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Research Article

Electroencephalographic Rhythms in Bruxism

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Abstract

Objective: To describe the frequency and amplitude of the electroencephalographic rhythms in bruxism patients using occlusal splints.

Method: Descriptive cross-sectional study, approved by Institutional Ethics UniCIEO classified as no risk investigation. Sample 84 patients, signed the informed consent, men and women older than 18 years, ASA I or II, with bruxism diagnosis, using a customized occlusal splint at least for 6 months. The Electroencephalograms (EEG) of all the patients were obtained in trelaxed wakefulness, closed-eyes. Variables: frequency and amplitude of α and β rhythms, response to light stimulation and hyperventilation. The clinical oral variables: tooth wear, occlusion and time using the splint. Descriptive statistics included average, standard deviation. The results were compared to normal ranges, between men and women was analyzed using the t test at a significance level p=0.05.

Results: The used the occlusal splint during the night, for 6-60 months, only two of them reported a reduction of sudden orofacial contractions, pain, stress, anxiety, muscle contraction, concentration difficulty, headache or migraine and sleep the frequency of Alpha rhythm in the patients was elevated: 95%CI: 25-57.6 Hertz (Hz), the Alpha rhythm amplitude 95% CI was (4-10.6 mcV). The 95% CI beta frequency (44.3-69.1 Hz). The 95% CI beta rhythm amplitude (2.6-4.2 mcV), The patients had an average ± S.D. slow wave frequency of 2.5 ± 1 Hz and average amplitude of 105.4 ± 37.7 mcV.

Conclusions: Patients with bruxism treated with occlusal splint show brain hyperactivity cerebral, outcomes of stress on anxiety.

Keywords: Bruxism; Electroencephalogram; Occlusal splint; EEG rhythms

Introduction

Bruxism is defined as a parafunctional activity of the stomatognathic system characterized by clenching and / or grinding of the teeth with no functional purpose [1]. The etiology of this pathology is under study and has a prevalence of 6-8%, with a ratio men/women of 1:2. During childhood the prevalence is 14-20% and it is reduced to less than 8% in adults and 3% in elder adults, according to polysomnographic criteria [2]. According to other literature sources the prevalence of bruxism is considered to have a range of 8-31% because it is frequently underestimated and most patients are not acquainted of the disease, that it is diagnosed only by specialists [3]. The disease is more frequent at early ages than in over 60 year adults and more common in women. Some authors find a prevalence as high as 90% [1]. Bruxism is a disorder relevant in dental medicine, neurology and sleep research, but dental professionals are interested in this disease because it is related to orofacial pain, tooth wear and restorative treatment failures. Bruxism is still difficult to define, diagnose and treat in an effective and safe way and demands a multidisciplinary approach [4]. A consensus conference organized by the Journal of Oral Rehabilitation in 2013 concluded that bruxism is a masticatory muscle activity occurring during sleep and characterized by rhythmic or not muscle contractions and during wake hours by the repetitive or sustained tooth contact and the reinforcement or pulling of the mandible. In healthy individuals, the bruxism is not considered as a disease but a behavioral risk factor (and/or protection) for some clinical sequelae [5].

Sleep Bruxism is now considered as a neurologic disorder induced by changes in the central nervous system [3]. There is consensus regarding the multifactorial etiology of sleep bruxism modulated by neurotransmitters such as the hypothalamic neuropeptide orexin /hypocretin and the GABA (Gamma-amino butyric acid) system that alter the circadian rhythm and sleep, inducing micro-arousal episodes as well as behavioral anxiety disorders related to stress and panic. Bruxism is therefore considered as a clinical manifestation of alterations the etiology producing emotional alterations of emotion and sleep architecture [5]. Orexin deficiency results in narcolepsy [6]. Other authors associate bruxism to a rapid transitory increase in brain, cardiac and muscular activity [7,8].

Dental treatment of bruxism is accepted only by conservative reversible modalities including occlusal splints, behavioral methods and physical procedures such as the use of TENS (Transcutaneous Electrical Nerve Stimulation) that is nerve electrostimulation through the skin to control pain. Dental treatments are combined according to symptoms or influence of particular etiologic factors but the occlusal treatments are not effective. There is not an effective treatment to permanently eliminate bruxism. Therefore, the therapeutic approach is addressed to prevent dental damage or any other pathologic effects on the masticatory system [9]. The occlusal splint does not eliminate or reduce bruxism but alleviates subjective symptoms and clinical signs. The use of occlusal splints is a common treatment to prevent tooth wear and damage to restorative devices caused by the occlusal overload due to bruxism. The splints for this purpose provide disocclusion guides and equilibrated occlusal planes avoiding interferences, occlusal contact disharmonies, muscle fatigue and articular damage [10]. The evidence supporting different kinds of treatment demands more controlled, randomized clinical trials [11]. To provide a multidisciplinary treatment the dentist usually must derive the patient to psychology or neurology professionals [3].

Considering the current developments in the study of bruxism, it is highly important to evaluate the brain electrical activity to improve the diagnosis and our knowledge of etiology and adequate therapy. Therefore, the objective of the present study is to analyze the frequency and amplitude of electroencephalographic rhythms in patients with bruxism that are using occlusal splints.

Method

This is a descriptive cross-sectional study, approved by the Institutional Ethics Committee of UniCIEO and classified as no risk investigation. The sample was 84 patients, from the Oral Rehabilitation Clinics of UniCIEO, treated during the period from January 2010 to January 2020, that volunteer to participate and signed the informed consent. The inclusion criteria were: men and women older than 18 years, ASA I or II, with bruxism diagnosis and using a customized occlusal splint at least for 6 months. The exclusion: mental disease, neurologic disability and lack of collaboration. The Electroencephalograms (EEG) of all the patients were obtained in the Foundation Central League against epilepsy in Bogotá, Colombia. All the EEG were obtained in relaxed wakefulness, closed- eyes. The EEG variables studied were frequency and amplitude of α and β rhythms, response to light stimulation and hyperventilation. The clinical oral variables were tooth wear, occlusion and time using the splint.

Descriptive statistics included average, standard deviation, 95% CI for α and β frequency and amplitude. The results were compared to normal ranges. No correlation between frequency and amplitude was considered because they are independent to each other and as well as correlations to age or sex needed a bigger sample. Comparison between men and women was analyzed using the t test at a significance level p=0.05.

Results

The study group included 42 men and 42 women (50% each), with an average age of 31,6 year for men and 31,8 year for women. All the patients used the occlusal splint during the night, for 6-60 months and only two of them reported a reduction of sudden orofacial contractions and pain, explains the clinical outcomes of stress, anxiety, muscle contraction, concentration difficulty, headache or migraine and sleep.

As shown in, both α and β rhythms show reduction of amplitude and increment of frequency, compared to normal ranges (Figure 1). The light stimulus and hyperventilation response were characterized by abnormal low wave discharges (Table 1).

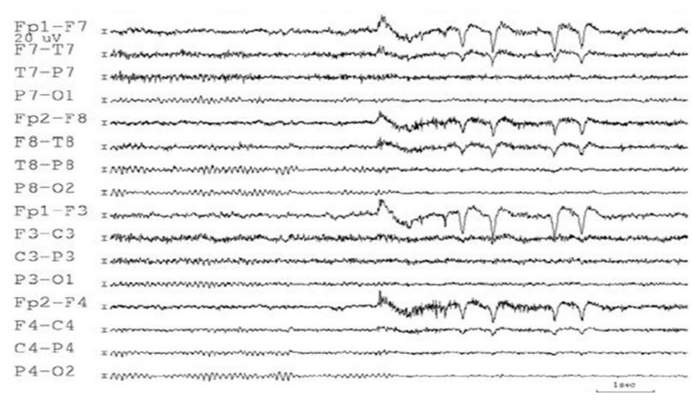

Figure 1: Electroencephalogram (EEG) of a patient with bruxism

Variable	Average	Std. Dev.	Standard error of the average	95% CI	Normal Reference Range
α frequency	41.33	25.67	7.41	(25.02; 57.64)	9-12 Hz
α Amplitude	7.33	5.18	1.49	(4.04; 10.62)	10-50 μV
β Frequency	56.75	19.51	5.63	(44.36; 69.14)	18-30 Hz
β Amplitude	3.417	1.240	0.358	(2.629; 4.205)	5-10 μV
Slow wave frequency	2.500	1.000	0	(1.865; 3.135)	0
Slow wave Amplitude	105.4	37.7	10.9	(81.5; 129.3)	0

Table 1: Frequency and Amplitude of alpha and beta rhythms (n=82 patients).

The differences in frequency and amplitude respect to the normal range was higher in women than in men and the slow wave discharge was higher in men than in women (Table 2). Except for α amplitude, sex differences are not statistically significant (t test $p<0.05$), probably due to the small number of cases per sex (n=22).

A linear comparison of the 95% confidence interval of the results with the normal interval clearly indicates that α frequency is higher than normal for all the subjects with bruxism Figure 2, while α amplitude tends to be lower with a small overlapping (Figure 3). For β frequency the complete 95% CI is higher than normal and the amplitude is lower than normal in the whole range of bruxism cases.

Variable	Sex	N	Average	S.D.	Coeff Var	Minimum	Maximum
α Frequency (Hz)	F	22	51.00	18.13	35.55	24.00	65.00
	M	22	31.7	29.9	94.56	10.0	70.0
α Amplitude (μV)	F	22	4.67*	2.66	56.96	3.00	10.00
	M	22	10.00	5.90	58.99	4.00	20.00
β Frequency (Hz)	F	22	62.83	14.47	23.03	49.00	78.00
	M	22	50.67	23.22	45.82	32.00	80.00
Β Amplitude (μV)	F	22	2.833	1.169	41.26	2.000	5.000
	M	22	4.000	1.095	27.39	3.000	6.000
Slow wave frequency (Hz)	F	22	2.000	0.894	44.72	1.000	3.000
	M	22	3.000	0.894	29.81	2.000	4.000
Slow wave Amplitude (μV)	F	22	100.3	50.0	49.88	50.0	160.0
	M	22	110.50	23.53	21.29	85.00	140.00
*Significant difference between sex, t test ($p<0.05$).							

Table 2: Frequency and Amplitude of α and β EEG rhythms and slow waves according to sex.

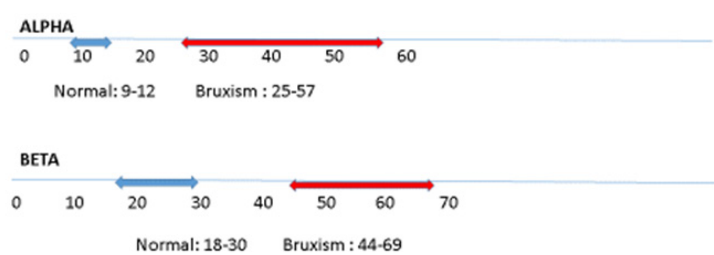

Figure 2: EEG Alpha and Beta rhythm frequencies (Hz): Normal range vs 95% Cl in Bruxism.

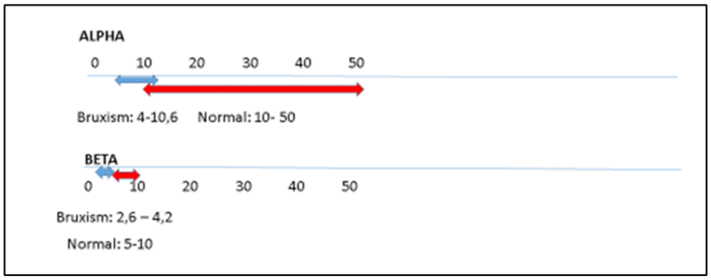

Figure 3: EEG Alpha and Beta rhythm amplitude (mcVolts): Normal range vs 95%Cl in bruxism.

Discussion

In the present study the age range of bruxism patients was 27-41 year, coinciding with most studies [12-14], that find higher prevalence of bruxism in chi Lavigne GJ, ldren and young adults. The use of occlusal muscle -relaxing splint was effective in 2 patients (16.6%), a result coincident as well with many studies [15,16], reporting that the splint do not arrest neither night contractions nor tooth wear, and Shetty, et al. demonstration that the splint use for ten years do not reduce the bruxism and also concluding that the splints do not control bruxism recommending the multidisciplinary approach to treat this disease.

The EEG results of the present study clearly show an increment of frequency and reduction of amplitude in α and β rhythms which is compatible with the diagnosis of brain hyperactivity, coincident with the study of Huynh N, et al. [17], that explains the clinical outcomes of stress, anxiety, muscle contraction, concentration difficulty, headache or migraine and sleep disorders in bruxing patients. There is also a coincidence with Cohen I, et al., Lobezzo et al., and Beleza P et al. studies that report emotional and behavior central effects associated to bruxism and related to brain cortex excitability [18-20].

All the patients in the present study referred sleep architecture alterations expressed as initial and continuity insomnia, coinciding with many studies [21-25].

Limitations of the present study such as the small sample size and the high range of times and modalities of splint use should be taken into account to take with caution the results of sex comparisons. Therefore, it is necessary to continue this research with higher samples and it is suggested to correlate the dental wear patterns with the brain cortex location of slow wave discharges and changes in EEG α and β rhythms. It is also necessary to compare bruxism patterns with the EEG patterns in a control group of non-bruxing dental patients.

Conclusion

Patients with bruxism treated with occlusal splint show brain hyperactivity demonstrated by concomitant EEG changes in the α and β rhythms (increased frequency and low amplitude). The mild effect of splint use corroborates the need to provide a comprehensive, multidisciplinary management of bruxism.

Authors Contributions

Beatriz Cepeda contributed to the design of the study, data analysis and interpretation, performed all statistical analysis, and drafted and critically revised the manuscript. Gisel Cristina Giraldo Rivera, Reyes Karina Ospino Arredondo, and Francy Tatiana Yañez Velandia were involved in the data collection and statistical analysis and edited the manuscript in general. Sofia Cepeda T was responsible for the design of the study, data collection and statistical analysis, wrote and revised the manuscript in general, and interpreted and critically revised the manuscript. All authors gave their final approval and agreed to be accountable for all aspects of the work.

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