



Correlation between sleep bruxism and headaches evaluated by polysomnography

Correlação entre bruxismo do sono e cefaleias avaliados pela polissonografia

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ABSTRACT

BACKGROUND AND OBJECTIVES: Sleep bruxism (SB) is an abnormal repetitive activity of masticatory muscles. It occurs during sleep for short or long periods, with or without dental contact. Several studies have deemed it as a possible causative and/or aggravating factor of primary headaches. This aims to investigate a potential correlation between SB and patients complaining of primary headaches whose previous diagnosis was polysomnography (PSG) with electrodes positioned in the masseter region.

METHODS: The sample consisted of observing 76 electronic records of patients (60 females and 16 males) diagnosed with some type of primary headache. The adopted criteria were those of the International Classification of Headache Disorders, 3rd edition (ICHD-3 Beta). All patients underwent PSG with electrodes on the masseters to assess the presence of SB. Data was analyzed using Chi-square and Student *t* tests, with a confidence interval of 95%, adopting $p < 0.05$ as level of significance. The JASP software, version 0.17.2.1, was used for analyses.

RESULTS: There were no statistically significant differences regarding the correlation between different types of primary headaches and the presence of sleep bruxism.

CONCLUSION: The results suggest that the presence of SB identified by polysomnography does not point to a significantly high incidence of primary headaches compared to individuals in whom the absence of bruxism was confirmed by the same method.

KEYWORDS: Headache, Polysomnography, Sleep bruxism.

RESUMO

JUSTIFICATIVA E OBJETIVOS: O bruxismo do sono (BS) é uma atividade anormal repetitiva dos músculos mastigatórios. Ocorre durante o sono por períodos curtos ou longos, com ou sem contato dental. Diversos estudos o consideram como um possível fator causador e/ou agravante de cefaleias primárias. O objetivo deste estudo foi investigar uma possível correlação entre o BS e pacientes que se queixam de cefaleias primárias, cujo diagnóstico prévio foi feito por polissonografia (PSG) com eletrodos posicionados na região massetérica.

MÉTODOS: A amostra consistiu na observação de 76 prontuários eletrônicos de pacientes (60 mulheres e 16 homens) diagnosticados com algum tipo de cefaleia primária. Os critérios adotados foram os da Classificação Internacional de Cefaleias, 3ª edição (ICHD-3 Beta). Todos os pacientes foram submetidos à PSG com eletrodos nos masseteres para avaliar a presença de BS. Os dados foram analisados utilizando os testes Qui-quadrado e *t* de Student, com intervalo de confiança de 95%, adotando $p < 0,05$ como nível de significância. O *software* JASP, versão 0.17.2.1, foi utilizado para as análises.

RESULTADOS: Não houve diferenças estatisticamente significativas em relação à correlação entre os diferentes tipos de cefaleias primárias e a presença de BS.

CONCLUSÃO: Os resultados sugerem que a presença de BS identificada pela polissonografia não aponta para uma incidência significativamente alta de cefaleias primárias em comparação com indivíduos nos quais a ausência de bruxismo foi confirmada pelo mesmo método.

DESCRIPTORES: Bruxismo do sono, Cefaleia, Polissonografia.

HIGHLIGHTS

- No significant association was found between sleep bruxism diagnosed by polysomnography and primary headache types
- Polysomnography with masseter electrodes was used as the gold standard to ensure accurate diagnosis of sleep bruxism
- Findings suggest that sleep bruxism is not an isolated risk factor for primary headaches, reinforcing the need for further investigation

INTRODUCTION

Sleep bruxism (SB) has attracted the attention of researchers and healthcare professionals because of its prevalence and the potential impact on the quality of life of affected individuals. The term “bruxism” describes an abnormal activity of masticatory muscles. This activity is not the muscles’ usual physiological function¹. This activity happens during the sleep period or even when the person is awake²⁻⁴.

Epidemiological studies report that SB affects approximately 12.8% of adults. This high prevalence turns SB into a relevant health problem. Therefore, it is important to understand its causes, symptoms, and consequences to improve the quality of life of affected individuals⁵. The International Classification of Sleep Disorders (ICSD-3)⁶ allows for better standardization of SB and aids in the identification and treatment of this condition, contributing to improvements in both research and clinical practice related to SB.

SB is a multifactorial disorder with central mediation by the autonomic nervous system during sleep. There are several reported risk factors, classified into two main categories: primary (idiopathic) and secondary. Secondary etiology is associated with neurological diseases (e.g., Parkinson’s disease, dystonia, multiple sclerosis, and other neurological disorders), psychosocial factors (anxiety, stress, and depression), psychological factors (neurotransmitters and genetics), sleep factors (respiratory disorders, obstructive sleep apnea, and periodic leg movements), and exogenous factors (caffeine, alcohol, drugs, medications, and smoking). Another important factor associated with SB etiology is the presence of gastroesophageal reflux disease^{1,4,7-9}.

Headaches and/or morning facial pain in patients with SB arise from the repetitive activity of masticatory muscles. The main types are primary headaches, migraine, and tension-type headaches^{10,11}.

The diagnosis of SB is based on patient self-report or information from family members regarding teeth grinding, corroborated by clinical examination. Symptoms may be signs such as dental wear, scalloped tongue, linea alba, muscular hypertrophy, headaches, and pain in the masseteric and temporal regions. Questionnaires and the criteria of the ICHD-3¹² are also useful tools. However, masseter electromyography associated with polysomnography (PSG) is the preferred exam for an accurate diagnosis^{3,4,13}.

The purpose of this study was to evaluate the association between SB in patients complaining of headaches who underwent polysomnography with electrodes positioned on the masseter muscles to assess electrical activity. The aim was to identify whether there was a strong correlation between SB and specific types of headaches prevalent among the investigated sample.

METHODS

This is a retrospective and observational study analyzing electronic medical records of patients. It was registered by the Research Ethics Committee of the same institution where the consultations and subsequent analyses of the medical records were conducted, approving this study under opinion number

3.573.658, waiving the use of the Free and Informed Consent Term (FICT). The patients were of both genders, with no age limits, diagnosed by a neurologist specialized in cephalalgia using the ICHD-3 criteria¹², who underwent PSG examination with electrodes positioned on the masseter region to assess the presence of SB. This study used data from patients at the Headache and Orofacial Pain Department of the Curitiba Institute of Neurology (INC - Departamento de Cefaleia e Dor Orofacial do Instituto de Neurologia de Curitiba). In the medical records, there was a question regarding self-reported SB. This was evaluated along with the PSG.

Patients were diagnosed with headaches according to the criteria of the ICHD-3 examined by a neurologist specialized in headaches. Patients had undergone overnight type 1 PSG examination at the sleep laboratory of the INC. Patients who are completely edentulous wear full dentures, lack a defined diagnosis of headache or have secondary headaches.

Statistical analysis

The existence of a correlation between the presence of sleep bruxism diagnosed by PSG and the presence of headache was analyzed by the Chi-square test. In addition, the mean age between the groups with and without bruxism was compared by Student *t* test. All analyses were conducted at a significant level of 5% using the JASP software version 0.17.2.1.

RESULTS

This study evaluated 76 electronic medical records of patients, of which 76 reported the presence of headaches and underwent PSG examination. After the PSG examination, 42 individuals presented SB. The sample included 16 (28.58%) male individuals and 60 (71.42%) female individuals. Three individuals had all three types of headaches, resulting in a total of 79 samples.

The age ranged from 16 to 73 years, with a mean age of 41.96 ± 14.45 . The mean age was confronted with the presence of bruxism and there was no statistically significant difference ($p > 0.05$). The mean of the bruxism group was 43.7 ± 13.8 and the mean of the non-bruxism group was 41.9 ± 15.6 .

The frequency distribution of types of headaches found in the sample showed that migraine was the most common type (Table 1).

In the sample, 79 forms spontaneously reported SB (self-reported)^{2,3}. Also, six individuals who had not previously reported SB symptoms in the initial interview presented the condition.

Table 2 shows the frequency distribution of patients who presented bruxism assessed by PSG and headaches.

Table 1. Frequency distribution of headache types in the sample.

Headache	n (%)
Migraine	60 (79)
Tension-type	5 (6.6)
Cervicogenic	11 (14.4)

Table 2. Comparison between different types of headache and presence of bruxism.

Migraine	Bruxism		Total	p-value*
	No	Yes		
No	7	12	19	0.317
Yes	30	30	60	
Total	37	42	79	
Cervicogenic	No	Yes	Total	0.921
No	32	36	68	
Yes	5	6	11	
Total	37	42	79	
Tension-type	No	Yes	Total	0.542
No	34	40	74	
Yes	3	2	5	
Total	37	42	79	

*Chi-square test at a significance level of 5%.

There was no association between patients with bruxism diagnosed with PSG and migraine, cervicogenic, and tension-type headaches, according to the Chi-square test.

DISCUSSION

The trigeminocervical complex is a neural pathway of utmost importance. It plays an essential role in transmitting sensory and motor impulses related to regions of the skull, face, and neck. Nociception and sensory sensitization associated with headache episodes, along with activation of masticatory muscles, use the same pathway to make a connection to the cerebral cortex¹⁴. The correlation between the motor pathway in the context of SB and the nociceptive sensory pathway of the head is under debate, as both use the same nerve transmission complex¹.

Reference authors¹⁵ reported that during the presence of SB, there is abnormal excitability in masticatory pathways. This activity is preferably influenced by the brainstem region than by the primary motor cortex. These results suggest that the motor control of the masticatory system is not directly involved in the pathophysiology of SB¹⁵. Another group of authors observed that, unlike chewing, in which the movement begins at the cortical level, SB influences mainly the brainstem region, where there is a greater reflex of neural activity⁹.

The brainstem region is responsible for maintaining the homeostasis of subconscious body functions, controlling activities such as rhythmic muscle activity and breathing. Abnormal muscle activity, unrelated to a typical task, may occur when other areas of the central nervous system affect the reticular formation through interneurons. This may explain the intensification of the repetitive activity of masticatory muscles present in SB¹⁶.

There is an intensification of repetitive activity of the masticatory muscles that result from a yet unknown etiology of SB and its association with several health conditions affecting multiple brain areas¹.

In SB, due to the decrease in the functioning of the primary motor cortex, individuals with migraine also show a decrease in neural activity in the primary motor cortex and the primary somatosensory cortex. This situation may indicate an alteration in the sensory characteristics of nociceptive pathways^{17,18}. These findings suggest that there is impairment of the conduction of nociceptive impulses; synapses occur in the brainstem and then proceed to the thalamus, where nociception modulation occurs¹⁹.

Furthermore, studies have shown an increase in trigeminal nociceptive stimulation 24 hours before the onset of pain in the hypothalamus, which may be related to the rhythmic activity of masticatory muscles. Studies have associated this increase in nociceptive stimulation with an increase in heart rates and the presence of autonomic arousal in individuals with SB^{9,20,21}.

Functional neuroimaging studies suggest a correlation between the presence of SB and headaches. Also, clinical research adopting self-report questionnaires in conjunction with diagnostic criteria, such as ICSD and ICHD-3, has shown that individuals with SB are 3.12 times more likely to present headaches²².

Regarding the association between SB and temporomandibular dysfunction (TMD), it is noteworthy that studies based on questionnaires/self-reports of SB have shown low specificity for SB assessments. In general, these studies have found a positive association with painful TMD. On the other hand, instrumental studies (i.e., electromyography, polysomnography) have reported a low level of association or even a negative relationship among these conditions, as observed in this research, which reveals that individuals with bruxism do not present a higher incidence of headache than those without bruxism assessed by PSG^{9,20,21}.

The PSG is an examination performed overnight in a laboratory setting under the supervision of a qualified technician. It may cause discomfort to the patient, but it is the gold standard diagnostic method for the evaluation of sleep-related breathing disorders²³.

One study obtained results that showed a higher presence of chronic migraine ($p=0.0005$) in individuals with SB. However, in groups with episodic migraine and tension-type headache, there are no significant differences ($p=0.0927$ and $p=0.3007$, respectively) to substantiate such a relation¹¹.

There is insufficient scientific evidence on the association between SB and headaches. Many studies lack specific diagnostic criteria for SB, which often leads to confusion of data on individuals who present some painful types of TMD, especially when the diagnosis of SB is based on patient self-report^{24,25}. The use of PSG as the gold standard for the diagnosis of SB is unfeasible in many studies because of its high cost. Instead, many studies resorts to questionnaires based on the ICSD and clinical examinations for diagnosis. However, as demonstrated by another study²⁶, these questionnaires and clinical examinations do not provide a satisfactory specificity to replace PSG; they are suitable only for an initial screening and should be followed by complementary tests for a more accurate assessment.

This research used the best available diagnostic tools, including PSG with masseter electrodes, for SB, as well as the diagnostic criteria established by the ICHD-3 for headaches. The aim was to obtain precise results. Despite the study's efforts to find a possible correlation between these conditions, further research is necessary for a better understanding of the relationship between them.

CONCLUSION

In this study's sample, individuals with primary headaches do not present a higher incidence of SB. Further studies are needed to investigate a possible association of this parafunctional phenomenon with headaches.

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