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ORIGINAL ARTICLE

Respiratory Problems and Different Manifestations of Bruxism in Children: A Retrospective Cross-Sectional Study

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ABSTRACT

Objective: To comparatively analyze associations between respiratory problems and adenoidectomy with the different manifestations of bruxism in children. **Material and Methods:** Were analyzed retrospectively on secondary data from the database of a service specializing in bruxism and temporomandibular disorder (TMD) of 279 children, aged 6 to 12 years, from October to November 2022. Two trained and calibrated examiners performed data extraction, checked and organized it. Descriptive and comparative analysis was carried out using the chi-square test, and Pearson's association test was used for the relationship between variables, both with a significance level of 5%. **Results:** The sample included secondary data from 259 dental records of children with a mean age of 8.6 years (±7.7), 44% male and 51% female. Probable bruxism was diagnosed in 55% of these children. A negative association between adenoidectomy and teeth clenching while awake (p=0.002), clenching during sleep (p=0.004), and grinding during sleep (p=0.040) was observed. **Conclusion:** The respiratory problems analyzed were not associated with the occurrence of bruxism in its different types of manifestation. However, all manifestations of awake and sleep bruxism were less frequent in association with adenoidectomy.

Keywords: Bruxism; Child; Nasal Obstruction; Sleep Apnea, Obstructive; Adenoidectomy.

Introduction

Bruxism is defined as involuntary and repetitive masticatory muscle activity characterized by grinding or clenching of the teeth, which can lead to different impacts in systemic and oral health of the patient [1]. This already establishes two of its manifestations, which are combined with the phases of the circadian cycle: awake bruxism (AB), which occurs when awake, and sleep bruxism (SB), which manifests during sleep [1,2]. Signs and symptoms resulting from bruxism include muscle and/or joint pain in the temporomandibular region, muscle hypertrophy, mandibular locking, headaches, and dental implications of the overload, such as the presence of wear facets, tooth and restoration fractures, hypersensibility, and tooth mobility [1-3].

The bruxism can be classified as possible, probable and definitive bruxism. Possible bruxism is diagnosed based on self-assessment of noises or grinding during sleep and report of clenching, bracing and grinding during awake. The probable bruxism is self-assessment of noise or grinding and also the clinical assessment of tooth wear, markings on the mucosa, tongue, masticatory muscle pain, fatigue and muscle hypertrophy. The final diagnosis of bruxism included a self-assessment, clinical assessment, and confirmation with a polysomnography exam [2]. Bruxism can also be classified as not a risk or protective factor when this condition is harmless to the patient, as a risk factor when bruxism is associated with one or more negative impact on the health of the patient, and as a protective factor when bruxism can be associated with one or more health benefit to the patient [1]. Due to the different approaches to diagnosis, there is a wide variation in the prevalence of bruxism in children. Some authors suggest that demographic aspects such as socioeconomic and cultural factors may influence the prevalence of bruxism [4,5]. Reported levels of sleep bruxism in children and adolescents vary from 3.5% to 46% [6,7], with a prevalence of sleep bruxism of 25.8% in Brazilian children and a prevalence of awake bruxism of 20.1%, most of them based on possible bruxism diagnostic criteria [3].

The etiology of bruxism is multifactorial and can be associated, mainly, with structural, functional, and psychological factors [1,2,5]. Factors associated with bruxism in children are male gender, mental and emotional problems, parafunctional habits, sleep deprivation [8,9], allergies and respiratory problems [10,11]. Regarding respiratory problems, studies have shown that disorders such as obstructive sleep apnea (OSA) and nasal obstruction can lead to snoring and mouth breathing, which has been associated with sleep bruxism [11-15]. In addition, allergic diseases such as rhinitis and asthma are common in children [16,17] and have been described as one of the most common causes of nasal obstruction in this population, which leads to mouth breathing and exacerbation of respiratory problems and directly affects the quality of life of the child [18]. The prevalence of respiratory problems in children is highly variable, ranging from 0.7 to 43% [19,20]. The adenoid is lymphoid tissue located in the nasopharynx, which plays a role in viral infections of the upper airways and obstructive sleep disorders. Adenoidectomy is the procedure for removing the adenoids and is performed due to certain nasal symptoms, otitis media with effusion, and/or sleep-disordered breathing [21].

Considering this and given the high prevalence of respiratory problems in children and adolescents, as well as the high occurrence of sleep bruxism in the pediatric population, identifying and better understanding a possible association between both conditions may contribute to better diagnosis, follow-up, treatment, and quality of life in childhood. Therefore, the aim of this study was to comparatively analyze associations between respiratory problems and adenoidectomy and the different manifestations of awake and sleep bruxism in children.

Material and Methods

Ethical Clearance

The research was approved by the Ethics Committee on Human Research of the School of Dentistry of Ribeirão Preto, University of São Paulo (Atest. CEP 007/2023, approved in April 26, 2018) and parents/guardians signed the free and informed consent form. This study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Study Design

This is a retrospective cross-sectional study analyzing secondary data from the dental records of a service specialized in bruxism and temporomandibular disorders (TMD) in children at Ribeirão Preto Dental School. This multi-professional service provides care to children and adolescents with bruxism and/or symptoms of TMD. Dental records of all patients treated in this service between March 2016 and December 2019 were used.

The examiner LMM extracted the data of the dental records from the database of the service specialized in bruxism and created a spreadsheet with the variables of interest including age, gender, type of bruxism (awake and/or sleep, teeth grinding and/or clenching), presence of respiratory problems (allergic rhinitis, asthma, bronchitis, mouth breathing, nasal obstruction, sleep apnea, snoring), and patients who had undergone adenoidectomy. A second examiner (JLG), was responsible for checking the data.

These data were obtained during the patient evaluation process, which consisted of a protocol including a questionnaire (in conjunction with parents' interview) and physical/clinical examination for the diagnosis of bruxism and assessment of risk factors. The probable diagnosis for bruxism was established from the parents' reports referring to audible grinding or clenching of the teeth during sleep and/or wakefulness, frequent headaches and orofacial pain when waking up, chewing and/or opening mouth. During the clinical examination, dental impressions on the cheek and tongue mucosa, tooth wear facets and fractures of restorations, sensitivity and pain in the temporalis and masseter muscles, as well on the Temporomandibular Joint (TMJ) during bilateral palpation with standardized pressure of approximately 1500 g, calibrated with an algometer, were evaluated.

Regarding the respiratory condition, the child's breathing pattern was evaluated, observing lip sealing and posture, the presence of anterior open bite, dark eye circles, long face and gingivitis in the region of the upper anterior teeth. The mirror, the water retention and the swallowing tests were carried out. Parents were asked to report how often their child snored loudly and manifested episodes of allergic rhinitis, asthma, bronchitis, mouth breathing, nasal obstruction, breathing interrupted momentarily suggestive of sleep apnea over the last three months, requiring or not medical attention.

Eligibility Criteria

The sample included all patients treated at the service specializing in bruxism and TMD in children between March 2016 and December 2019, who presented medical records with complete information. Medical records with missing, incomplete, or questionable data were excluded.

Statistical Analysis

Descriptive and comparative data analysis was performed using SPSS 20.0 software for Windows (IBM Corp., Chicago, IL, USA). The significance level was 5% for the Pearson and Chi-square association tests.

Results

The final sample consisted of 259 medical records of children aged 4 to 12 years, with an average of 8.6 years (±7.7), 44% male and 51% female. Regarding racial identity, 52.6% were identified as white, 10% as brown, and 4.2% as black. Family income below one minimum wage accounted for 6.1% and income between one and two minimum wages accounted for 13.8% (Table 1).

Table 1. Socioeconomic-demographic characteristics of the sample.

Variables	N (%)
Age	
≤ 6 years	26 (10.0)
6 to 8 years	88 (34.0)
8.1 to 10 years	71 (27.4)
≥ 10 years	63 (24.4)
Missing data	11 (4.2)
Sex	
Male	114 (44.0)
Female	132 (51.0)
Missing data	13 (5.0)
Racial Identity	
White	137 (52.9)
Black	11 (4.2)
Brown	26 (10.0)
Missing data	85 (32.9)
Mother's Educational Level	
Did not complete Elementary school	13 (5.0)
Completed Elementary school	7 (2.7)
Did not complete High school	7 (2.7)
Completed High school	33 (12.8)
Did not complete University	13 (5.0)
Completed University	11 (4.2)
Missing data	175 (67.6)
Father's Educational Level	
Did not complete Elementary school	17 (6.5)
Completed Elementary school	6 (2.3)
Did not complete High school	7 (2.8)
Completed High school	28 (10.9)
Did not complete University	11 (4.2)
Completed University	8 (3.1)
Missing data	182 (70.2)
Household Income	
< 1 BMW	16 (6.1)
1-2 BMW	36 (13.9)
>3 BMW	8 (3.1)
Missing data	199 (76.9)

BMW: Brazilian Monthly Minimum Wage (US$200.00 – 220.00) during the data collection.

When analyzing the diagnosis of awake and sleep bruxism (Table 2), 77 (29.6%) of the children were not diagnosed with bruxism and 143 (55%) were diagnosed with bruxism. Regarding of the respiratory problems present in the entire sample, included for analysis (Table 3), allergic rhinitis was present in 149 (57.3%) of the patients, asthma in 13 (5%), bronchitis in 47 (17.3%), and nasal obstruction in 148 (56.9%). Other respiratory disorders such as mouth breathing, sleep apnea, and snoring were present in 185 (71.4%), 16 (6.1%), and 25 (48%) individuals, respectively. Thirty-three (33) (12.7%) of the patients included in the analysis underwent adenoidectomy.

Table 2. Characterization of the data based on the type of bruxism.

Bruxism Type	N (%)
Bruxism	
Yes	143 (55.3)
No	77 (29.7)
Missing data	39 (15.0)
Awake Clenching	
Yes	64 (24.7)
No	163 (63.0)
Missing data	32 (12.3)
Sleep Clenching	
Yes	67 (25.8)
No	161 (62.1)
Missing data	31 (12.5)
Awake Grinding	
Yes	66 (25.4)
No	161 (62.1)
Missing data	32 (12.5)
Sleep Grinding	
Yes	150 (57.9)
No	80 (30.9)
Missing data	29 (11.2)

Table 3. Frequency of respiratory problems.

Variables	N (%)
Rhinitis	
Yes	110 (42.4)
No	75 (29.0)
Missing data	74 (28.6)
Asthma	
Yes	30 (11.6)
No	108 (41.7)
Missing data	121 (46.7)
Bronchitis	
Yes	40 (15.5)
No	170 (65.6)
Missing data	50 (18.9)
Nasal Obstruction	
Yes	134 (51.7)
No	84 (32.5)
Missing data	41 (15.8)
Mouth Breathing	
Yes	185 (71.4)
No	58 (22.5)
Missing data	14 (6.1)
Sleep Apnea	
Yes	4 (1.5)
No	5 (2.0)
Missing data	250 (96.5)
Snore	
Yes	113 (43.6)
No	92 (35.5)
Missing data	54 (20.9)
Adenoidectomy	
Yes	33 (12.7)
No	201 (77.6)
Missing data	25 (9.7)

Associations with the different manifestations of bruxism separately and the respiratory problems analyzed were not observed. Adenoidectomy cases had a negative association with manifestations of teeth clenching while awake (p=0.002), teeth clenching during sleep (p=0.004), and grinding during sleep (p=0.040). Other respiratory problems, such as rhinitis, asthma, bronchitis, mouth breathing, sleep apnea, and snoring, were not positive or negative associated with the different manifestations of awake and sleep bruxism (Table 4).

Table 4. Associations between the types of bruxism and respiratory problems.

Variables	Bruxism			Awake Clenching			Sleep Clenching			Awake Grinding			Sleep Grinding		
	Yes N	No N	p-value	Yes N	No N	p-value	Yes N	No N	p-value	Yes N	No N	p-value	Yes N	No N	p-value
Rhinitis															
Yes	69	41	0.557	30	87	0.177	32	87	0.212	34	86	0.253	77	43	0.643
No	47	28		87	51		25	50		19	55		49	27	
Asthma															
Yes	18	12	0.354	7	22	0.280	9	21	0.551	8	22	0.278	20	9	0.364
No	71	37		34	72		21	75		31	74		68	39	
Bronchitis															
Yes	29	11	0.332	12	29	0.705	12	29	0.711	12	29	0.817	26	16	0.370
No	107	63		52	124		50	126		50	125		117	59	
Nasal Obstruction															
Yes	94	40	0.052	38	95	0.715	41	94	0.683	43	90	0.367	94	41	0.083
No	48	36		95	65		26	64		23	68		54	38	
Mouth Breathing															
Yes	113	54	0.217	49	125	0.333	53	121	0.305	56	116	0.118	113	60	0.507
No	28	21		15	33		13	36		9	41		35	17	
Sleep Apnea															
Yes	2	2	0.953	3	1	0.851	3	1	0.150	3	1	0.212	4	1	0.858
No	3	2		0	5		2	3		2	4		2	4	
Snore															
Yes	72	41	0.869	33	83	0.732	37	77	0.415	38	77	0.302	77	40	0.946
No	61	31		28	69		24	75		23	75		64	34	
Adenoidectomy															
Yes	16	13	0.439	2	27	0.002*	2	27	0.004*	3	26	0.040*	18	12	0.228
No	119	59		62	123		59	127		58	127		123	63	

*Statistically significant.

Discussion

The results of the present study clearly show that the relationship between the different manifestations of bruxism and respiratory problems, one of the factors that have been associated with it, are established in different ways, corroborating that the mechanisms involved in the forms of manifestation of bruxism have to be studied distinctly, leading taking into account the possible interactions and specific characteristics of the studied population.

The sociodemographic characterization of the data analyzed indicates a predominance of females, which is not consistent with previous studies reporting a preference for males [10,22], although the analysis of this difference was not investigated. However, some studies found no association between bruxism and gender [6,23], contradicting others that found an association between bruxism and different risk factors, such as male gender [9,10,22].

Regarding the level of education of the parents, it was reported a higher prevalence of bruxism in children whose mothers had a higher level of education [24]. However, in the present study, data reflected that most children had fathers and mothers with a level of education between elementary and high school, which could be related to the fact that the service is part of a public educational institution directly linked to the public health system, which in Brazil, although universal, has the low-income population as the target group [25], in addition to the fact that only 8.7% of the Brazilian population have completed university education [24]. Accordingly, the vast majority of families in the studied population received 1 to 2 minimum wages, which, according to some studies, is associated with a lower level of education [26,27]. In addition, a recent observational cross-sectional study has shown that parents' education level has a significant association with oral health and oral-related sleep disturbance in children. The authors found that unemployed mothers were associated with a higher likelihood of snoring and chronic oral breathing [28].

The prevalence of probable bruxism in children in this study was 55%, which is very close to the prevalence reported in the literature [22,24]. However, the present study is the first to report the prevalence of the different manifestations of bruxism separately since most studies only assessed cases of sleep bruxism [3,5,8]. In this study, bruxism was characterized in terms of teeth clenching and grinding and its period of manifestation according to the circadian cycle. This distinction brings a difference to the present work which revealed that nasal obstruction is associated with sleep and awake bruxism, and not only with sleep bruxism, as has been shown over the years.

A previous study did not find an association between bruxism and mouth breathing in children aged 2 to 5 years [29]. The current study analyzed data from children with a mean age of 8.6 years, which described a high frequency of respiratory disorders such as rhinitis (42.4%), nasal obstruction (51.7%) and mouth breathing (71.4%). These findings are in agreement with the results reported by Grechi et al. [10], who found that 65.1% of children with nasal obstruction had bruxism, as well as with Oh et al. [14], who reported an association of tonsillar hypertrophy, limited tongue mobility, and nasal obstruction with bruxism in children. The population of both of these studies is represented by children in an age range similar to that evaluated in the present study.

It is worth noting that some authors have demonstrated that respiratory problems such as rhinitis, sinusitis, asthma, and bronchitis are associated with a greater occurrence of nasal obstruction [12,14]. Therefore, the results of this work showed that nasal obstruction was present in 51.7% of the sample, as related by the parents, but the cause of this obstruction would need to be investigated in depth, which would show that it was a symptom of undiagnosed respiratory problems. This specific investigation requires medical evaluation and several complementary tests for an adequate diagnosis, which are not generally available to low-income

populations, such as the one described in this study. It should be noted that clinical tests that assess respiratory changes, such as those used in the assessment of patients whose medical records made up our sample, have been shown to be appropriate.

In children with nasal obstruction, sleep bruxism has been described as a protective factor that tends to prevent airway collapse, although cause-and-effect relationships cannot be established for the entire population based on single cases [15,30]. However, this possible protective relationship between bruxism during sleep and nasal obstruction highlights the importance of considering each clinical case individually in terms of therapeutic approaches because the use of occlusal splints may not be an adequate treatment in cases of disordered breathing during sleep and may even affect the patient's respiratory status [30].

Another important finding was the negative association between adenoidectomy and grinding during sleep and while awake and clenching during sleep. Some studies have shown that surgical treatment of adenoid hypertrophy has positive effects on the patient's breathing [21], craniofacial morphology, and bruxism [31]. This study found that adenoidectomy probably contributed to the lower occurrence of the different manifestations of bruxism.

It is important to highlight the limitations of this study. It is a retrospective study with information extracted from a database composed of medical records from treated patients. This limitation impacts the available data. Additionally, respiratory problems were assessed based on reports provided by the patient's parents, relying on the patients' medical histories. However, the results of this study reinforce the need to evaluate the variety of behaviors of the different manifestations of bruxism related to the different factors to which it has been associated, as well as the relevance of a multidisciplinary approach for the comprehensive care of children with bruxism. In addition, signals and symptoms of bruxism are observed in children; dentists can act preventively since this could be a primary manifestation of systemic conditions such as respiratory problems.

Conclusion

The respiratory problems analyzed were not associated with the occurrence of bruxism in its different types of manifestation. However, all manifestations of awake and sleep bruxism were less frequent in association with adenoidectomy.

Authors' Contributions

JLG	https://orcid.org/0000-0002-0029-346X	Formal Analysis, Investigation, Writing - Original Draft and Writing - Review and Editing.
LMM	https://orcid.org/0000-0003-1250-3740	Formal Analysis, Investigation, Writing - Original Draft and Writing - Review and Editing.
CPT	https://orcid.org/0000-0003-3924-4494	Investigation and Data Curation.
RG	https://orcid.org/0000-0002-9195-7689	Formal Analysis and Visualization.
KVDS	https://orcid.org/0000-0001-9497-0005	Conceptualization, Methodology, Formal Analysis, Investigation, Writing - Original Draft and Writing - Review and Editing.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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