis and vastus medialis of the control group and after ACL reconstruction.

CONCLUSIONS

Pacients after ACL reconstruction and healthy individual have similar resistance to fatigue.

REFERENCES

1. Beynnon BD, et al. (2005). Treatment of Anterior Cruciate Ligament Injuries, Part 1. American Journal of Sports Medicine. 33, 1579-1602.
2. Hermes HJ, et al. (1999). European recommendations for surface electromyography – results of the SENIAN project.
3. Mchugh M, et al. (2001). Electromyographic analysis of quadriceps fatigue after anterior cruciate ligament reconstruction. Journal of Orthopaedic & Sports Physical Therapy. 31 (1), 25-32.

174 ELECTROMYOGRAPHIC ACTIVITY OF GLUTEUS MEDIUS DURING FUNCTIONAL ACTIVITIES IN PATELLOFEMORAL PAIN SYNDROME

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INTRODUCTION

The Patellofemoral Pain Syndrome (PPS) is a disorder frequently found in orthopedic physical therapy practice. Recently factors distal to the knee, such as changes in time of the gluteus medius muscle, have been suggested as predisposing to the emergence of this syndrome. However, there is no consensus on the electromyographic patterns of muscle in subjects with PFPS. The aim of this study was to analyze the intensity and early activation of the gluteus medius (GM) correlated with the electromyographic activity of vastus lateralis (VL) and vastus medialis oblique (VMO) during functional activities in subjects with the PPS.

METHODS

This research characterized by being an observational study cross-sectional study. This study was conducted from February to May 2009 at the Laboratory of Neuromuscular Performance Analysis, Department of Physical Therapy, Federal University of Rio Grande do Norte. Participants were 20 female volunteers, and these were divided into two groups, 10 control (22.8 ± 1.78 years, 53.9 ± 5.39 kg, 1.61 ± 0.06 m, 20.23 ± 2.18 kg/m2) and 10 with clinical diagnosis of PFPS (21.2 ± 2.44 years, 53.3 ± 3.26 kg, 1.59 ± 0.04 m, 20.90 ± 1.57 kg / m2). For the study used a conditioner module 8 channels interfaced with a microcomputer, and software for digital signal analysis, AqDados (version 5.0). We used surface active electrodes composed of two rectangular parallel bars of Ag / AgCl electrode and a reference type claw. The active electrodes were positioned according to the criteria tracking SENIAM. The rate of signal acquisition was 1000 Hz, and passed a filter between 20-500Hz. We also used a universal goniometer and two steps of rubber. Subjects were evaluated during the execution of the following activities: Abduction of the hip in maximal voluntary isometric contraction, supine lateral extension of the knee in maximal voluntary isometric contraction in isokinetic dynamometer, with 60° of knee flexion; Rise in step, starting with State evaluated followed by the contralateral Descent of step, starting with the limb contralateral to the subject followed by homolateral.

RESULTS and DISCUSSION

The results showed that the relative onset of GM / VMO was altered in subjects with PFPS during the activity of stepping-up ($p = 0.014$). There was significant difference in the VMO / VL activity in the increase ($p = 0.014$) and step down ($p = 0.004$) where the VMO showed greater intensity in subjects with PFPS.

CONCLUSIONS

Under the experimental conditions, the study suggests a pattern of abnormal muscle recruitment GM, as well as increase in the VMO / VL in subjects with PFPS.

REFERENCES

1. Christou EA. Patellar taping increases vastus medialis oblique activity in the presence of patellofemoral pain. J Electromyogr Kinesiol. 2004;14(4):495–504.
2. Powers CM, Ward SR, Fredericson M, Guillet M, Shellock FG. Patellofemoral kinematics during weigth-bearing and non-weigth-bearing knee extension in persons with lateral subluxation of the patella: a preliminary study. J Orthop Sports Phys Ther. 2003;33(11):677-685.
3. Mascal CL, Landel R Powers, CM. Management of patellofemoral pain targeting hip, pelvis, and trunk muscle function: 2 case reports. J. Orthop. Spor. Phys Ther. 2003;33 (11). 647-659.
4. Cichanowski HR, Schmitt JS, Johnson RJ, Niemuth PE. Hip Strength in Collegiate Female Athletes with Patellofemoral Pain. Med Sci Sports Exercise; 2007:39(8) 1227-1232.
5. Kollock RO, Onate JA, Van Lunen B. Assessing muscular strength at the hip joint. Athletic Therapy Today. 2008;13(2): 18-24.

175 ANTIDEPRESSIVE AND ANTIPSYCHOTIC DRUGS EFFECT ON MASTICATORY MUSCLES IN INDIVIDUALS WITH SCHIZOPHRENIA AND AFFECTIVE DISORDERS COMPARED TO CONTROL GROUP

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INTRODUCTION

Drugs used in psychiatric disorders treatment are influent on muscular system as a whole. The use of antidepressant and antipsychotic medications causes chronic and acute motor collateral effects, including Parkinsonism, akathisia and dyskinesia (Marchese et al., 2002), characterized by involuntary buccofacial movements, that appear on around 20% treated patients.

METHODS

The aim of this study was to compare the sEMG activity of the right and left temporalis and masseter muscles during rest position and postural movements (10s), between 20 individuals with schizophrenia (GI), 20 individuals with affective disorders (GII) and 40 controls (GIII). The sEMG analysis was performed using a MyoSystem-BR1 electromyographer with differential active electrodes (silver bars 10 mm apart, 10 mm long, 2 mm wide, 20x gain, input impedance 10 GΩ and 130 dB common mode rejection ratio). Surface differential active electrodes were placed on the skin, bilaterally on both masseter muscles and on the anterior portion of the temporalis. A ground electrode was also used and fixed on the skin over the sternum region. The sEMG signals were analogically amplified with a gain of 1000x, filtered by a pass-band of 0.01-1.5KHz and sampled by a 12-bit A/D converter with a 2 KHz sampling rate. The data collected were normalized by maximum voluntary contraction (MVC), and the results were statistically analyzed using the ANOVA test (SPSS- 17.0-Chicago) during the comparison between groups ($p<0.05$).

RESULTS

The psychiatric individuals presented higher EMG activity than control individuals (Table 1) during all positions tested in this study, including rest. During EMG data comparison there was a statistical significance between groups for all conditions ($p<0.05$).

CONCLUSIONS

The data allow us to conclude that the mental health medication had a stronger influence on the masticatory muscles activity, causing an exaggerated recruitment of muscle fibers to perform a static and dynamic activity. The results may provide valuable data to be considered when choosing one of these treatments for psychiatric patients, which will improve their quality of life.

REFERENCES

1. Marchese G, Casu MA, Bartholini F, Roiu S, Saba P, Gessa GL, Pani L. (2002). Sub-chronic treatment with classical but not atypical antiphsychotics produces morphological changes in rat nigro-striatel dopaminergic neurons directlyrelated to "early onset" vacuous chewing. Eur J Neurosc, 15(7): 1187-96.

ACKNOWLEDGEMENTS

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Table1 - Normalized sEMG activity of the masseter and temporalis muscles according the clinical conditions. All data presented statistical significance between the groups ($p<0.05$).

Group	Masseter		Temporalis	
	Right	Left	Right	Left
Rest GI	0.11	0.14	0.21	0.28
Rest GII	0.25	0.32	0.31	0.25
Rest GIII	0.07	0.07	0.09	0.08
Right Laterality GI	0.18	0.18	0.22	0.23
Right Laterality GII	0.37	0.15	0.39	0.21
Right Laterality GIII	0.08	0.09	0.12	0.08
Left Laterality GI	0.12	0.15	0.21	0.19
Left Laterality GII	0.38	0.47	0.31	0.35
Left Laterality GIII	0.11	0.07	0.08	0.09
Protrusion GI	0.18	0.27	0.33	0.26
Protrusion GII	0.74	0.46	0.29	0.13
Protrusion GIII	0.17	0.15	0.09	0.08

176 ELECTROMYOGRAPHY ACTIVITY AND MUSCLE SYMMETRY OF ANTERIOR TEMPORAL AND MASSETER MUSCLES IN SKELETAL CLASS III PATIENTS BEFORE AND AFTER ORTHOGNATHIC SURGERY

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INTRODUCTION

The term Class III of Angle characterizes a dental skeletal pattern of occlusion in what soft and hard tissues are involved in the constitution of this disharmony, when considered the Class I as a pattern of harmony.

Orthognathic surgery may correct these conditions, providing a better balance between face and cranium dimensions. It can also improve masticatory, phonetics and breathing functions. Orthognathic surgery also modifies the facial esthetics, and consequently causes benefit in the psychological status of patient.

The aim of this work was to investigate the electromyographical characteristics during the conditions of mandibular rest, isometric contraction (maximum intercuspidation) and isotonic contraction (mastication) of the masseter and temporal (anterior part) in bilaterally mode, before and after orthognathic surgery. Normalized and raw Root Mean Square (RMS) of the masseter and temporal was acquired, processed and used to calculate the symmetry indicator. All variables were submitted to statistical procedures.

METHODS

Nineteen prognathic volunteers (9 male and 10 female), with ages between 18 e 36 years old (average 23.3 and standard deviation 8.2) in pre-operatory period of 2 a 3 months before the surgery (T0); 2 a 3 months post-operatory procedure (T1) and 6 to 8 months after the surgery (T2) were availed through electromyographic activity in the anterior part of the temporal muscle (right and left) and in the masseter (right and left). During all procedure, the volunteers stay sited in a chair, with the back completely supported by backrest, with the plan of Frankfurt parallel to the ground, eye closed, feet on the floor, arms resting on the lower limbs.

Before each record, the same posture was taken to standardize the registration.

The electric activity observed in the masseter and temporal muscles in both side (right and left) in condition of rest, isometric contraction (maximum intercuspidation) and isotonic contraction (mastication) recorded in microvolt (μV) and acquired in frequency of 2000Hz and resolution of 12 bits were submitted to a high pass filter of 20Hz and to a low pass filter of 500Hz and then used to calculate the RMS value (the square root of the sum of each squared data) through software Miosystem BR-1, version 3.0.

The symmetry were calculated as PCS%, with the formula:

$$PCS=[1-?_{i=1}^{100} (\text{right muscle - left muscle}) /?_{i=1}^{100} (\text{right muscle - left muscle}) * 100]$$

RESULTS

Table 1. Mean (Standard Deviation) and comparison of means of absolute RMS of different phases through Tukey test at level of 5% in maximal voluntary contraction (MVC).

Periods		Right temporal	Left Temporal	Right Masseter	Left Masseter
Pre Surgery	2-3 months (T0)	95.02 (51.02)	93.93 (33.43)	107.46 (70.05)	80.86 (44.12)
Post Surgery	2-3 months (T1)	80.77 (53.27) ns ns	0.43 (0.22) ns ns	83.23 (56.97) ns ns	60.25 (40.50) ns ns
	6-8 months (T2)	100.61 (50.93) *	0.52 (0.26) *	96.34 (53.22) ns	83.98 (43.67) **

** significant 5%, ** significant 1%; ns=Non significant.*

Table 2. Mean (Standard Deviation) and comparison of normalized values of means of RMS in different phases through Tukey test at level of 5% in maximal voluntary contraction (MVC).

Periods		Right temporal	Left Temporal	Right Masseter	Left Masseter
Pre Surgery	2-3 months (T0)	0.55 (0.28)	0.54 (0.18)	0.42 (0.46)	0.49 (0.25)
Post Surgery	2-3 months (T1)	0.40 (0.24) ns ns	0.43 (0.22) ns ns	0.41 (0.33) ns ns	0.41 (0.27) ns *
	6-8 months (T2)	0.52 (0.26) *	0.52 (0.26) *	0.49 (0.26) ns	0.49 (0.26) **

** significant 5%, ** significant 1%; ns=Non significant.*

Table 3. Mean (Standard Deviation) and comparison of means of absolute RMS of different phases through Tukey test at level of 5% in isotonic activity (mastication).

Periods		Right temporal	Left Temporal	Right Masseter	Left Masseter
Pre Surgery	2-3 months (T0)	65.31 (28.55)	59.74 (22.91)	107.46 (70.05)	55.33 (28.42)
Post Surgery	2-3 months (T1)	47.87 (53.27) * ns	42.20 (25.67) * ns	83.23 (56.97) * ns	40.41 (39.63) ns
	6-8 months (T2)	64.92 (34.51) *	56.35 (30) **	53.76 (45.48) *	53.76 (45.48) *

** significant 5%, ** significant 1%; ns=Non significant.*

Table 4: Mean (Standard Deviation) and comparison of normalized values of means RMS in different phases through Tukey test at level of 5% in isotonic activity (mastication).

Periods		Right temporal	Left Temporal	Right Masseter	Left Masseter
Pre Surgery	2-3 months (T0)	0.86 (0.55)	0.67 (0.23)	0.71 (0.42)	0.82 (0.53)
Post Surgery	2-3 months (T1)	0.70 (0.34)	0.62 (0.26)	0.58 (0.41)	0.76 (0.54)
	6-8 months (T2)	0.73 (0.37)	0.65 (0.27)	0.56 (0.24)	0.72 (0.70)

Non significant difference between normalized values.

Table 5. Mean (Standard Deviation) and comparison of symmetry, before and after surgery, in isotonic (masticatory) and isometric (CVM). Analyze for Tukey test.

MUSCULAR SYMMETRY									
	T0		T1		T2		P		
	M	DP	M	DP	M	DP	T0/T1	T0/T2	T1/T2
Isotonic (Mnstg)									
PCO m (%)	75.27	0.20	73.00	0.21	76.01	0.17	0.7	0.8	0.04*
PCO t (%)	83.18	0.13	83.09	0.10	84.55	0.11	0.9	0.6	0.61
Isometric (CVM)									
PCO m (%)	77.55	0.18	84.75	0.24	83.53	0.16	0.62	0.24	0.05*
PCO t (%)	82.53	0.13	87.31	0.12	84.45	0.13	0.32	0.97	0.19

* Significant 5%

DISCUSSION

We could show that electromyography values (absolute and normalized) was decreased for all muscles, two and three months post surgery. This fact can be explained by the presence of pain and discomfort when the patients pressing the teeth, by new morphological, physiological and mechanical adaptations.

The kind surgical can cause alterations in soft and hard tissue changing the functional relationship previously stable and balanced (Proffit et al., 1991). Six to eight month post surgery, when evaluating electromyography activity, the value of the RMS is increased, which may indicate that the time has a positive effect in stabilizing the occlusion (Shiratsuchi et al. 1991; Throckmorton etal. 1995; Ellis et al 1996, Harada et al., 2000).

Post surgery, we found that the masseter and temporal muscles present positive changes in relation a symmetry in the isotonic and isometric moviments, increasing its porcentagem. However, all these changes were not statistically significant, agreeing with the findings of Sforza CV et al (2008) & Di Palma et al. (2009), showing improvements in neuromuscular activity compared before and after surgery (6-8 months assessed by the POS%).

The neuromuscular adaptation after orthognathic surgery is slow and progressive by some morphological components such as dental and skeletal malformations, may affect the muscle activity. Other factors may be related, as the relation-jaw posture and occlusal force.

CONCLUSIONS

Orthognathic surgery has a significant influence in the changes of the electromyographic patterns when observed the RMS value and the symmetry providing a better balance in bilateral activities after the surgery and enhancing the neuromuscular equilibrium during the static and dynamic movements of mandible.

Are needed more studies in future of the masticatory muscles and of neuromuscular system that objectively demonstrate the modifications of muscle activity in influenza and its painful symptoms after treatment of different diseases of the stomatognathic system.

REFERENCES

1. Di Palma E, Gasparini G, Pelo S, Tartaglia MG, Chimenti C. Activities muscle in patient after orthognathic surgery.J facial Cranio Maxillo Facial Surgery 2009,37:417-20.
2. Sforza Ch, Peretta R, Grandi G, Ferronato G, Ferrairo VF. J Soft Tissue Facial Planes and Masticatory Muscle Funtion in Skeletal Class III Patients Before and After Orthognathic Surgery Treatment Maxillofac. Oral Surg 2008 66:691-98.
3. Abrahamsson C, Ekberg EC, Henrickson T, Nilner M, Sunzel B, Bondemark L. TMD, in Consecutive Patients Referred for Orthognathic Surgery. The Angle Orthidontist 2009;79:621-27.

177 ELECTROMIOGRAPHIC ACTIVITY OF THE PELVIC FLOOR IN DIFFERENT MODES OF DELIVERY: A COMPARATIVE AND PROSPECTIVE STUDY

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INTRODUCTION

Several studies evidenced the association between pregnancy, mode of delivery and genitourinary symptoms. However, there are still controversies about the role of mode of delivery in the prevention or aggravation of these symptoms (Van Brummen, Bruinse, Pol, Heintz e Vaart., 2007).
This study aimed to evaluate through electromyography (EMG), the muscle contractility of the pelvic floor in pregnant and late puerperal women, comparing three modes of delivery: vaginal, elective cesarean section and emergency cesarean section.

METHODS

A prospective, longitudinal and comparative study composed of both clinical and electromyography evaluation of 75 pregnant women with an age range from 14 to 39 years ld (mean 23, 24 years old) between February 2006 and February 2008, in Poços de Caldas-MG. All patients signed the informed consent, approved by PUC MINAS Research Ethics Committee (CAAE N° 0207.0.213.146-05).
Patients were classified into three groups: (1) vaginal delivery with mediolateral episiotomy-28 patients; (2) elective cesarean section-26 patients and (3) emergency c-section-21patients.
The following variables were analyzed in each group:
(a) Functional Evaluation of the pelvic floor muscles (AFA), through palpation grading the contraction accordingly to the standardized Ortiz's muscle contractility graduation table from 0 to 5 (Contreras, Coya e Ibañez, 1994);
(b) Surface electromyography of the pelvic floor (electromyography EMG 400C - EMG System do Brazil®) was recorded by a vaginal probe introduced using a little amount of anti-allergenic lubricating gel KY (Johnson's & Johnson's®). All women were asked to perform three consecutive pelvic floor contractions with maximum effort each one followed by a rest of twice the length of the preceding contraction. Each contraction was recorded for 5 seconds in microvolt (μV) and analyzed by Root-mean-square (RMS). The RMS arithmetic mean obtained from all contraction was considered. All the 75 patients were evaluated during the last gestational trimester and re-evaluated on the 45th (± 10 days) of the puerperium, by the same researcher.
The variance analysis (ANOVA) was used with Rank transformation due to the non-normality of data, aiming to reduce their asymmetry and variability. Aiming to investigate the reliability of the results, the Pearson's coefficient correlation was used to evaluate the correlation between AFA and EMG.

RESULTS and DISCUSSION

When the pre and post birth periods are compared (Table 1), a significant raise of the muscle contractility in the group which underwent elective cesarean section was found, according to AFA clinical evaluation while a significant reduction of muscle contractility was found in the group of patients who underwent vaginal delivery, evaluated through electromyography (EMG).

Table 1 - AFA and EMG of the pelvic floor muscles.

	Vaginal delivery (n=28)	Elective cesarean (n=26)	Emergency cesarean (n=21)	P - value
AFA (score) Gestational Mean	2.21	**2.35**	2.43	
AFA (score) Puerperal Mean	2.21	**2.92**	2.81	0.03
EMG (μV) Gestational Mean	**39.17**	35.40	31.78	
EMG (μV) Puerperal	**31.14**	38.55	32.68	0.001

ANOVA nos ranks

In order to evaluate the reliability of the results, a correlation test between the clinical and electromyographic findings through Pearson's coefficient correlation. Significant correlations between AFA and EMG data during both gestational and puerperal periods were found ($p \leq 0,05$).
Only few studies are based on EMG for this kind of evaluation in pregnant women, which impedes the comparison with results obtained from other researchers. However, the EMG with endovaginal probe has been indicated as a trustable method for evaluating the pelvic floor muscles since the patients are correctly positioned (Grape, Dedering e Jonasson, 2009). These authors have issued a protocol in which the patient is positioned in supine position with flexed knees and then they evaluated three maximum contractions recorded in 10 seconds, with a ten-second rest period between one contraction and the next one. Their studies demonstrated that the issued protocol was reliable for the pelvic floor muscles evaluation using electromyography which corroborates our findings.
According to Bo and Sherburn (2005), the surface electromyography is more efficient to evaluate the pelvic floor muscles when compared to palpation. However, the interpretation of the obtained data might be influenced by other muscles if the electrode is not correctly positioned in a standardized way. Our study showed a significant correlation between AFA and EMG, proving the efficacy of these evaluation methods for the pelvic floor muscles, since they are made by the same researcher.

REFERENCES

1. Van Brummen H, Bruinse H, Pol G, Heintz A, Vaart C. (2007). The effect of vaginal and cesarean delivery on lower urinary tract symptoms: what makes the difference? Int Urogynecol J. 18:133-9.
2. Contreras O, Coya NF, Ibañez G. Evaluación funcional del piso pelviano feminino - Classificacion funcional. (1994). Boletim de La Sociedad Latinoamericana de Uroginecologia y Cirurgia vaginal. 1:5-9.
3. Grape HH, Dedering A, Jonasson AF. (2009). Retest reliability of surface electromyography on the pelvic floor muscles. Neurourol Urodyn. 28(5):395-399.
4. Bø K, Sherburn M. (2005). Evaluation of Female Pelvic-Floor Muscle Function and Strength. Physical Therapy. 85(3):269-82.

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PROTOTYPE FOR TRAINING THE TONGUE STRENGHT

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INTRODUCTION

The tongue muscles are divided in two groups: intrinsic e extrinsic (Zemlin, 2000). The muscles that are inserted in the bones around and enable the tongue move itself in all directions are named extrinsic. The intrinsic muscles are the tongue muscles and are responsible for the tongue shape changing. It's a speech therapist job to rehabilitate this structure when muscles unbalance are found.
The speech therapist in order to work the muscles changes can use two ways: the myotherapy and the myofunctional therapy. The myotherapy acts on the muscle that the changing are expect, using both isotonics and isometrics exercises. The principles of muscles training are essential to a succeed work.
This study´s aim is to describe a prototype developed to training the strength in the tongue structure.

METHODS

Primary a literature review was done in journals and in the patent registrations, where was searched the description of instruments used for training the muscles in the tongue structure. Those descriptions point for instruments used just for tongue´s strength evaluation or muscles training that doesn´t provide the control of the weight applied in the exercises.
Once there were no instruments to improve the tongue muscle´s strength, was constructed by the UFMG Biomechanical Engineering Group an instrument able to control the tongue muscle resistance during the protrusion movement.
The instrument, presented in the illustration 1 (with numbered indication of it contains) consist in an instrument formed by an biter (3) that easily fits to the dental arch witch makes the instrument fit correctly; a protect cover (2), that involves the biter, protect and isolate from external damage acting, an receptor (3) in the middle of the biter acts as a barrier where the tongue will press to push it; the instrument body (5) witch design enable the connection of the inner part of the instrument and a support for the patient´s hands; an spring inside the instrument making an opposite reaction to the tongue action; and at last two pins: the indicator pin (6) that has an fixing structure that shows the tongue´s strength applied during the exercise; and the level pin (7) that allows the changing of strength level during the exercise.

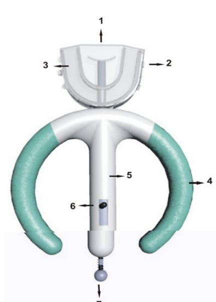

Illustration 1 – Instrument overview and its numbered parts

RESULTS and DISCUSSION

The main difference of this developed instrument is the possibility of knowing the weight applied during the exercise. The instrument can also have the level of strength changed (up and down) according to the patient progress during the treatment. It's also fits easily in the patient´s mouth, appropriated to the jaw position, and can be used for people in all the ages.
In the planning of body training that search to improve the strength, it´s important to consider the muscle action intensity, volume, exercise's type, exercise´s order, period of resting between the series of exercises, number of series and frequency (Barbani et al., 2004; Kraemer et al, 2002)
It´s known that the exercises in body training are acted with the help of a weight applied in resistant to the movement (Kraemer et al., 2002). However, until now the Speech Therapy didn´t have an instrument to control this parameter.
It´s important to show that according to the muscle training concepts, exceed weight in intensity and volume can cause lesions or muscle dysfunction (Kraemer et al., 2002; Cunha et al., 2006) being important to care during the use of this instrument.
Another aspect to be consider is the damages of using the instrument. Although the activity of tongue protrusion activates specially the intrinsic muscle (Pittman, Bailey, 2009) we suppose to consider the cases when the intrinsic muscles activity are not wanted.

CONCLUSIONS

It was possible to develop an instrument that enables the control of parameters of weight during the training of tongue strength. The next step will be the analyses the result of using the instrument in the speech therapy treatment.

REFERENCES

1. Barbanti VJ, Tricoli V, Ugrinowitsch C. Relevância do conhecimento científico na prática do treinamento físico. Rev Paul Educ Fís 2004;18:101-9.
2. Kraemer WJ, Adams K, Cafarelli E, Dudley GA, Dooly C, Feigenbaum MS, et al. Progression models in resistance training for healthy adults. Med Sci Sports Exerc 2002;34:364-80.
3. Cunha GS, Ribeiro JL, Oliveira AR. Sobretreinamento: teorias, diagnóstico e marcadores. Rev Bras Med Esporte. 2006;12(5):297-302.
4. Pittman LJ, Bailey EF. Genioglossus and intrinsic electromyographic activities in impeded and unimpeded protrusion tasks. J Neurophysiol. 2009;101(1):276-82.
5. Zemlin WR. Princípios de Anatomia e Fisiologia em Fonoaudiologia. 4ª ed. Porto Alegre: ArtMed; 2000.

179 ELECTROMYOGRAPH STUDY OF SUPERIOR ORBICULARIS ORIS AND MENTALIS MUSCLES IN CHILDREN PRESENTING SUCKING HABITS AND OPEN BITE MALOCCUSION

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INTRODUCTION

Prolonged sucking habits can cause damages in stomatognathic system and determine changes in occlusion. Anterior open bite, one of kind of that malocclusion may be associated with myofunctional disorders. (Felicio et al., 2003; Degan & Puppin-Rontani, 2004). The aim of this study was to analyze the electromyography (EMG) signal by muscular activation pattern in children aged between forty-eight to fifty-nine months presenting nutritive and/or non-nutritive sucking habits and anterior open bite malocclusion.

METHODS

Twenty-two children, aged 36 and 42 months presenting primary dentition, anterior open bite, bottle and pacifier sucking habits, were evaluated through surface electromuography. The values of the variability coefficients (VC) of the rectified full-wave, low-pass filtered and normalized by the average amplitude EMG signal were analyzed. The studied muscles were the orbicularis oris (upper), mentalis, and left and right buccinators. The tested movement was the sucking of different consistency drink, with straw. The drinks were water, yogurt, and chocolate cream. The Beckman surface electrodes acquired the EMG signals with one centimeter between their detection points. The raw EMG signals were digitalized by a 12-bit-A/D converter board, *Butterworth* filter, low-pass of 509Hz, high-pass of 10.6Hz, gain of 100 times, and 1,000Hz sample frequency.

RESULTS and DISCUSSION

The results of VC were: 17.62% and 13.23% during water suction, respectively for the orbicularis oris and mentalis muscles. During yogurt suction, for the same muscle sequence, the results of VC were: 20.61%, 16.46%, 17.23% and 12.26%. For the chocolate cream suction, the results were: 24.61%, 17.07%, 21.04% and 13.70%. The VC values found were not higher than 32% in the activation patterns of the studied muscles.

Nowadays, the use of the electromyography data obtained for study of the movement comes suffering several alterations mainly as a result of two factors. The first of them is the technological progress, the introduction of the computer science in the acquisition means, registration and processing of the electromyography sign. The second, it is the necessity of the standardization of the techniques used by the researchers in the different stages of its studies, to create groups of data to compare and reproduce the results, since the lack of details on the protocol, the registration equipment and the techniques of the sign processing make difficult the validation and comparison of the obtained results. This concern with the establishment of similar methodology to they be followed for collection, registration, analysis and interpretation of the electromyography signs has been discussed by several authors (Basmajian & De Luca, 1985; Oliveira et al, 2004) tried to describe the characteristics of the electric activation of the muscles orbicular oris and mentalis in different contexts, on the other hand the direct comparison with our results demands caution and special considerations because they differ in characteristics and ages of the subjects, procedures for the collection and equipment used and signal processing.

In this research the values of CV are below 32% and, as they are related to a biological event, they are considered low and, therefore, indicative of the confirmation of an activation pattern described in relation to the medium width of the electromyography sign surface for the four muscles studied in the suctions of the different liquids, reaffirming its likeness in the activation pattern along the movement, independent of the consistency of the sucked drinks.

CONCLUSIONS

This shows there is an activation pattern of those muscles in the studied sample. In agreement with the data found in the present experimental situation, differences were not found in the activation quality of the orbicularis oris (upper), mentalis, and left and right buccinators muscles during different consistency drink suctions in children with open bite malocclusion and sucking habits.

REFERENCES

1. Basmajian JV, De Luca JC. (1985).Muscle alive: their function reveled by electromyography. 5th ed. Baltimore: Willians & Willians,
2. Degan VV, Puppin-Rontani RM. (2004). Terapia miofuncional e hábitos orais infantis. Rev CEFAC.; 6 (4), 396-404.
3. Felício CM, Ferreira-Jeronymo RR, Ferriolli BHVM, Freitas RLRG. (2003). Análise da associação entre sucção, condições miofuncionais orais e fala. Pró-fono.; 15(1):31-40.
4. Oliveira AS, Rodrigues D, Bérzin F. (2004). Avaliação da amplitude eletromiográfica do músculo deltóide em diferentes faixas etárias. Rev. bras. fisioter;8(3):171-177, set.-dez.

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180 POSTURAL ASSESSMENT IN PATIENTS WITH TEMPOROMANDIBULAR DISORDER

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INTRODUCTION

A temporomandibular disorder (TMD) is characterized by a group of disorders that affect the masticatory muscles, temporomandibular joint and adjacent structures. Due to the whole human body and a close relationship between the stomatognathic system and cervical spine, a change in the support structure causes a disharmony posture.
The aim of this study was to evaluate the postural changes present in patients with temporomandibular disorders.

METHODS

The study included 30 subjects who initially submitted to the RDC/TMD (Research Diagnostic Criteria for Temporomandibular Disorder) proposed by Dworkin and Leresche (1992), were divided into two groups of 15 subjects with a TMD and one without, considered as controls . The average age was 23.07 (± 5.66) years for the control group and 22.33 (± 2.55) years for the group with TMD.
After the diagnosis of TMD, we used a Postural Assessment Software (SAPO). Assessed: the misalignment of the head (DCA), the unevenness of the shoulders (DOM), misalignment of the hip with respect to horizontal (DQH), the angles of the trunk (ILT), the unevenness of the scapula (DE), unevenness pelvic (DPP), the protrusion of the head (PC), protrusion of the shoulder (PO) and tipping of the pelvis (BP).
Statistical analysis was performed by checking the result obtained by the p-value (P test) implemented using the Mann-Whitney Rank Sum.

RESULTS and DISCUSSION

The comparison of each posture changes between the TMD group and the control group revealed no statistically significant difference between the positioning of the head, spine, shoulder girdle and pelvic girdle in TMD patients and subjects without TMD (Figure 1).
However, some postural changes between the groups were observed such as the misalignment of the blade and the protrusion of the head which although not present statistically significant differences, one can observe a higher prevalence in the TMD group (Figure 2).
In assessing the RDC / TMD questionnaire, none of the patients had a disability or severe limitation of mandibular function due to TMD. Therefore, we diagnose TMD subjects who were classified as mild.
The data head position measured in the lateral plane through the angle of SAPO PC showed no differences between subjects with and without TMD, according to the results of Munhoz, Marques and Smith (2005). However, other studies found that subjects with TMD present more protrusion of the head in relation to the control group (NICOLAKIS et al, 2005). The differences can be attributed to methodological or sampling differences between the works.
Iunes et al. (2009) evaluated the posture of the head and spine in subjects with and without TMD by means of photography, radiography, visual assessment and RDC / TMD. The study concluded that the posture of the head and neck of an individual with TMD does not differ from individuals without TMD, going against the results obtained in this study.
The biomechanical relationship between TMJ, cervical spine and head position and the presence of common postural abnormalities in these segments in subjects with TMD, the data in this study questioned whether postural change can be considered predisposing this disorder. This study obtained results that are consistent to those observed in the literature, however, future studies should elucidate the relationship between the posture of subjects with and without TMD.

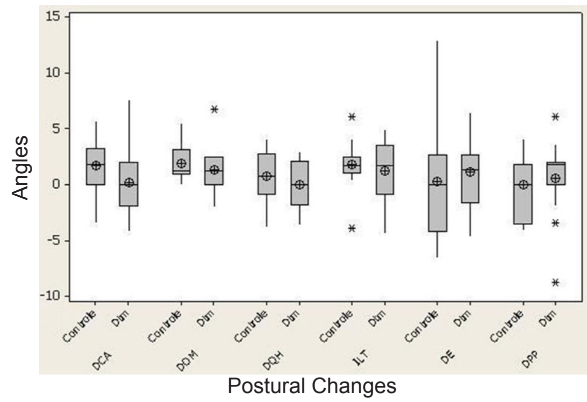

Figure 1 - Graphical representation of mean values, standard deviation, minimum, median, maximum, 1st and 2nd quartile of postural changes: DCA (misalignment of the head), DOM (unevenness of the shoulders), DQH (misalignment of the hip with respect to horizontal), ILT (lateral trunk tilt), DE (unevenness of the shoulder blades), DPP (posterior pelvic height differences) and outliers represented by the asterisk in the control and TMD.

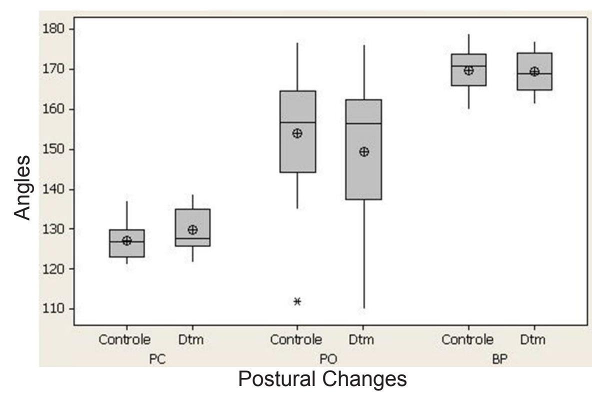

Figure 2 - Graphical representation of mean values, standard deviation, minimum, median, maximum, 1st and 2nd quartile of postural changes: PC (protrusion of the head), PO (protrusion of the shoulder), BP (tipping the pelvis) and the presence of outliers by the asterisk in the control and TMD.

CONCLUSIONS

In this study, the results of the study showed that the posture of the head, shoulder girdle, pelvic girdle and trunk inclination not differ between the groups with and without TMD. Photogrammetry through the SAPO is a feature that contributed to the quantitative assessment of postural subjects with and without TMD.

REFERENCES

1. Dworkin SF, LeResche LJ. Craniomandib Disor. 1992; 6(4):301-55.
2. Munhoz WC, Marques AP, Siqueira JTT. Cranio. 2005; 23(4): 269-77.
3. Nicolakis P, Nicolakis M, Piehslinger E, Ebenbicheler G, Vachuda M, Kirtley C, Fialka-Moser V. Physical Therapy. 2000; 18(2):106-12.
4. Iunes DH, Carvalho LCF, Oliveira AS, Bevilaqua-Grossi D. Rev Bras Fisioter 2009; 13(1): 89-95.

181 ELECTROMYOGRAPHIC ANALYSIS BETWEEN DIFFERENT TYPES OF HEEL

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INTRODUCTION

High heel footwear ended up becoming part of the daily clothing in the feminine universe (Tedeshi Filho, 2007). Women relate high heel use to elegancy (Yoon, et al. 1009), but one cannot yet demonstrate such a relationship between type of heel and biomechanical changes.
The objective of the present study was to verify whether type of heel (platform and stiletto heel) promotes difference in muscle recruitment in the crural region compared to barefoot gait.

METHODS

Electromyographic activity of 20 women who wore high heels everyday, with same shoe size (35), was analysed. The sample had mean age of 23.5 ± 2.86 years old, mean weight of 54.10 ± 7.16 kg, and mean height of 1.61 ± 0.05 m. Women presenting neuro-psychomotor changes, limb amputation, fracture sequelae, and rheumatoid arthritis were excluded from study. This work was approved by the Unifenas Human Research Ethics Committee. Anterior tibialis, Gastrocnemius, fibularis, and posterior tibialis were the muscles evaluated by means of surface electromyography (EMG) in which the subjects wore stiletto heel (8.0 cm height), platform heel (6.5 height), and no footwear (barefoot) during gait over a 3-metre course. These procedures were repeated three times for each type of footwear. The procedures were performed according to recommendations of the project called surface electromyography for non-invasive assessment of muscles (SENIAM). Only data on heel touch were analysed. ANOVA using factor analysis was used to exclude variables at $p < 0.05$.

RESULTS and DISCUSSION

It was observed significant difference ($p < 0.001$) between types of heel. With regard to high heel, the mean values for neuro-muscular recruitment of each muscle were found to be greater than those of platform heel. Barefoot gait showed the lowest mean values. Lee et al. (2000), who studied tibialis anterior muscle, concluded that the higher the heel height the greater the neuro-motor recruitment, which corroborates the results found in the present study. Stefanyshyn (2000) found a relationship between height and increase in neuro-motor recruitment for the femoral rectus muscle. However, no study comparing different types of heel was found in the literature. Although there exists a belief that platform heeled shoes do not cause biomechanical changes, this study reports data suggesting that both types of heel can yield muscular overload. Further studies are needed to compare stiletto heel to platform heel, both with same height.

Table 1: Comparison of type of footwear and use of heel.

Muscle	Type Heel	Mean (µv) and Standard Deviation	p-Value
Anterior Tibialis	Barefoot	88.0 ± 36.9a	* < 0.001
	Platform	96.5 ± 44.1b	* < 0.001
	Stiletto	110,4 ± 45.0c	* < 0.001
Fibularis	Barefoot	49.4 ± 24.4a	* < 0.001
	Platform	72.0 ± 35.8b	* < 0.001
	Stiletto	125.6 ± 49.8c	* < 0.001
Gastrocnemius	Barefoot	34.3 ± 21.4a	0.102
	Platform	48.8 ± 23.4b	* 0.045
	Stiletto	68.9 ± 30.9c	* < 0.001
Posterior Tibialis	Barefoot	28.4 ± 18.1a	* 0.049
	Platform	36.2 ± 19.1b	0.08
	Stiletto	48.8 ± 34.8c	* 0.004

*p<0.05 significant difference between the groups in the horizontal. Different letters mean differences between the types of shoes for each muscle

CONCLUSIONS

There exist a muscular overload related to the increase in height heel, regardless of the type of heel.

REFERENCES

1. Tedeschi Filho W, Piccinato CE, Moriya T, JovilianoEE, Dezotti NRA. Influência da altura do salto de sapatos na função venosa da mulher jovem J Vasc Bras 2007, 6 (4): 352- 8.
2. Yoon JY, An DH, Yoo WG, Kwon YR. Differences in activities of the lower extremity muscles with and without heel contact during stair ascent by young women wearing high-heeled shoes. J Orthop Sci 2009, 14:418–422.
3. SENIAM Project. Surface Electromyography for the Non-Invasive Assessment of Muscles Disponível em http://www.seniam.org/. Acesso em 01/10/08
4. Lee CM, Jeong EH, Frievalds A: Biomechanical effects of wearing high-heeled shoes. International Journal of Industrial Ergonomics 2001, 28:321-326.

182 ANALYSIS OF THE EVOLUTION OF POSTURAL CONTROL WITH AGING

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INTRODUCTION

Keeping the body upright is a complex task, which requires a highly sophisticated control system to maintain the center of gravity inside the area of base of the body.
One of most important techniques to evaluate the corporal dynamics, during postural control, is based on monitoring the Center of Pressure (COP) by means of a force platform to measure Antero-Posterior (AP) and Medio-Lateral (ML) displacements. Once the data has been converted into digital, some mathematical techniques can be applied to extract information that can be used to help understanding the process of postural control and for clinical evaluation.
Although one can find a number studies on the subject (Collins & Luca (1993), Norris et al (2005) e Prieto et al (1996)), there is a lack of investigation on properties of the displacement of the COP that can reflect the slow changes in postural control during the aging process. This paper describes an assessment of postural control in different age brackets, checking for possible alterations due to the aging process. To do so, the displacement of the COP was studied with traditional techniques, such as mean value, RMS value, mean frequency and confidence ellipsis. We also used a novel method, called Linear Discriminant Analysis in order to search for any subtle changes, hard to be pinpointed by traditional methods.

METHODS

The experiments were previously approved by the Ethics Committee of the Federal University of Uberlândia and were conducted with 59 healthy subjects, ie without clinical evidence or history of neuromuscular diseases. The subjects were divided into seven groups: Group 1 (N = 10; 20 to 29 years old); Group 2 (N = 10; 30 to 39 years old); Group 3 (N = 8; 40 to 49 years old); Group 4 (N = 10; 50 to 59 years old); Group 5 (N = 9; 60 to 69 years old); Group 6 (N = 8; 70 to 79 years old); Group 7 (N = 4; 80 to 89 years old), where N means the number of participants of the group. During the experiment, each person stood for 30 seconds on a force platform at the upright position with the hands flat beside the body, the feet forming an angle of 20 degrees and the heels 2cm apart. This procedure was executed 3 times for each condition under analysis (eyes open and eyes closed). The subject was asked to try and minimize any postural oscillation. When executing the test with the eyes open, the subject was also asked to look at a fixed point positioned 2 meters away at eye level.
The authors used the Pearson's correlation coefficient (r) to investigate possible correlations between the characteristics extracted from of displacement of COP and the ages of the subjects. The analysis of variance (ANOVA) was also applied in order to verify the level of statistical significance between the groups under analysis.
To extract the various characteristics of the COP displacement, the following methods were first used: mean velocity, total displacement, RMS value, confidence ellipses and spectral analyses. Some more sophisticated methods, such as those related to mathematical techniques of mechanical statistics (Detrended Fluctuation Analysis - DFA, Stabilogram Diffusion Analysis – SDA and R/S Analysis of Approximate Entropy) were also experimented. Those techniques were applied to both axis of the COP (AP and ML axis). Finally, the authors used a novel method in this area, called Linear Discriminant Analysis (LDA), which was applied with the objective of estimating a unique variable (called LDA-value) that comes from the combination of all relevant characteristics extracted from the COP displacement, for each group.

RESULTS and DISCUSSION

The analyses described earlier sought to verify the existence of variations in the behavior of the COP correlated with the age of the volunteers. The assessment of the data based on individual mathematical analyses, didn't offered any result that could correlated changes in the variation of the COP with aging, i.e., none of the characteristics observed were significantly correlated with age ($r < 0.5$). Hence, the LDA analysis was used to try and associate all the techniques, in order find out if it was possible to extract any new information.

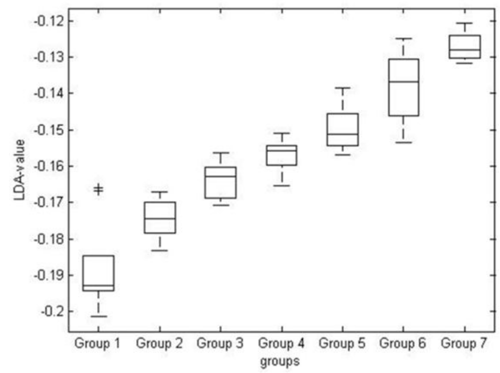

Figure 1 – LDA-value for the seven age brackets.

Figure 1 shows that the LDA-Value increases almost linearly with the age. The statistical analyses showed that the LDA-Value is highly correlated with the age ($r > 0.9$). The analysis of variance (ANOVA) also showed that the seven groups were significantly different from each other.

CONCLUSIONS

The analysis of the COP displacement, based on the LDA technique, allows us to conclude that, with the advance of age, the process of postural control shows important alterations. Nevertheless, it is not possible, as yet, to reach clear conclusions about what are the reasons and the effects of those alterations, since that the LDA analysis doesn't allow us to identify, individually, the contribution of each parameter. In future works, the authors intent to search for means of identifying how each parameter influences the global behavior of the LDA-Value, in order to understand how the postural control is affected by variations of each of those parameters, as one ages.

REFERENCES

1. Collins JJ, Luca CJ. (1993). Open-loop and closed-loop control of posture: A random-walk analysis of center-of-pressure trajectories. Experimental Brain Research, 95:308-318.
2. Norris JA, et al. (2005). Ability of static and statistical mechanics posturographic measures to distinguish between age and fall risk. Journal of Biomechanics, 38, 1263-1272.
3. Prieto TE, et al. (1996). Measures of Postural Steadiness: Differences Between Healthy Young and Elderly Adults. lEEE Transactions on Biomedical Engineering, 43,9.

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183 CORRELATION BETWEEN FACIAL TYPE AND HEAD POSITION IN NASAL BREATHERS AND OBSTRUCTIVE AND VICIOUS MOUTH BREATHERS

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INTRODUCTION

The forward head position, commonly related to mouth breathing, is described as an adaptation to amply and facilitate the air passage through oropharynx.
The literature affirms that the long facial type presents bigger resistance to the air passage through nasal tract (Bianchini, 2001) and that this resistance increase is related to the forward head (Costa et al, 2005). In this way, it is asked about the existence of a direct correlation between facial type and head position, it means, how longer and narrower is the face, bigger would be the resistance to the air passage by nasal tract and more forward is the head posture.
The purpose of the current study was to verify the correlation between facial type and head position in relation to the horizontal plan in nasal and mouth breathing children.

METHODS

59 children at age between 8 and 11 years and 10 months old took part in the study. It was carried out a speech-language selection and otolaryngologist evaluation, followed by a nasal fibroscopy, leading to the participants' classification into three groups.
The group RN was composed by 15 children that presented nasal breathing predominantly; the group ROO, by 22 children that presented mouth breathing due to obstructive pathology of air tracts, associated or not to rhinitis; and the group ROV, by 22 children that presented mouth breathing in obstruction in the air tracts absence and by those that presented nasal mucosa transitory edema, treated or not, and that keep the usual mouth breathing even without obstruction.
With digital caliper, were measured, by a speech language pathology professional, height and width face in order to determine the facial index and type (Ávila, 1940; Izuka et al, 2008). The head position was evaluated by a physiotherapist through computerized photogrammetry. The children had the anatomical points considered delimited in the body and they were photographed in orthostatic position, in swimsuit and barefoot. It was considered the angle formed among the seventh cervical vertebra, the ear tragus and the horizontal as reference of the head position in right profile.
The analysis of the correlation between face index and head position was carried out by Spearman correlation coefficient and it was considered the significance level of 5% ($p<0.05$).

RESULTS AND DISCUSSION

It was verified the predominance of short face in the group RN (46.6%) and the long face in the groups ROO (50%) and ROV (40.9%). The head position was similar in the three groups. The mean values for the angles evaluated were: 46.15° in the group RN; 45.71° in the group ROO; 45.09° in the group ROV. Probably, such mean values correspond to the forward head position; however, the reviewed literature does not present for this angle a value referent to the alignment head in the age group of this study.
It was not verified correlation statistically significant between face index and head position angle in each group, indicating that the facial type and head position are not related.
In opposite from this result, Solow and Tallgren (1976) verified that the forward head is associated to the long facial type, when they studied the facial type and the head position through cephalometry in young male adults.
A probable explanation for the result in this study would be the fact the body position is influenced by several aspects besides breathing mode alteration. Among these aspects that could modify the head and cervical vertebra positions are the heredity, environment conditions in which the children are inserted, the physical activity level, the physiological adaptations due to body growth and development. As well the occlusal conditions frequently altered in the mouth breathers.
It is suggested that new studies be carried out in the sense to get better comprehension of these relations, considering also the occlusal conditions that can influence the head position and that were not investigated in this study.

CONCLUSIONS

There is no correlation between facial type and head position in relation to the horizontal plan in nasal breathers children and obstructive and vicious mouth breathers, rejecting the initial hypothesis that would have directly proportional correlation between these variables.

REFERENCES

1. Bianchini EMG. (2001). Rev. Dental Press Ortod. e Ortop. Facial.6, 73-82.
2. Costa JR, et al. (2005). Rev Paul Pediat. 23. 88-93.
3. Ávila B. Antropometria e desenvolvimento físico. (1940). Rio de Janeiro: Patronato.
4. Izuca EM, et al. (2008). Int J Orthod Milwaukee. 19, 3-16.
5. Solow B, Tallgren A. (1976) Am. J. of Phys. Antropol. 44,417-435

Table 1: Correlation between the head position and the face index in each group

	Head position in relation to the horizontal					
	RN		ROO		ROV	
	Sp	p	Sp	p	Sp	p
Face index	0.132	0.64	-0.262	0,24	-0.385	0.07

RN: Nasal Breathers; ROO: Mouth Obstructive Breathers; ROV: Mouth Vicious Breathers; Sp: Spearman correlation coefficient; p: significance level ($p> 0.05$).

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184 POSTURAL ANALYSIS OF CLASSICAL BALLET DANCERS

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INTRODUCTION

The ballet movements require performance with a perfection of technique, involving extreme joint positions and muscle strain that may exceed the normal ranges of motion, thus generating high mechanical stress in bone and soft tissue facilitating the emergence of postural changes (PICON and FRANCHI, 2007). This work aimed to verify the postural condition of classical ballet dancers.

METHODS

This is a cross-sectional study, which was approved by the Ethics Committee of the Federal University of Santa Maria (CAAE - 0024.0.243.000), according to the established norms in the Resolution 196/96 of the National Health Council on research involving humans.
Inclusion criteria were: Having more than three years' experience of classical ballet; have between 13 and 18 years. The exclusion criterion adopted was having accomplished some treatment for the postural correction.
Three ballet academies from the city of Santa Maria participated, where were found thirty-two eligible dancers for the study group, of these, ten fit the established criteria, which received the Term of Free and Illustrious Consent, which was signed by their parents or responsible, consenting with the participation in the research in a voluntary way. The ballet dancers were informed about the freedom of leaving their participation in the study, as well as of the secrecy that would be maintained in order to protect their identity.
The dancers answered a questionnaire related to the physical characteristics (age, menarche, weight and height), after that where submitted to the postural evaluation through postural orthostatic photographs, in anterior-posterior, posterior-anterior and lateral right and left positions.
The photographic record was made with a Sony camera, positioned 3.5 meters away from the ballet dancer evaluated over a 1 meter tripod. For spatial reference, a plumb line was positioned laterally at 1 meter distance from the subject, who was wearing bathing suits and, before the image acquisition, was marked with reflective indicators in anatomic points, according to the software, protocol Postural Analysis (SAPO) version 0.67. The digitization of the points allowed the acquisition of the following angles: horizontal alignment of the head, acromial horizontal alignment, horizontal alignment of iliac spine previous superior (EIAS), horizontal alignment of the scapula in relation to back T3, vertical alignment of the trunk, horizontal alignment of the pelvis.
Data analysis was conducted through distribution of percentage.

RESULTS and DISCUSSION

From this analysis is possible to see that the most of the dancers showed head tilt to the right (80%), left shoulder high (80%) and left EIAS high (70%), similar to the findings of Simas and Melo (2000), those authors suggest that training in specific movements of the practitioner repeats the movement on the side of better execution of the technique, developing the muscles in a disharmonious, allowing the appearance of postural deviations.
Most of the dancers had put forward scapulae (70%), according to Bristot et al. (2009) to stabilize the shoulder blades with a light intake is of great importance during the arm movements in classical technique, which leads to hyperextension of the pectoralis major and minor. This can often trigger the trunk extension, present in 100% of the dancers studied. According to that author, this attitude leads to a shift of the center of gravity as a result of clearance of cervical and thoracic curves increased lumbar lordosis, and may thus explain the occurrence of antepulsion trunk found in 80% of dancers in this study.
In addition, 100% of the dancers studied had anterior pelvic tilt, Dezan et al. (2004) affirm that the request physical disproportionate between flexors and extensors of the hip may favor the development of imbalances of the forces generated by the muscles involved in this joint and lumbar spine by changing the angle of pelvic tilt.
Changes in the posture of dancers are common, Pereira et al. (2008) argue that the analysis of postural changes is important for the prevention of injuries that may appear as a result of them.
Among the study limitations, we cite the fact that the study group was relatively small, that has not been investigated the dancer's preferential side, which may influence the side slopes.

CONCLUSIONS

In the studied group of dancers' alterations of posture was verified, as inclination of the head for the right, high left shoulder, EIAS left high, adduced scapulas and angle of pelvic tilt, which are capable of causing injury. In that way, preventive actions are high importance for the apprentices of classic ballet, in order to improve awareness of body alignment and facilitate the use of physical capacity of the dancer without compromising the musculoskeletal system.
It is suggested that studies should be conducted with a larger number of ballet dancers group.
It was found that the postural analysis becomes of great need, as the group of dancers studied was verified certain postural alterations which are capable of causing injury.
Thus, preventive physiotherapy are very important for the practitioners of classical ballet in order to improve awareness of body alignment and facilitate the use of physical capacity of the dancer without compromising the musculoskeletal system.
It is suggested that studies should be conducted with a larger sample, excelling by the homogeneity of the study group.

REFERENCES

1. BRISTOT C., et al. (2009) *Rev Bras Ed Física, Esporte, Lazer e Dança*, 4, 1: 12- 26,.
2. DEZAN VH., et al. (2004) *Rev Bras Ci Mov*, 12, 1:35-38.
3. PEREIRA ACM., et al. (2008) *Terapia Manual*, 6, 23: 11-17.
4. PICON AP., FRANCHI SS., (2007) *Revista* UNIARA, 20.
5. SIMAS JPN., MELO SIL. (2000) *Rev Ed Fis*, 11, 1:51-57.

185 EFFECTS IN LARYNGECTOMY POSTURE: A SYSTEMATIC REVIEW

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INTRODUCTION

Borges et al. (2008) appointed the cancer with a group of malignant diseases characterized by abnormal and uncontrolled growth of cells that were changed in their genetic material, causing changes in function or on gene expression.
Salomão et al. (2008) reported that cancer be a public health problem, to had a large price and social and institutional costs, making it necessary to develop programs for epidemic control, detection and early prevention.
According to Santana et al. (2003), even with available treatments, the cancer has a high mortality rate. In Brazil is the 3rd leading cause of death, secondary only to circulatory diseases and external causes.
Among the tumors of the head and neck, cancer of the larynx is one of the most frequent to reach this region (about 25% of malignant tumors and 2% of all cancers in Brazil). According to Carvalho et al. (2001) occurs predominantly in men about 50 to 70 years of age, having on the smoking and drinking its main risk factors.
The cancer treatment varies according to tumor staging and can be: radiotherapy and chemotherapy in association to surgery (tumorectomy, total laryngectomy). As Salomão et al. (2008) say there are several consequences of treatment: structural and tissue damage, leading to functional disability, and a middle to high oncology surgery risk, due to old age.
Due to the reduced numbers of references, it is necessary research that can contribute to scientific knowledge, through understanding and investigating of postural changes and body notion as a consequence of the emergence of larynx tumor and the appropriate treatment, since according to the current literature, there is some deficiency in a more detailed and specific of these effects. This study aims to analyze the national and international literature, the effects on posture in patients with larynx cancer, through a systematic review.

METHODS

This is a retrospective systematic review cohort study, case control, with the methodology proposed by the Cochrane Collaboration. Carried out from september/2009 till december/2009, to search for articles on computer databases (Medline, Medline OLD, LILACS, SciELO Brazil, Pub Med and Cochrane Lybrary). No filter was used to limit articles.
The crosses used in the search were: (sternocleidomastoid [ECOM] AND laryngectomy) OR (laryngectomy AND posture) OR (electromyography AND laryngectomy) OR (AND larynx posture AND electromyography), and their equivalents in Portuguese, French and Spanish.
Inclusion criteria were: presenting the effect of postural disorders for treatment of larynx cancer, effects on postoperative laryngectomy; electromyography in laryngectomized patients and ECOM muscle analysis in laryngectomized.

RESULTS and DISCUSSION

We obtained 855 reports who were judiciously and independently analyzed by 3 researchers.
Where 9 publications were selected, even with methodological heterogeneity, because had criteria included on inclusion criteria.
Kruk-Zagajewska et al. (2001) affirmed that the bigger exposure is in men due to exposure to environmental factors and background related to smoking and alcohol consumption; and the difference in sex may be due to endogenous factores (sex hormones).
In all the studies chosen, there is the realization of laryngectomy, in association with radiotherapy and chemotherapy postopetory.
The literature points to the late effect of radiatherapy as a complicating factor on the posture of head and neck of this population, not only by the fibrotic factor, but the tissue atrophy, swelling, scar, redness, neck hardening, necrosis of soft tissues, burns and dry skin of the neck, beyond of pain from the face till the neck, muscle contractures and joint limitations, changing the tissue integrity of this region.
These issues generate limitations of joint moviment range of the upper limb (MS) in relation to him motor activity and neck mobility, all secondary to the treatment used.
All these changes impact both in body image, as on the quality of life in this population, because there's a story that facial disfigurement be a serious problem.

CONCLUSIONS

It is estimated that the installation of the laryngeal tumor predisposes to postural changes, due to pain, swelling and local signs. When the treatment is elected, all these effects come into exacerbated by changing the tecidual elasticity, interfering in the biomechanics of the head and neck. Besides, there is an increase in the disorder of body image, interfering directly on the quality of life of people affected.
Due to the small range of publications relating to specific postural changes, we suggest new studies emphasize that this condition secondary to treatment of laryngectomy.

REFERENCES

1. Borges CAM, et al.(2008). Análise dos métodos de avaliação, dos recursos e do reconhecimento da fisioterapia oncológica nos hospitais públicos do Distrito Federal. Rev Bras de Cancerol, 54(4):333-344.
2. Carvalho MB, et al.(2001). Características clínico epidemiológicas do carcinoma epidermóide de cavidade oral no sexo feminino. Rev da Assoc Méd Bras, 47(3):208-214.
3. Kruk-Zagajewska A, et al.(2001). Value of estradiol, progesterone and cortisol binding globulin (cgb) in patients with laryngeal cancer. Otolaryngol polska,55(5):477-82.
4. Salomão CHD, et al.(2008). Incertezas do paciente a ser submetido à cirurgia de laringectomia total. Rev Enferm UFPE, 2(1):55-60.
5. Santana ME, et al.(2003). A complicação fístula faringocutânea após laringectomia total: uma análise preliminar. Rev Bras de Cancerol, 49(4):239-44.

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186 PARAMETER OPTIMIZATION FOR A NEW HUMAN POSTURAL CONTROL MODEL

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INTRODUCTION

Since human being possesses two-thirds of the body mass situated in two-thirds of the height, it becomes an inherently unstable system, and it requires the presence of a control system that operates continuously to ensure its balance (Winter, 1995). Fortunately, the human species is endowed with an extremely skilled neuromuscular system to perform precisely that task. However, this ability has decreased, either by old age and/or the result of being affected by various diseases, which has forced many researchers to understand more about how this system works and how to quantify it. Believing that computer modeling can help to clarify how the nervous system and muscles interact to produce coordinated movement of different body parts, Naves (2006) proposed a physical-mathematical model dedicated to study the upright human posture control. Thus, this paper aims to evaluate the compatibility of the response of this postural control system (PCS) (Naves, 2006), with the physiological limits presented in data acquisition carried out at Biomedical Engineering Laboratory, Faculty of Electrical Engineering, Federal University of Uberlândia.

Human postural control model

This section aims to briefly describe the characteristics of Naves postural control model. In this model, the body dynamics is represented by a linear inverted pendulum, whose oscillation around the reference upright posture is reproduced by inserting an appropriate disturbance torque (Td). The body positions related to center of gravity (y) and center of pressure (u) are then calculated by the angle (θ) measured between the body inclination and the vertical line.

According to the diagram proposed by Naves (Figure 1), any body deviation (θ) from the upright posture taken as reference (θ = 0), is detected by the PCS model which then sends neural stimuli (Nin) to muscles to generate a resistant motor torque (Tm) against such deviation. The torque control is provided by a PID controller (proportional-integral-derivative) which is specified by three constants: K_p system rigidity factor, K_d system damping control factor, and K_i slow compensation factor for the system error setting. These constants (K_p, K_d and K_i) are determined by Ziegler-Nichols method, in such way that the neural control simulated by PID provides consistent responses to those observed empirically.

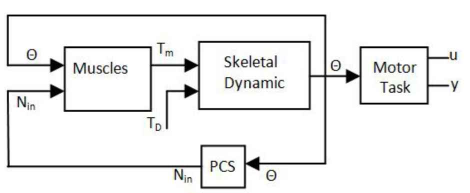

Figure 1 – Naves model block diagram

METHODS

This paper proposes an optimization of the PID controller constants to obtain PCS response in the normal physiological range. Therefore, the methodology follows the same standard suggested by Maurer and Peterka (2005).

For each set of values determined for K_p, K_d and K_i constants, a signal is simulated which represents the antero-posterior oscillation from the human body center of pressure. Each signal has a duration of 800 seconds and sampling frequency of 100Hz.

After the simulation of these signals through Naves model, fourteen oscillation measurement parameters, suggested by Prieto et al. (1996) and Collins and De Luca (1993), were calculated. They are determined by varying the constants K_d, K_p and K_i between 90% and 110%, in five steps of 5%, taking into account the reference value. From 125 simulated signals, resulting from all possible combinations of the constants in the mentioned range, the mean of these parameters is calculated and presented in the next session.

To compare the simulated results with real physiological data, three successive signals are acquired for each patient. It was used a population of 60 patients aged between 20 and 84 years old. The collected data had duration of 30 seconds each and a sampling frequency of 150Hz. As referred above, fourteen parameters were calculated for each measured signals, as well as the mean and the standard deviation (relative to all patients) to determine normal physiological ranges (mean ± standard deviation).

RESULTS

As shown in the previous session, it was calculated from Naves model signals the oscillation measurement parameters suggested by Prieto et al. (1996), which are shown in Table 1.

Table 1: Parameters as Prieto et al

	Simulations results	Data Collected ($\bar{x}$ ± SD)
RMS (mm)	2.6280	2.51 - 5.96
MV (mm/s)	6.0724	4.11 - 9.25
MAXD (mm)	19.2012	13.25 - 27.5
MD (mm)	2.0886	1.46 - 2.75
MFREQ (Hz)	0.5179	0.3 - 0.53
POWER (mm²)	6.9727	1.52 - 40.36
P50 (Hz)	0.4046	0.20 - 0.41
P95 (Hz)	0.7707	0.76 - 1.25
CFREQ (Hz)	0.4606	0.45 - 0.71
FREQD (Hz)	0.6815	0.57 - 0.71

K_p=33.5Nm.deg^{-1}, K_d=4.5 Nm.s.deg^{-1}, K_i=4.1 Nm.s^{-1}.deg^{-1}

To calculate the parameters for Stabilogram Diffusion Function (SDF), it was used the methodology of Collins and De Luca (1993). The results are shown in Figure 2 and Table 2.

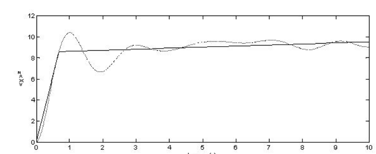

Figure 2 – Stabilogram Diffusion Function

Table 2: Parameters related to SDF

	Simulations results	Data Collected ($\bar{x}$ ± SD)
ΔT_C (s)	0.8004	0.44 - 1.68
$\langle \Delta X^2 \rangle$ (mm²)	13.1377	1.57 - 29.43
D_S (mm)	16.4371	2.78 - 28.06
D_L (mm)	0.0801	-0.69 - 8.79

K_p=33.5Nm.deg^{-1}, K_d=4.5 Nm.s.deg^{-1}, K_i=4.1 Nm.s^{-1}.deg^{-1}

CONCLUSIONS

It can be concluded from the results presented in the tables that the behavior of the model proposed by Naves is compatible with the fundamental properties of the somatosensory system observed experimentally.

ACKNOWLEDGMENTS

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REFERENCES

1. Collins JJ, De Luca CJ. (1993). Open-loop and closed-loop control of posture: a random-walk analysis of center-of-pressure trajectories. Exp Brain Res 95:308–318.
2. Maurer C, Peterka RJ (2005). A new interpretation of spontaneous sway measures based on a simple model of human postural control. J Neurophysiology, n.93, p.189-200.
3. Naves ELM. (2006). Modelagem e simulação do controle da postura ereta humana quase-estática com reflexos neuromusculares. Tese Doutorado, Faculdade de Engenharia Elétrica – UFU.
4. Prieto TE, Myklebust JB, Hoffman RG, Lovett EG, Myklebust BM (1996). Measures of postural steadiness: differences between healthy young and elderly adults. IEEE Trans Biomed Eng 43: 956–966.
5. Winter DA. (1995). Human balance and posture control during standing and walking. Gait & Posture, no. 3, 193-214.

187 EVALUATION OF THE EMG SIGNAL DURING SYMMETRIC LOAD LIFTING

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INTRODUCTION

Due to the high incidence of problems involving the posterior-medial trunk muscles a number of studies is dedicated do them. These focused on different analyses and used several techniques. One of the most common is Electromyography (EMG).

EMG signal have been evaluated using electrodes placed uni or bilaterally. Yet, few studies have investigated the electric activation similarity between right and left sides. Most studies that have analyzed both sides focused on scoliotic individuals. Though part of these has also evaluated normal subjects for comparison, most of the analyses used restricted movements, limited amplitude activities and no extra load.

On the other side, unilateral electrodes appear, particularly, in studies analyzing supposedly symmetrical trunk movements. Like the flexion-extension movement.

Therefore, the aim of the present study was to investigate whether the electrical activation of the posterior-medial trunk muscles occurs symmetrically when lifting a load from the floor using a symmetrical movement without mechanical restriction.

METHODS

Sample consisted of 16 healthy volunteers of both genders. All right handed, 25.3±4.3 years old, 170.8±10.4 cm height and body mass of 67.0±12.5 kg. History or complain of back pain or indications of lateral deviations were exclusion factors.

EMG signal was collected with a sampling rate of 2000 Hz per channel (Miotool 400, Miotec). Skin was prepared according to the ISEK/SENIAM standards (Merletti, 1999). Fourteen pairs of 30 mm-diameter Ag/AgCl surface electrodes in a bipolar configuration (20 mm between electrodes) were positioned, according to Basler et al. (1997), bilaterally, 3 cm lateral to the distal region of the spinal processes of C7, T3, T6, T9, L1, L3 and L5. Reference electrode was positioned on the right anterior-superior iliac spine. For later normalization of EMG data, each subject performed a three-second maximum isometric voluntary contraction (MVC).

Two sets of 10 repetitions of the symmetrical lifting of an object from the floor with a hip flexion-extension movement were analyzed. The movement started and finished in orthostatic position without load. Each execution was divided into four phases using the digitalized data from T1 marker. Phases 01 and 03 consisted of frontal flexion of the trunk until grabbing or depositing the object and phases 02 and 04 of the extension of the trunk to the initial position with or without the object. Each phase was four seconds long and an audible feedback was used in order to dictate the rhythm. Load was calculated using the NIOSH index (1998), corresponding to a load of 13.13±1.39 kg. Subjects were oriented to maintain the physiological curvature of the spine unchanged, keep the knees extended, and perform the movement smoothly. When needed, object's height on the floor was adjusted using a platform with by the necessary number of wood layers.

In order to separate the phases of the movement and examine the symmetry of the movement, kinematic data was collected synchronously with the acquisition of the EMG data. Two digital video cameras were used (GR-DVL9800, JVC – sampling rate of 25 Hz), and three reflective markers (diameter 15 mm) positioned on the spinal process T1 vertebra and on the inferior angle of each scapula.

Verification of movement symmetry was made per phase comparing the displacement of the scapula markers using Pearson correlation coefficient (PCC). To be considered symmetrical, a PCC≥0.9 in each axis was required. EMG signal was processed using a 3rd order, Butterworth band-pass digital filter (20 and 500 Hz cutoff frequencies). Root Mean Square (RMS) value was calculated for each phase, side and level of the repetitions found symmetrical.

EMG symmetry was checked using Wilcoxon test ($p<0.05$) in each level, between right and left sides, per phase.

RESULTS and DISCUSSION

Considering all phases, from 190 to 200 symmetric repetitions were found in each. Repetitions considered not symmetrical were excluded from data. EMG symmetry was only found in the lumbar region, but it was not present in all phases. Level L1 was only symmetrical in phase 02, level L3 in phases 01, 03 and 04 and level L5 was symmetrical throughout all the phases of the movement.

The majority of the asymmetric levels present higher activation of the left side of the trunk (90%). It may be speculated that some influence of handedness happened. It may be due to a better dominance of the right side musculature, impaling on a minor necessity of activation for the same task.

Most part of the studies found in literature that have verified EMG of the trunk region found symmetry in their results. But while in the present study the task was designed to be performed freely, most of the studies found have used data obtained from isometric tasks or dynamic movement with few repetitions performed with the use of mechanical limitations or external feedback intended to ensure symmetrical execution of the movement.

CONCLUSIONS

When the posterior-medial muscles of the trunk are analyzed during a task involving symmetrical flexion-extension of the trunk, activation symmetry is only seen in the lumbar region, and this symmetry is more evident the lower the vertebral level studied. Hence, it may be suggested that studies that analyze the upper levels of the vertebral spine should place electrodes bilaterally, even when the movement is considered symmetrical.

REFERENCES

1. Basler HD, Keller S, Herda C. (1997). "Good postural habits: A pilot investigation using emg scanning of the paraspinals." Applied psychophysiology and biofeedback 22(3): 171-182.
2. Merletti R. (1999). "Standards for reporting emg data." Journal of Electromyography and Kinesiology 9(1): 3-4.
3. Waters T, Baron S, Kemmlert K. (1998). "Accuracy of measurements for the revised niosh lifting equation." Applied Ergonomics 29(6): 433-438.

188 ELECTROMYOGRAPHIC ACTIVITY OF FLEXOR TRUNK MUSCLES DURING THE EXECUTION OF THE TEASER EXERCISE OF PILATES METHOD

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INTRODUCTION

The Pilates is an exercise method that objective to train the deep muscles of the trunk, or core muscles, promoting improvement on tonus, strength and flexibility, besides increase dynamic control on this musculature, and could prevent injuries (Gladwell et al 2005).
Understanding the effect of exercise on muscle should be a prerequisite in the prescription of a training program to stabilize the spine. However, there is still a lack of evidence on the effect of Pilate's exercises on muscular activity during the exercise.
The aim of this study was to evaluate the electromyographic activity (EMG) of flexor muscles of the trunk during one advanced Pilates method exercise and to compare the muscle activation according to the place where the exercise was carried out (mat or apparatus).

METHODS

Seven healthy females were recruited for this study. The characteristics of subjects were: age = 25±3.9 years, mass = 60.7±8.2 kg, height = 170.4±7.2 cm, body mass index (BMI) = 20.8±1.6 kg/m². All subjects should be healthy, physically active and practicing Pilates for at least six months. The exclusion criteria were back pain, abdominal surgery, severe scoliosis or congenital malformation of the spine, prolapsed intervertebral disc, spondylolisthesis, previous surgery of the spine, radicular symptoms, degenerative neurological diseases, history of stroke, inflammatory diseases or cancer and pregnancy. The subjects gave a signed written consent prior to their participation. This study was previously approved by the Ethics Committee of the Institution involved (196/96).
An 8-channel electromyography (MP150 model, BIOPAC System Inc, USA) composed of an analog-digital converter 16-bit resolution, input range of ±10 volts. The signals were adjusted to 2000 samples per second and a frequency of filter pass of 20 to 450 Hz.
Active electrodes were positioned on the rectus abdominis (RA) and external oblique (EO) muscles and a reference electrode in the styloid process of the non-dominant wrist. All procedures of electrodes placement followed the recommendations of the SENIAM (Surface EMG for the Non Invasive Assessment of Muscle).
A video camera standard 30 Hz (Sony) was used to record the execution of the exercise in order to identify the phases (concentric and eccentric) and synchronize them with the respective EMG signals.
The teaser exercise was performed in three conditions: mat, cadillac and combo chair, with four repetitions each. Prior to executing the exercise, the subjects performed a warming-up exercises: spine stretch, cat stretch and ab prep.
All data were collected using the Aqcknowledge 3.9.1 software and processed using Matlab subroutines. The signal was normalized by the EMG peak of dynamic activity. The linear envelope and the root mean square (RMS) were calculated for each muscle, phase and exercise condition.
In order to compare the conditions of the exercise in each phase, for each muscle, a repeated measures ANOVA was performed. The paired t test was used to compare the phases for each muscle. The significance was set in 5% ($P < 0.05$).

RESULTS and DISCUSSION

Statistically significant difference was found for RA muscle in mat x cadillac (P=0.01). This result could be explained by the initial position of the superior members in these two conditions, which differ in the lever movement. In addition, despite the resistance provided by spring in the cadillac, the volunteer was with the arms supported on the cross bar, which requires less control during the ascent.
In the eccentric phase were found statistically significant difference for the EO muscle in the mat x combo chair (P=0.02); and RA muscle in cadillac x combo chair (P=0.0001) and mat x combo chair (P=0.04) conditions. In combo chair, the upper limbs remain supported in the apparatus, which helps sustenance the trunk during the return. The spring of the cadillac apparatus was in maximum tension; this would lead to an abrupt return of the trunk to the initial position. Thus, the required control on descent take to increased muscle activation.
When the concentric and eccentric phases were compared it was found statistical significance difference for all muscles tested, in these three exercises conditions (P=0.0001). The lower activation was found in the eccentric phase. This result can be explained by the approximation of the upper limbs to the trunk and by the knee flexion, which reduces the load imposed on abdominal muscles. In addition, the contact of the pelvis with the support during return is higher, facilitating balance.

CONCLUSIONS

These results showed that the exercise approached on this study appear to recruit the abdominal muscles to a level that is sufficient for conditioning, mainly in mat condition.

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REFERENCES

1. Esco MR, et al. (2004). Med Sci Sports Exerc. 36, S357.
2. Gladwell V, et al. (2006). J Sport Rehab. 15, 338-350.
3. Queiroz BC, et al. (2010). Arch Phys Med Rehab. 91, 86-92.
4. Soderberg GL, Knutson LM. (2000). Phys Ther. 80, 485-498.

189 INFLUENCE OF PROPRIOCEPTIVE INSOLE ON MUSCULAR ACTIVITY OF TRAPEZIUS MUSCLE

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INTRODUCTION

Posture can be defined as a position or attitude of the body, relative arrangement of the parts of the body for an specific activity, or an own manner of sustaining the body. Cranium is sustained in position by cervical column muscles. For the head to be maintained in an erect position in order to be possible to look ahead, once the weight of head predispose it to bend forward, the muscles inserted in the posterior part of the cranium have to contract against gravity, demonstrating more potentiality in relation with the neck flexor muscles. There is an intimate relation between stomatognatic system and cervical muscles, meaning that any kind of dysfunction in this system could also provoke a head unbalance.

The objective of the present study was to compare pain level and electromagnetic activity of trapezius muscle during gait, before and after the use of proprioceptive insoles with subcapital bar in subjects with anterior chain predominance.

METHODS

Subjects without pain and with posterior chain predominance were exclusion criteria. Ten subjects were submitted to postural evaluation by SAPO program and EVA pointing during trapezius muscle palpation. Round and pre gelded surface electrodes of Ag/ClAg from MEDITRACE were placed According to SENIAM recommendation. Subjects walked randomly for five minutes in an electric treadmill at the speed of 4km/h with and without the subcapital stimulus. Muscular activity was collected by a surface electromyography tool from MIOTEC model MIOTOOL 400 of 4 channels. It was considered significance level of 5% and values are represented in RMS.

RESULTS and DISCUSSION

It was possible to observe a statistically significant decrease ($p<0,05$) of muscular activity during gait with the use of insoles, once the media activity was 295,76µV before and 112,56µV afterward. Besides, sensibility during palpation also showed lower with the use of the stimulus, but in this case the difference was not significant ($p=0,09$).

CONCLUSIONS

The results suggest for the analyzed sample that the use of subcapital bar decreased the muscular activity of trapezius muscle during gait, indicating the relation among muscular chains during gait and the proprioceptive stimulus on foot can be associated to conventional treatment.

REFERENCES

1. De Luca CJ, (1997). J Appl Biom. 13, 135-163.
2. De Luca CJ, et al. (2009). J. Neurophysiol. 101(3) 1620-8.
3. Herbert S, (2009). Ortopedia e Traumatologia. Artmed.