ELECTROMYOGRAPHIC ANALISYS OF MASSETER WOMEN PRESENTING SLEEP BRUXISM AFTER OCCLUSAL SPLINTS WEARING: a pilot study

Análise eletromiográfica de masseter em mulheres apresentando bruxismo do sono após o uso de placas miorrelaxantes: um estudo piloto

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Abstract

This paper aims to analyze the electric activity of masseter muscles through surface electromyography (EMG) and the efficiency of occlusal splints in women who present sleep bruxism (SB). SB was defined by its clinical characteristics. For the surface EMG study, a system of registration of signs was used and silver bipolar electrodes with 10mm diameter, positioned on motor points. The acquisition was done during mandible occlusion without clenching and maximum voluntary contraction in two situations. The first was the reception of the EMG signs of masseter muscles of all subjects after a work day without using of the occlusal splint; and the second, after a sleeping night using occlusal splints. Evaluating masseter muscles during mandible occlusion without clenching, it could be observed that lower values were noticed after splint wearing in both sides. The same results were verified in maximum voluntary contraction. These results confirmed that the use of occlusal splints for SB women reduced the myoelectric activity of the right and left masseters, showing its myorelaxing effect.

Keywords: Sleep bruxism; Electromyography; Occlusal splint; Masseter muscle, Women.

Resumo

Este artigo tem por objetivo analisar a atividade elétrica dos músculos masseteres por meio da eletromiografia de superfície (EMG) e a eficiência das placas miorrelaxantes em mulheres portadoras de bruxismo do sono (BS). SB foi definido por suas características clínicas. Para o estudo da EMG de superfície, um sistema de registro dos sinais foi utilizado e eletrodos bipolares de prata de 10 mm de diâmetro foram posicionados sobre os pontos motores dos músculos. A coleta dos sinais foi realizada na posição de oclusão mandibular sem apertar e na posição de máxima contração voluntária em duas situações distintas. A primeira coleta registrou recepção dos sinais dos músculos masseteres em todos os indivíduos após um dia normal de trabalho sem utilização de placas miorrelaxantes; e, a segunda, após uma noite de sono com o uso de placas miorrelaxantes. Avaliando os músculos masseteres durante a oclusão mandibular sem apertamento, foi observado que valores menores dos sinais EMG foram encontrados após o uso de placas miorrelaxantes em ambos os lados. Os mesmos resultados foram verificados na posição de máxima contração voluntária. Esses resultados confirmam que o uso de placas miorrelaxantes em mulheres portadoras de bruxismo do sono reduz a atividade mioelétrica dos masseteres esquerdo e direito, mostrando seu efeito miorrelaxante.

***Palabras-chave**: Bruxismo do sono; Eletromiografia; Placa miorrelaxante; Músculo masseter; Mulheres.*

INTRODUCTION

The International Classification of Sleep Disorders defines Sleep Bruxism (SB) as a desease caracterized by tooth clenching and grinding harmful movements during the sleep. It could be clinically observed by signs like abnormal tooth wear; orofacial pain; temporal headache; tooth hypersensibility to cold foods and drinks. Noises and hinge in the temporomandibular joints (TMJ) also are related to SB (1). Sleep bruxism is considered an idiopathic disease since innumerous physiological and pathological motor activities could involve the orofacial muscles during sleeping. The masticatory activity consists of mimic, lips protrusion, and tongue and swallow movements, which are completely physiological during the sleep (2, 3).

SB is a controversial phenomenon regarding to its etiology. Its diagnosis is described as a complex process composed by periferic and central factors (4). The peripheral factors, morfological, like occlusion and anatomical differences of the bone structures of orofacial region, were considered as involved in SB etiology (5). Other factors like chronic alcohol use, drugs, smoking, diseases and traumas could also be involved in SB etiology, as well as pathological and psychological factors which appear as central factors (6, 7). More specifically, disturbances in the central dopaminergic system had been recently described as involved in SB etiology (8).

According to Treacy, the effects of SB are not limited to the TMJ, head or neck areas. It could also be related to the physiological and psychological health. Disturbs related to SB include insomnia; headaches; muscle stiffness in the morning, congestion of facial sinuses, cervicodynia, arthrosis and vertigo (9).

In other study, the authors showed that SB was found in 8% of a sample of 846 subjects with clinical signs of tooth wear and it is associated to the rhythmical masticatory muscle activity (RMMA). SB consequences include tooth destruction, mandibular pain and tooth grinding (10).

Occlusal splint wear is considered an effective and non-invasive treatment for many SB patients and those with temporomandibular disorders (TMD). Several studies have been proposed to elucidate the splint action such as the modulation of neuromuscular function, relief of TMJ loads and psychological effects (11).

Glaros and Rao related that some studies had demonstrated changes in the masticatory muscular activity after the sear of occlusal splints wear in awaken patients. Those studies used systems of conventional electromyographic signs registration to monitor the electric activity of masticatory muscles (12).

SB was also studied using polissonographic method including surface electromyography of mandibular muscles. The presence or absence of SB and its frequency were determined by these registers using a match of EMG pattern and amplitude of masseter and temporal muscles (13).

Electromyography (EMG) has been widely used as an auxiliary method on TMD diagnosis. Its use allows evaluating the functional and biomechanical answer of masticatory muscles in rest, chewing and grinding (14).

The study of muscular function by EMG is defined by the analysis of electric signal produced during the muscular contraction and allows interpretations in pathological and normal conditions (15).

The present study aims to analyze the electromyographic signs of masseter muscle in women who presented SB, after a working day, correlating stress factors, psychological and intellectual conditions, and after the occlusal splint wearing during a sleeping night.

METHOD

Subjects

The sample consisted of 06 (six) women with average age of 26,5 ± 3 years, realizing a work journey of 08 (eight) hours per day, 40 hours per week. Clinical diagnosis was made under world standards of diagnosis, based upon patient history and orofacial examination (13). Teeth's wearing was evaluated with a dental mirror and adequate light. Upper and lower casts were made to analyze teeth wear degree (16, 18). Diagnose of muscular hypertrophy was also taken considering patient age and dental facial morphology (19, 20).

All of them were wearing flat and plane, myorelaxing occlusal splints during the sleep time to avoid teeth wear and TMJ overloading for more than 30 days.

The present study was approved by the eligible ethical committee from UNIVAP.

Electromiographic evaluation

The electromyographic study was realized in the Sleep Disorders Laboratory - IP&D – UNIVAP, with a system of electromyographic signs registration (EMG System do Brasil Ltda) with 8 channels of analogical input, with 1000 times of amplification gain, filter with frequency range from 20 to 500 Hz and digital analogical converter with a resolution of 12 bits. The sample frequency was 2000Hz by channel. This system obtained data, in root mean square (RMS), of each sample participant. Surface silver electrodes of 10 mm diameter were positioned in the motor point, located in the muscular womb center, indicated by masseter muscle hypertrophy in contraction. The patient skin was cleaned with alcohol 70% to reduce the impedance. The EMG evaluation occurred on mandibular rest position, and after a maximal volunteer contraction (isometric muscle contraction), biting a chewing gum placed bilaterally. Chewing gum was used to eliminate the discomfort of tooth contact.

Patients were placed sitting safely on a comfortably chair, staring the computer screen, which was exhibiting the electromyographic signs. A clear and precise verbal command was given to the patients concerned about muscles contractions and signs acquired. The utilization of computer screen like a biofeedback was used to control de intensity of maximum volunteer contraction, in order to eliminate the subjective muscular effort.

The data were collected twice per patient: after a work journey without occlusal splint wear (before occlusal splint wear) and after a sleeping night wearing the occlusal splint (after occlusal splint wear).

The signal treatment was performed by complete wave rectification, linear cover by Butterworth of fourth level, with 5 Hz frequency of cut, normalized in time base and amplitude, where the amplitude was normalized by mean.

The intensity variability of the EMG signs in the different muscular situations was made by 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

TABLE 1 - Values of EMG signs of right (RM) and left (LM) masseters in rest; before and after occlusal splint. The * marks subjects in which there was a statistically significant difference between the values before and after splint wearing

	RM	RM		LM	LM	
Subject	RMS average µV Before splint	RMS average µV After splint	p<0,05	RMS average µV Before splint	RMS average µV After splint	p<0,05
1	7,29	5,35	*	7,34	6,24	*
2	8,23	6,59	*	7,23	8,17	*
3	6,05	5,00	*	7,55	5,82	*
4	6,21	5,68	*	6,40	6,48	*
5	7,32	7,08		7,38	6,74	*
6	9,31	6,14	*	10,03	6,45	*

TABLE 2 - Values of EMG signs of right (RM) and left (LM) masseters in maximum voluntary contraction; before and after occlusal splint. The * marks subjects in which there was a statistically significant difference between the values before and after splint wearing

	RM	RM		LM	LM	
Subject	RMS average µV Before splint	RMS average µV After splint	p<0,05	RMS average µV Before splint	RMS average µV After splint	p<0,05
1	92,51	90,05	*	130,60	127,30	*
2	178,90	120,40	*	170,60	146,30	*
3	152,60	159,60	*	134,90	171,10	*
4	275,20	120,40	*	99,37	95,14	*
5	58,96	30,37		35,71	46,09	*
6	77,29	83,93	*	86,82	53,38	*

Table 1 shows the values concerning to electromyographic signs acquired on left and right masseter muscles in rest position. It could be observed the comparative values of EMG signs measured respectively on right and left masseter muscle in mandibular rest position. Both masseter muscles show EMG signs verified after a work journey before and after wearing occlusal splint.

Table 2 demonstrates the values concerning to electromyographic signs acquired on left and right masseter muscles in maximal volunteer contraction (isometric muscle contraction). It shows the comparative values of EMG signs measured respectively on right and left masseter muscle in maximal volunteer contraction before and after occlusal splint wear.

DISCUSSION

SB is a parafunctional oral habit characterized by tooth clenching and grinding harmful movements during the sleep, which result in excessive teeth wear, periodontal disease and temporomandibular disturbances (21).

Recently, the relationships among stress, muscular hyperactivity and painful symptoms are being studied by EMG. The clinical use of EMG in orofacial pain, muscular hyperactivity and specific daily activities shows considerable variations among patients (22).

EMG signs evaluated on the right masseter in rest (Table 1) showed reduction of the myoeletric activity with a significant statistical difference in 05 of the subjects analyzed. EMG signs obtained on the left masseter in rest (Table 1) also showed a significant statistical difference in 05 subjects, from whose 04 presented reduction in the myoeletric activity. One of the subjects tested presented no significant statistical difference on EMG signs measured on the right masseter but showed significant differences on EMG values of the left one. In other patient it could be observed an inverse situation: significant differences on EMG signs on the right masseter and no significant differences on EMG signs of the left masseter.

This situation of different results found in masseter muscles of the same individual can be explained by Baba et al. (23), which stated that inadequate forces distribution of masticatory muscles and TMJ, should leave to occlusal asymetry.

EMG signs obtained on the right masseter in maximum voluntary contraction (Table 2) showed that 02 subjects presented no significant statistical differences between signs measured before and after occlusal splint use. EMG signs on the left masseter in maximum voluntary contraction (Table 2) showed that 04 subjects presented significant statistical differences, from whose 03 had reduction of the signs values. Two subjects presented no statistical differences.

Another study showed a significant difference in the distribution of masticatory forces on muscles and TMJ. During teeth clenching, small jaw movements occur and it affects the TMJ loading. In an experimental situation, the maximum level of force could differ depending on jaw movement, which affect the clenching force and the EMG activity. The results from this study indicate that the distribution of clenching forces in SB could be influenced by occlusal patterns of the subject (24).

Our findings related to electric potential produced by right and left masseter during occlusion without clenching are in accordance with scientific literature. Our results showed a significant statistical decrease of myoelectric activity for muscles of both sides. Only one subject presented no significant result.

The efficacy of occlusal splint and placebo was compared during 6 weeks, and the authors found no statistical difference between the 2 types of devices, but the findings showed that there was statistically significant reduction of the masseter EMG activity immediately after the insertion of splints. However, there were no significant changes in 2, 4 and 6 weeks after the insertion of either splint (25).

The results of our study also are in agreement with those found by Landulpho et al. (26), which showed a significant reduction ($p<0,05$) in the EMG activity of masseter and temporal muscles during isometric muscle contraction in occlusal splint wearers, indicating decrease of myoelectric activity.

A randomized cross over study using 10 patients, compared the masseter EMG effects of two types of occlusal splint: a nociceptive trigeminal inhibitory (NTI) splint providing occlusion only on the front teeth and a standard occlusal splint (OS). Each patient received both splints and the study lasted 7-8 weeks including the

washout period. The authors concluded that the significant decrease of EMG activity is not associated with a reduction in TMD signs or symptoms, once 5 to 10 patients perceived pain at baseline (27).

Armijo-Olivo and Magee evaluated the electromyographic activity of the masticatory (masseter and anterior temporalis) and cervical (upper trapezius and splenis capitis) muscles during resisted jaw opening in awake patients, and found that EMG activity of these 4 muscles significantly increased during resisting jaw opening technique (28).

Therefore, more investigative studies are necessary to verify the relationship among peripheral and central factors and SB etiology. Different investigative methods may also be tested, comparing the control and pathological groups after situations of induced stress or electroencephalographic exams correlating sensitive-motor activities during the sleep.

CONCLUSION

Occlusal splints wearing as a prevention or treatment of SB should decrease electric activity of right and left masseter in situation of mandibular rest and maximal isometric muscle contraction in women.

Stress factors during a work journey should influence the increase of electric activity of masseter muscles in SB bearers.

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