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Sleep and Awake Bruxism in Pediatric Patients: A Cross-Sectional Study of Prevalence and Associated Factors

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Authors' contributions

This work was carried out in collaboration among all authors All authors read and approved the final manuscript.

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ABSTRACT

Aims: To identify the prevalence and associated factors of dental bruxism in children during the development of occlusion.
Study Design: *Cross-sectional* observational study.
Place and Duration of Study: Data was collected in two private dental clinics in the city of Maringá - PR. Children treated between 2014 and 2021 were included.
Methodology: 417 medical records of children aged between 5 and 12 years old were selected from two dental clinics in the same city. 260 participants answered a questionnaire to identify bruxism complaints. Bruxism was considered possible when those responsible for the patients indicated the occurrence of audible sounds such as teeth grinding and considered probable when there was a report from those responsible for the patients and tooth wear assessed in the clinical

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examination. 42 children were included in the group of patients with possible bruxism (GB) and 42 in the control group (absence of bruxism - GC). The results were subjected to statistical and descriptive analysis.
Results: A prevalence of possible bruxism of 24.6% was observed and an association was found for the variables: pain in the temporomandibular joints, ringing in the ears, headache, unilateral chewing, joints with pain when chewing, fatigue in the muscles of the face after a long meal, harmful habits such as onychophagia, biting cheeks and pen; snoring, sleeping with their mouth open; behavioral profile: nervousness about new things and lack of motivation with tasks, in addition to the severity of tooth wear.
Conclusion: The prevalence of probable bruxism in children was 24.6%, with manifestations most occurring at night. More clinical studies are needed to develop multidisciplinary approaches for managing childhood bruxism.

Keywords: Bruxism; pediatric dentistry; child development; sleep bruxism.

ABBREVIATIONS

AB : Awake bruxism
GB : Group with possible bruxism
GC : Control group
OR : Odds ratio
PSG : Polysomnography
SB : Sleep bruxism
SPSS : Statistical Package for Social Sciences
TMD : Temporomandibular disorder
TMJ : Temporomandibular joint

1. INTRODUCTION

The development of occlusion in pediatric patients involves complex biological processes, and it is common to encounter several changes, such as dental bruxism [1]. This condition is defined as a repetitive activity of the jaw muscles, generally unconscious, characterized by grinding, touching the teeth, or clenching the jaw in the same position. Dental bruxism has two distinct circadian cycles: during sleep (SB) or during wakefulness (AB) [1,2]. Among sleep behaviors recognized in children, SB is one of the most commonly reported problems [3].

The systematic review by Soares *et al.* (2021) demonstrated that bruxism has a prevalence in children of 33.65% [4]. This is a high percentage when compared to the adult (8%) and elderly (3%) population [1]. Sleep bruxism affects one in four Brazilian children, and presumably occurs because of individual rather than regional or collective factors [5]. Despite the frequency of bruxism and its effects during childhood, few studies are addressing the habit during this phase.

Several methods are used to assess SB and AB, including self-report and/or report from parents/guardians [2,6], clinical examination [7], and instrumental techniques, such as polysomnography (PSG) with audiovisual recordings [8]. The International Consensus on the Assessment of Bruxism defines AB/SB as possible when the diagnosis is based solely on self-report; probable AB/SB when the diagnosis is by self-report with additional clinical inspection; definite SB when there is self-report, positive clinical evaluation, and polysomnography; and definite AB when there is self-report, clinical evaluation and electromyography [2].

Guo *et al.* [9] point out that the risk factors related to bruxism are: genes, sleeping position, a lot of movement, anxiety, nervousness, psychological reactions, responsibility, passive smoking, loud snoring, restless sleep, sleeping with lights on, noise in the room, less than 8 hours of sleep, headache, biting objects, conduct problems, emotional symptoms, and mental health problems [10]. Although several risk factors have been listed, there is not enough scientific evidence to support all of them [5].

Bruxism can cause tooth wear, fractured restorations, problems with the temporomandibular joint, and, in rare cases, even tooth fractures [11]. Therefore, patients with bruxism must be diagnosed and treated appropriately to avoid further complications. The

literature supports the need for further studies to better understand bruxism and joint disorders in children [12]. It is crucial to identify cases, so interdisciplinary clinical approaches may be implemented during the growth and development of occlusion. Therefore, this work aimed to identify the prevalence and association factors of dental bruxism in children aged 5 to 12 during the development of occlusion, through an observational study.

2. MATERIALS AND METHODS

2.1 Sample Characteristics

This cross-sectional study followed the STROBE [13] criteria.

Data were collected in two dental clinics in the city of Maringá - PR. Children between 5 and 12 years of age, of both genders, treated from 2014 to 2021, were included.

2.2 Eligibility Criteria

Patients with severe skeletal syndromes or discrepancies resulting from congenital malformations that may involve the joints, previous mandibular fractures, and schoolchildren who were undergoing fixed orthodontic treatment were considered ineligible.

2.3 Sample Calculation

The sample size calculation considered the prevalence of SB to be 35.3% [14] with an estimation error of 5% and a significance level of 95%. These parameters indicated a minimum sample of 111 patients to carry out the prevalence study (primary outcome).

The sample calculation to evaluate the association between the presence/absence of probable bruxism with the variables of snoring and headache was based on data from a similar study with children [15]. For a two-tailed alpha error of 0.05 and test power of 80%, there was a minimum indication of 30 volunteers for each group.

2.4 Research Protocol

The medical records of all 417 children treated at two clinics in the city of Maringá - PR were evaluated. After applying the eligibility criteria, 260 child records (118 girls and 142 boys) were included in the study. Data were collected using a questionnaire developed by Serra-Negra et al. [16], based on the criteria of the American Academy of Sleep Medicine via telephone contact (Fig. 1). This initial sample was obtained to assess prevalence (primary outcome).

To evaluate possible factors associated with the occurrence of probable bruxism (secondary outcome), the families of 84 children were invited to attend the clinic for an assessment of their children by a trained professional. Two subgroups were then formed, GB-group with probable bruxism (n=42) and GC-control group consisting of children without reports of bruxism and without clinical evidence of tooth wear (n=42).

Both GB and GC groups had the same number of boys and girls, 23 and 19 respectively, and were evaluated regarding the habits of probable bruxism, sleep quality, symptoms in the temporomandibular joint, respiratory problems, behavioral profile, occlusion characteristics and the severity of dental wear.

After completing the study, children in the GB group with cases of tooth wear were referred for dental treatment and follow-up. Those responsible for the children were informed about the diagnosis and the recommended actions.

The presence of possible bruxism was considered when an affirmative answer was obtained from the responsible for the child to the question, "Does your child have noises on their teeth during the day, or when sleeping?". The questions used in the questionnaire with parents and/or guardians to diagnose probable bruxism were in accordance with the International Consensus on the Assessment of Bruxism [2]. Parents' report regarding the identification of teeth grinding noise at night was used as a definition method of bruxism since detection only through tooth wear has a cumulative nature, which does not make it possible to differentiate between present-day bruxism and its past history [17].

2.5 Statistical Analysis

The research data were recorded in specific and individual forms, and the results were subjected to statistical analysis with the aid of SPSS (Statistical Package for Social Sciences), version 22.0. The Fisher's Exact test was used to verify

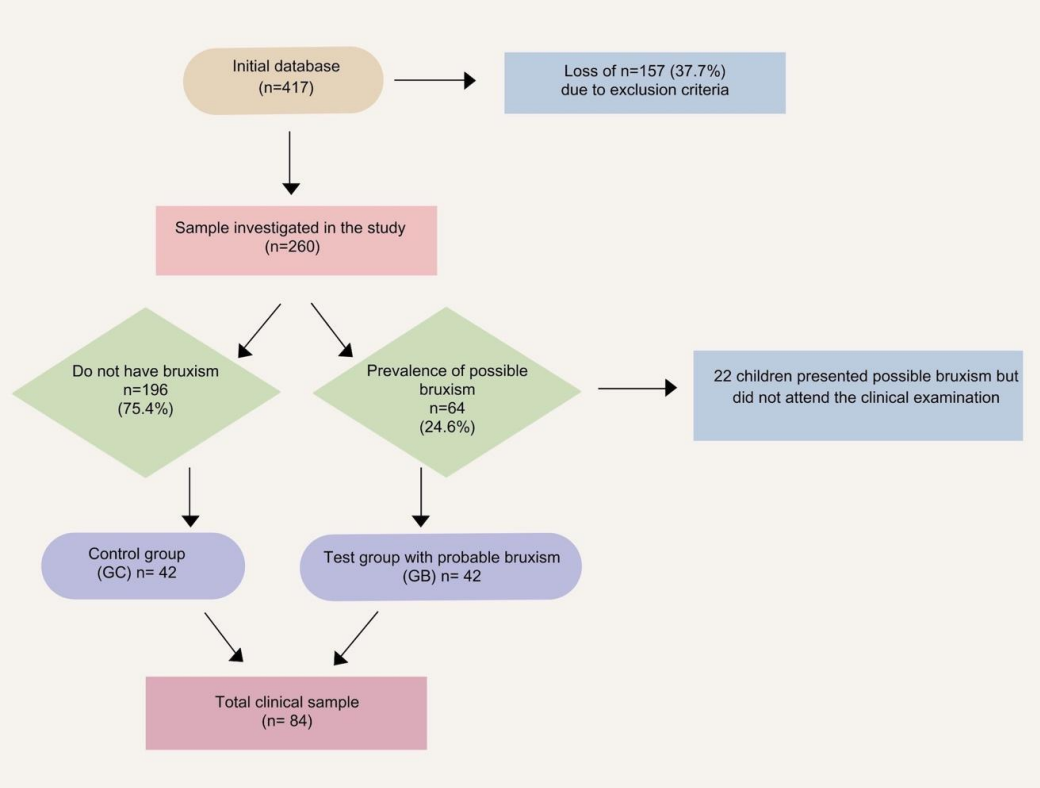

Fig. 1. Flowchart of database and sample distribution

the association between the presence/absence of probable bruxism and “click”, “ear pain”, “ringing in the ears”, “face or neck pain”, “mouth locked”, and “trauma”. Chi-square was used to verify the association between probable bruxism and all the other independent variables. Odds ratio (OR) analysis was performed to assess the habit of snoring during sleep. The significance level was set at 5%.

3. RESULTS

In the population investigated (n=260), 24.6% of the children presented probable bruxism according to their parents and/or guardians, with 75.4% not reporting the observation of teeth grinding at the time of the research (Fig. 2) In the clinical sample, the children with probable bruxism in GB (n=42) had a mean age of 7.81 and in the GC (n=42) mean age of 7.14.

Regarding circadian manifestations, the children's parents and/or guardians reported 88.1% probable bruxism at night, 4.8% during the day, and 7.1% day and night. Regarding frequency per week, 59.5% presented more than 4 times. In the clinical examination, the severity of tooth wear in children with bruxism (GB) was evaluated, with 54.8% presenting mild wear, 11.9% with moderate wear, and 33.3% with no apparent wear. The deciduous canines were the teeth that showed the greatest wear.

The presence of probable bruxism about sex comprised 20 girls and 22 boys, respectively 7.69% and 8.46% (P = 0.827) (Fig. 3).

Of the children with probable bruxism, 31% have pain in the temporomandibular joints (P = 0.000), and 19% have ringing in the ears (P = 0.005). It was observed that 22 children (52.4%) presented manifestations of headache associated with probable bruxism, 26.2% in the morning, 16.7% in the afternoon, and 9.5% at night (P = 0.000). The quality of “acute” pain was the most prevalent in these cases (21.4%). On the other hand, 6 patients who did not present bruxism (14%) reported a headache. Furthermore, of the children with probable bruxism, 23.8% had joint pain or sensitivity when chewing food (P = 0.013) (Table 1).

There was no association between the probable presence/absence of bruxism and clicking, pain in the ears, face and neck, difficulty opening the mouth and trauma to the jaw (P > 0.05).

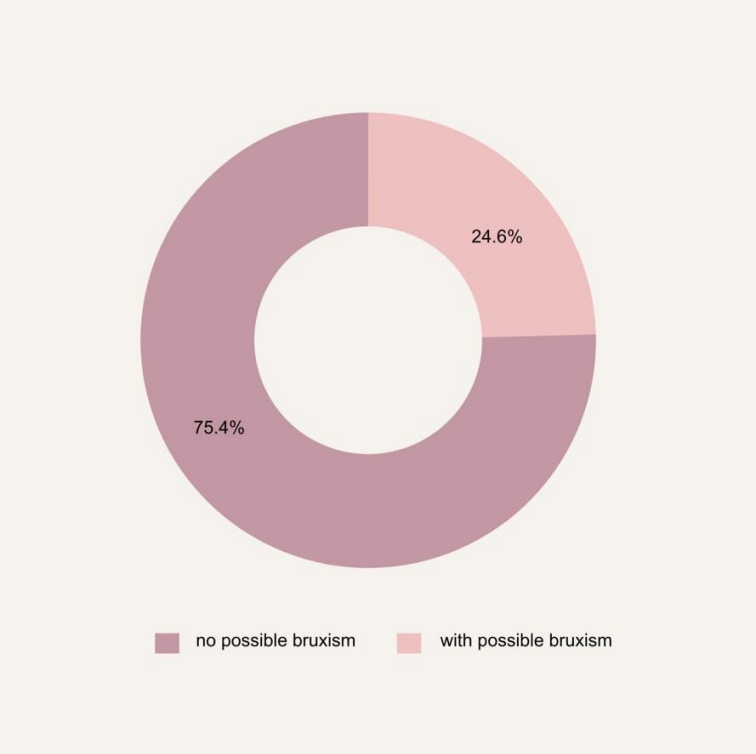

Fig. 2. Prevalence of possible bruxism in the population investigated (n=260)

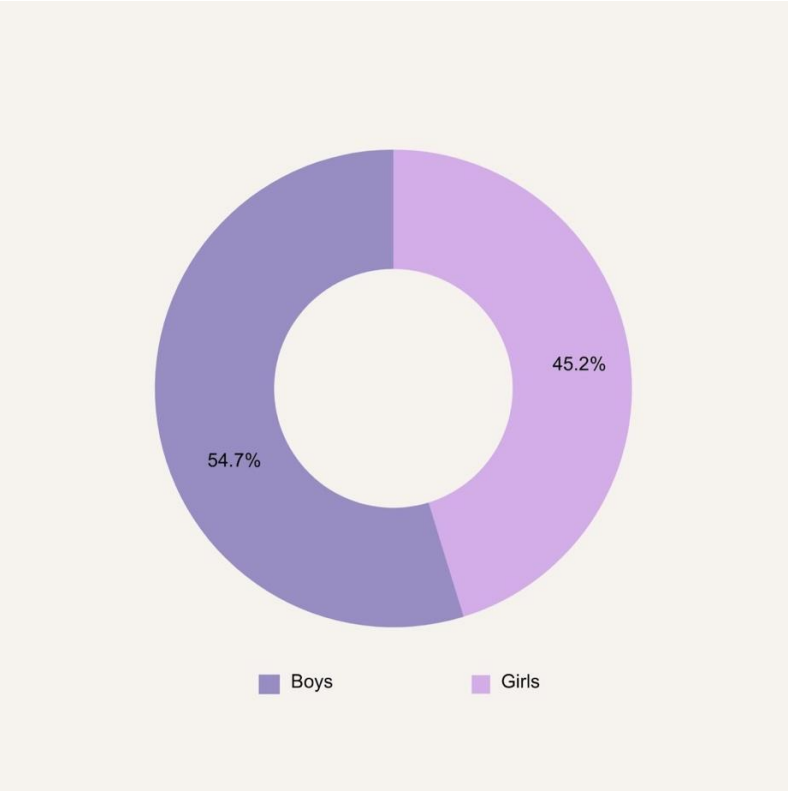

Fig. 3. Prevalence of probable bruxism according to gender in the group with bruxism (GB) (n=42)

The presence of harmful oral habits was observed (61.4%), with onychophagia being the most prevalent condition. There was a significant association (*P* = 0.029) in the probable presence of bruxism with the habit of biting nails, cheeks, and pens (Table 2).

Table 2 shows the frequency and percentage of children with and without bruxism about their behavioral profile reported by their parents. Among the variables researched, it was observed that children being nervous about news and unmotivated with tasks are associated with bruxism (*P* = 0.005 and *P* = 0.039, respectively). On the other hand, the present study did not find a significant association between anxiety and the probable presence of bruxism.

In the clinical analysis, an association between malocclusion and probable bruxism (*P* > 0.05) was not found, observed through the relationship of canines (26.2%) and deviation of the dental midline (28.6%).

Regarding respiratory problems, the habit of sleeping with the mouth open showed a significant association with probable bruxism (*P* = 0.003). The habit of snoring during sleep,

Table 1. Association of the probable presence/absence of bruxism with temporomandibular joint variables (n=84)

	Probable bruxism group (GB)		Control group (GC)		
Variables	**n**	**%**	**n**	**%**	**Value - *P***
TMD	13	31%	1	2,4%	*0,000[b]
Click	1	2,4%	0	0%	1,000[a]
Ear pain	4	9,5%	1	2,4%	0,360[a]
Ringing in the ears	8	19%	0	0%	*0,005[a]
Headache	22	52,4%	6	14,3%	*0,000[b]
Face or neck pain	5	11,9%	2	4,8%	0,433[a]
One-sided chewing	13	31%	8	19%	*0,007[b]
TMJ hurts when chewing	10	23,8%	2	4,8%	*0,013[b]
Fatigue in the muscles	13	31%	8	19%	*0,013
Problem opening mouth	2	4,8%	0	0%	0,494[a]
Mouth locked	1	2,4%	0	0%	1,000[a]
Jaw trauma	3	7,1%	1	2,4%	0,616[a]

*[a]Fisher's Exact Test; [b]Chi-square test; *statistically significant (P ≤ 0.05)*

Table 2. Association of the probable presence/absence of bruxism with the variables of harmful oral habits, with the variables of the behavioral profile and with the habit of snoring and sleeping with the mouth open (n=84)

	Probable bruxism group (GB)		Control group (GC)		
Variables	**n**	**%**	**n**	**%**	**Value - *P***
Has a habit	27	61,4%	17	38,6%	0,029*
Has no habit	15	37,5%	25	62,5%	
Nervous about news	22	52,4%	12	28,6%	0,005*
Nervous about responsibilities	30	71,4%	18	42,9%	0,008*
Calm behavior when	.	.	.	.	.
contradicted	7	16,7%	16	38,1%	0,088
Unmotivated with	.	.	.	.	.
tasks	14	33,3%	12	28,6%	0,039*
Snores	17	40,4%	5	11,9%	0,011*
Sleeps with mouth open	26	61,9%	11	26,2%	0,003*

*Chi-square test *statistically significant (P ≤ 0.05)*

according to the odds ratio (OR) analysis, was 2.9, that is, children who snore are 2.9 times more likely to present probable bruxism when compared to children without this habit (*P* = 0.011). Table 2 also shows the percentage distributions of these findings. When investigating with parents and/or guardians the change in the pattern of probable bruxism in the face of rhinitis and sinusitis, 40.5% were unable to inform, 33.3% responded that bruxism remained unchanged and 26.2% reported an increase in the frequency of the habit, findings that were not significant.

Regarding sleep, it was observed that the insufficient number of recommended hours of sleep and having problems sleeping (insomnia and sleep disorders) were not associated with the probable presence of bruxism. It was observed that 50% of children who have probable bruxism sleep 8 hours, while 50% sleep less time. 66.7% of those without bruxism sleep less than 8 hours, 28.6% sleep 8 hours, and 4.8% sleep more.

A high occurrence of changes in mouth opening (deviation and deflection) and a suggestive presence of ligament hypermobility were observed in both groups (GB and GC), with no association with bruxism.

Parents and/or guardians were asked whether they observed greater evidence of probable bruxism during the Covid-19 pandemic. The reports were of a decrease in the habit for 66.6%, 31% with an increase in teeth grinding and 1 guardian (2.4%) was unable to respond. Therefore, the present research did not express an association between the increase in probable bruxism during the COVID-19 pandemic.

4. DISCUSSION

Approximately 25% of the children evaluated in the present study had the habit of grinding their teeth during the day and/or night. Serra-Negra *et al.* [14] found a higher occurrence of bruxism in the investigated children, at 35.3%. According to a systematic review [18], prevalence rates vary from 5.9% to 49.6%, possibly due to the lack of standardization and uniformity of the criteria adopted for the assessment and diagnosis of bruxism [14,18,19].

Regarding gender, this study did not find significant differences in the prevalence of probable bruxism in children. Similar results to the work of Nahás-Scocate *et al.* [20]. However, Clementino et al. [21] observed a higher frequency of the habit in girls, while Alves *et al.* [22] in boys.

It was possible to observe an association between bruxism and headache in this study, as well as in other studies [20,23]. The habit can tense the muscles of the face, increasing discomfort. Therefore, it is important to guide parents regarding their children's possible complaints and seek the necessary treatments.

Furthermore, no association was observed between the probable presence/absence of bruxism and clicking, pain in the ears, face, and neck, difficulty in opening the mouth, and trauma to the jaw. These results are consistent with other works in the literature. In studies by Santos *et al.* [23] and Nilner and Lassing [24] the values for these conditions also approached 8%.

There was a significant association between the probable presence of bruxism and the habit of biting nails, cheeks, and pens. This finding is in agreement with the study by Simões-Zenari and Bitar [25]. However, the investigation by Shinkai *et al.* [26] did not find such a relationship. Some factors can influence the onset of these harmful oral habits, including the breastfeeding pattern [27].

Regarding the behavioral profile reported by parents, it was observed that children being nervous about news and unmotivated with tasks are associated with parafunction, corroborating the studies by Shinkai *et al.* [26], which describes that when human beings feel threatened in their integrity, whether physical or mental, an emotional state of anxiety occurs, characterized by tension, agitation, apprehension and physiological responses from the autonomic nervous system. This anxiety favors the discharge of nervous tension on the masticatory muscles, causing the development of parafunctional habits, such as bruxism. On the other hand, the present study did not find a significant association between anxiety and the probable presence of bruxism, probably due to the high frequency of anxiety, being 40.5% for both groups (GB and GC).

No association was found between malocclusion and probable bruxism, a condition also observed in the study by Gonçalves et al. [28], in which malocclusion also showed no significant difference.

Regarding respiratory problems, children who have the habit of sleeping with their mouths open and snoring during sleep are more likely to present probable bruxism, when compared to children without this habit. According to Marks [29], sleeping with your mouth open and snoring reduces the amount of saliva and the need to swallow, increasing the tendency to grind your teeth during the night. The author demonstrated a three times higher incidence of bruxism in allergic children, when compared to children without allergic respiratory processes, since allergic children tend to sleep with their mouths open, although in the current study, there was no statistically significant relationship. Furthermore, according to Miller et al. [15], the parents of the children interviewed in their research reported a rate of sleep disorders, such as snoring, of 23% in children with bruxism, a rate considered high, equivalent to the results observed here.

Furthermore, it was observed that the number of hours of sleep and difficulty sleeping were not associated with the probable presence of bruxism. Contrary to what was demonstrated in the study by Simões-Zenari and Bitar [25], which observed an increased risk of approximately five times more when the child sleeps less than 10 to 11 hours per night. However, the parameter evaluated in the present study was 8 hours of sleep, following the reference by Serra Negra et al. [16].

The present research did not express an association between the increase in probable bruxism during the COVID-19 pandemic. However, notes by Almeida-Leite *et al.* [30] showed that psychological factors associated with the pandemic can lead to a greater risk of developing, worsening, and perpetuating bruxism.

Thus, given the present findings, there was a significant association between the probable presence/absence of bruxism for the variables: pain in the temporomandibular joints, ringing in the ears, frequent pulsating and acute headache, unilateral chewing, joint pain when chewing, tiredness in the facial muscles after a long meal, harmful habits such as onychophagia, biting cheeks and pens, snoring, sleeping with the mouth open, behavioral profile when nervous about news and unmotivated with tasks and, in terms of tooth wear severity, light and moderate. These findings facilitate a comprehensive approach during the clinical assessment of pediatric patients, thereby enabling accurate diagnosis and formulation of treatment strategies.

de Alencar et al. related that there exists no significant association between probable bruxism and the socioeconomic or sociodemographic status of the Brazilian children examined. The author posits that sleep bruxism functions as a mechanism for alleviating stress accumulated during waking hours. How individuals manage daily conflicts is intricately intertwined with the habit [31], since there are different personalities in each child.

There are several types of treatments proposed for bruxism, such as the use of an occlusal splint. According to Santos *et al.* [32], sleep hygiene and relaxation techniques should be considered the first line of approach for patients with sleep bruxism, as they are non-invasive, easy to perform, and appear to improve patients' quality of life.

The use of rigid stabilizing interocclusal splints, when carefully supervised and monitored, is a good option, as it prevents tooth wear and reduces orofacial pain [33]. However, the acrylic splint should not be used for more than a year due to the risk of restricting the transverse growth of the maxilla. An alternative to compensate for this restriction is the inclusion of an expanding device on the protection plate [19]. Nightly use of the plate and periodic monitoring of the patient is recommended.

Furthermore, sleep hygiene can be useful in treating bruxism in children, which includes keeping the room dark, quiet, and with good ventilation; avoiding heavy meals after 7 pm; at night, stopping drinking coffee and tea, in addition to avoiding exhaustive physical and mental activity or watching TV to relax before bed and reducing stress levels [34,35].

Treating bruxism is challenging and requires the cooperation of professionals, parents, and the child. Appropriate clinical guidelines for the treatment and prevention of bruxism in children must be developed [34]. During childhood, many changes will occur with craniofacial growth and development, an important period in which the professional needs to be attentive, both for the diagnosis of bruxism and for your multidisciplinary follow-up, and also be prepared for the referral and/or planning of possible interventions, considering the changes in the dental arches expected until the establishment of permanent dentition.

It can be pointed out that among the limitations found in the present study, was due to the COVID-19 pandemic period, which made clinical care difficult and probably influenced the families' attendance at scheduling.

There has been an increase in reports from parents and caregivers of children about the occurrence of bruxism, especially during and after the pandemic period. Due to this condition, it is necessary to develop more studies with clinical approaches for multidisciplinary action in the management of childhood bruxism.

5. CONCLUSION

Based on the methodology used and the results obtained, it was concluded that the prevalence of probable bruxism in children aged 5 to 12 years was 24.6%, with probable bruxism occurring most frequently at night. The most observed severity of probable bruxism was mild, at 54.8%.

There was a significant association of probable bruxism for the variables: pain in the temporomandibular joints, ringing in the ears, frequent pulsating and acute headache, unilateral chewing, joints with pain when chewing, fatigue in the facial muscles after a long meal, harmful habits such as onychophagia, biting cheeks and pens, snoring, sleeping with your mouth open, behavioral profile such as being nervous with news and unmotivated with tasks and, in terms of the severity of tooth wear, mild and moderate. These findings can aid in a comprehensive clinical assessment of pediatric patients, leading to precise diagnosis and treatment planning.

For new studies, well-designed clinical research with children and standardized methodologies is suggested, to verify the association between bruxism and factors related to its occurrence and the severity of tooth wear.

CONSENT

All authors declare that a written informed consent was obtained from the patients for publication of this study. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee ethics (State University of Maringá CAAE No: 48027421.7.0000.0104) and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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