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ORIGINAL ARTICLE

Association between Possible Sleep Bruxism and Anxiety Disorders, Circadian Cycle and Sleep Disorders in Children and Adolescents: A Cross Sectional Study

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ABSTRACT

Objective: To evaluate the frequency and association between anxiety disorders (AD), sleep disorders (SD), and the circadian cycle (CC) with possible sleep bruxism (SB) in children/adolescents. **Material and Methods:** The clinical records of children/adolescents, between 7-11 years, who were treated at the pediatric dentistry clinic/UFRJ (January/2018 to March/2020), were evaluated. SCARED and CIRENS questionnaires and, SD were analyzed. The chi-square test, t-test, and Cohen's D were applied. **Results:** Of 85 clinical records were evaluated, 41 (48.2%) were from girls and 44 (51.8%) from boys of 7 (3.5%), 8 (5.9%), 9 (25.9%), 10 (24.9%) and 11 (40%) years old. There were identified in 40 (47.1%) participants with AD, while SB was identified in 28 (32.9%). The most prevalent CC was "neither morning nor night" (75.3%), followed by "morning type" (20%). No association was found between CC and SB ($p>0.05$). Likewise, no association was found between AD and SB, SD and AD ($p>0.05$). However, an association was identified between SD and SB ($p<0.05$). In addition, the shorter the sleep duration, the greater the likelihood of bruxism ($p<0.01$). For effect size Cohen's d was 0.955, considered large. **Conclusion:** It was not possible to identify an association between the CC and psychological factors, such as anxiety, with the presence of SB. However, sleep disorders and sleep duration demonstrated a relationship with sleep bruxism.

Keywords: Sleep Bruxism; Anxiety; Sleep Disorders, Circadian Rhythm.

Introduction

Anxiety disorders share features of fear, emotional response to imminent real or perceived threat, and excessive anxiety, characterized by an anticipated future threat, and related behavioral disturbances [1]. However, in the 21st century, anxiety has came to be considered a disorder in psychiatric classification, as there is a clinical threshold between normal adaptive anxiety, a result of everyday life, and pathological anxiety that requires treatment [2]. In addition, it is considered a common and disabling condition, which often begins in childhood, and can persist into adulthood if left untreated [3].

In this sense, the emotions experienced in early childhood can be considered a primary risk for the development of symptoms related to anxiety disorders, which in turn may interfere in family and social relationships, negatively affect quality of life, result in low self-esteem and a drop in academic performance [4,5].

In addition to emotional factors, sleep disorders and the circadian cycle can be considered risk factors for bruxism [6], being defined as an activity of the masticatory muscles during sleep that is characterized as rhythmic or non-rhythmic and is not necessarily a disorder in healthy individuals [7].

Given this context and the few studies [6,8,9] that investigate this reality and its associations and, knowing that children and adolescents can develop some type of anxiety disorder from early childhood [6,8,9], which can increase the possibility of bruxism as well as the fact of experiencing changes in your sleep cycles and the rhythm at which the body performs its functions throughout the day [10], the aim of this study was to evaluate the frequency of possible sleep bruxism, anxiety disorders, sleep disorders and the circadian cycle, and association between possible sleep bruxism and anxiety disorders, circadian cycle and sleep disorders in children and adolescents.

Material and Methods

Ethical Aspects and Study Design

The present study was submitted to the Research Ethics Committee of *Hospital Universitário Clementino Fraga Filho* under protocol number 4.941.732 and was described in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [11]. This is an analytical, a cross-sectional study, based on the analysis of dental records of paediatric patients attended at Department of Pediatric Dentistry and Orthodontics, in the subjects of Pediatric Dentistry I and II, Federal University of Rio de Janeiro, from January 2018 to March 2020.

Sample and Eligibility Criteria

A non-probabilistic convenience sample composed of the fulfilled clinical records of children and adolescents, between 7 and 11 years of age, was included in this study. In addition, the SCARED (Screen for Child Anxiety Related Emotional Disorders), a self-report questionnaire, and, CIRENS (Circadian Energy Scale), a proxy questionnaire, were fully completed by the patients' parents or guardians. The dental records of children and adolescents with disabilities were excluded from this study.

SCARED and CIRENS Questionnaires

The SCARED questionnaire [12] is composed of 38 multiple-choice questions. For each question, there are four response options, with the following classification for understanding the presence or absence of anxiety disorders: 0=never, 1=sometimes, 2=often and 3=always. In general, the cut-off point of the questionnaire is 34 points, established through a general anxiety index. This instrument also allows for the assessment of

comorbidities that make up Anxiety Disorder. The cut-off point is established separately for each factor, they are: general anxiety index, 15 points; panic factor, 9 points; general anxiety, 8 points; separation anxiety, 4 points; social phobia, 4 points; and, school phobia, 3 points.

The CIRENS [13] contains three questions regarding the individual's energy level at different periods of the day: morning, afternoon and, night, with five possible levels: very low, low, medium, high and, very high. The answers related to the CIRENS scale are classified as 1 (very low), 2 (low), 3 (medium), 4 (high) and 5 (very high). The individual's total energy value can vary between 3 and 15 (summation of morning, afternoon and night energy levels). The circadian cycle rating is determined by subtracting the morning from the evening energy score. Therefore, the CIRENS score ranges from -4 (stronger morning preference) to 4 (stronger night preference) in the quantitative assessment. In the qualitative classification, subjects are considered as morning type (≤ -2), neither morning nor night (≥ -1 and ≤ 1) or night type (≥ 2).

Data Collected

Data were collected from dental records regarding age, gender, CIRENS and SCARED scores, and the absence or presence of sleep bruxism.

Potential Sources of Bias

As this is a study carried out with data from medical records and assessment instruments, there is the possibility of information bias as it is data from the patient's history. The students' experience with filling out medical records in the form of an interview was one of the factors that contributed to minimizing the risk factors for this bias.

Statistical Analysis

Data were tabulated and analyzed using IBM SPSS 21.0 software (IBM Corp., Chicago, IL, USA). A descriptive analysis of the population of the present study and qualitative analysis of the circadian energy scale (CIRENS) was performed. For quantitative analyses, possible sleep bruxism was considered a dependent variable when associated with the circadian cycle, anxiety disorders and sleep disorders. In addition, anxiety was considered a dependent variable when associated with sleep disorders. In this way, the chi-square test and t-test were applied. The effect size was calculated through Cohen's D test in d(0.1) = very small, d(0.2) = small, d(0.5) = medium, d(0.8) = large , d(1.2) = very large and d(2.0)= huge was considered [14].

Results

A total of 85 clinical records were evaluated (Figure 1). Of these, 41 (48.2%) were from girls and 44 (51.8%) from, boys varying from 7 to 10 years old (9±1.10).

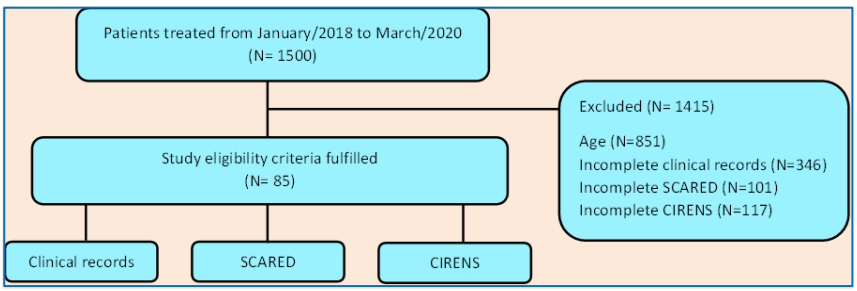

Figure 1. Flow diagram of patients treated in Pediatric Dentistry I and II disciplines.

Anxiety disorders were present in 40 (47.1%) of the children and adolescents evaluated. In addition, the presence of possible sleep bruxism was identified in 28 (32.9%) of them. Regarding the circadian cycle, it was observed that the most prevalent circadian cycle was neither morning nor night 64 (75.3%) (Table 1).

Table 1. Sociodemographic data of the participants.

Variables	N (%)
Gender	
Female	41 (48.2)
Male	44 (51.8)
Age (Years)	
7	3 (3.5)
8	5 (5.9)
9	22 (25.9)
10	21 (24.7)
11	34 (40.0)
Sleep Bruxism	
Presence	28 (32.9)
Absent	57 (67.1)
Anxiety Disorders	
Presence	40 (47.1)
Absent	45 (52.9)
Circadian Energy Scale	
Morning type	17 (20.0)
Neither morning nor night	64 (75.3)
Night type	4 (4.7)

There was no association found between anxiety and its associated disorders (general anxiety index, panic factor, general anxiety, anxiety separation, social phobia and school phobia) with possible sleep bruxism ($p>0.05$). The same lack of association was found when anxiety and sleep disorders ($p>0.05$), and when circadian cycle and sleep bruxism were compared ($p>0.05$) as shown in Table 2.

Table 2. Association between circadian cycle, anxiety disorders and possible sleep bruxism in children and adolescents.

Variables	Possible Sleep Bruxism		p-value*
	Presence N (%)	Absent N (%)	
Circadian Cycle			
Morning type	5 (5.88)	12 (14.11)	0.120
Neither morning or night	22 (25.88)	42 (49.41)	0.241
Night type	1 (1.17)	3 (3.52)	0.120
Anxiety Disorders			
Anxiety			
Presence	10 (11.76)	18 (21.17)	0.142
Absent	18 (21.17)	30 (35.29)	
Panic Factor			
Presence	7 (8.23)	20 (23.52)	0.348
Absent	21 (24.70)	37 (43.52)	
General Anxiety Index			
Presence	18 (21.17)	42 (49.41)	0.371
Absent	10 (11.76)	15 (17.64)	
Separation Factor			
Presence	23 (27.05)	54 (63.52)	0.062
Absent	5 (5.88)	3 (3.52)	
Social Factor			
Presence	17 (20.0)	30 (32.29)	0.481
Absent	11 (12.94)	27 (31.76)	

School Factor			
Presence	13 (15.29)	24 (28.23)	0.706
Absent	15 (17.64)	33 (38.82)	

*Chi-square test (p>0.05).

When sleep disorders and possible sleep bruxism were evaluated, it was observed that children and adolescents who sleep alone presented more sleep bruxism (p=0.017), as well as those who wake up during sleep (p=0.016), those who stop breathing while sleeping (p=0.007), those who talk during sleep (p=0.015) and those who have nocturnal enuresis (p=0.012) (Table 3).

Table 3. Association between anxiety and sleep disorders and, sleep bruxism and sleep disorders in children and adolescents.

Variables	Anxiety			Bruxism		
	Presence N (%)	Absent N (%)	p-value	Presence N (%)	Absent N (%)	p-value
Sleep alone						
Yes	10 (11.7)	13 (15.29)	0.687	3 (3.52)	20 (23.52)	0.017*
No	30 (35.29)	32 (37.64)		25 (29.41)	37 (43.52)	
I don't know	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Sleep with light on						
Yes	4 (4.70)	10 (11.7)	0.129	4 (4.70)	10 (1.17)	0.703
No	36 (42.35)	35 (41.17)		24 (28.23)	47 (55.29)	
I don't know	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Sleep with the TV on						
Yes	12 (14.11)	14 (16.47)	0.912	7 (8.23)	19 (22.35)	0.433
No	28 (32.94)	31 (36.47)		21 (24.70)	38 (44.70)	
I don't know	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Sleep listening to music						
Yes	5 (5.88)	5 (5.88)	0.843	3 (3.52)	7 (8.23)	0.833
No	35 (41.17)	40 (47.05)		25 (29.41)	50 (58.82)	
I don't know	0	0		0	0	
Play video games before bed						
Yes	14 (16.47)	8 (9.41)	0.070	5 (5.88)	17 (20.0)	0.236
No	26 (30.58)	37 (43.52)		23 (27.05)	40 (47.05)	
I don't know	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Wake up in the middle of the night						
Yes	7 (8.23)	7 (8.23)	0.839	9 (10.58)	5 (5.88)	0.016*
No	30 (35.29)	33 (38.82)		18 (21.17)	45 (52.94)	
I don't know	3 (3.52)	5 (5.88)		1 (1.17)	7 (8.23)	
Agitated sleep						
Yes	25 (29.41)	29 (34.11)	0.853	25 (29.41)	36 (42.35)	0.919
No	15 (17.64)	16 (18.82)		10 (11.76)	21 (24.70)	
I don't know	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Nightmares						
Yes	3 (3.52)	6 (7.05)	0.131	5 (5.88)	4 (4.70)	0.310
No	34 (40)	39 (45.88)		22 (25.88)	51 (60.0)	
I don't know	3 (3.52)	0 (0.0)		1 (1.17)	2 (2.35)	
Stop breathing during sleep						
Yes	1 (1.17)	6 (7.05)	0.159	6 (7.05)	1 (1.17)	0.007*
No	32 (37.64)	34 (40.0)		18 (21.17)	48 (56.47)	
I don't know	7 (8.3)	5 (5.88)		4 (4.70)	8 (9.41)	
Snore						
Yes	11 (12.94)	16 (18.82)	0.671	12 (14.11)	15 (17.64)	0.305
No	26 (30.58)	25 (29.41)		14 (16.47)	37 (43.52)	
I don't know	3 (3.52)	4 (4.70)		2 (2.35)	5 (5.88)	
Speak						
Yes	16 (18.82)	13 (15.19)	0.535	15 (17.64)	14 (16.47)	0.015*
No	22 (25.88)	30 (35.29)		11 (12.94)	41 (48.23)	

I don't know	2 (2.35)	2 (2.35)		2 (2.35)	2 (2.35)	
Nocturnal Enuresis						
Yes	11 (1.17)	3 (3.52)	0.256	4 (4.70)	0	0.012*
No	39 (45.88)	40 (47.0)		23 (27.05)	56 (65.88)	
I don't know	0 (0.0)	2 (2.35)		1 (1.17%)	1 (1.17)	
Sleep-walking						
Yes	1 (1.17)	2 (2.35)	0.628	1 (1.17)	2 (1.17)	0.988
No	39 (45.88)	43 (50.58)		27 (31.76)	55 (64.70)	
I don't know	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	

*Chi-square test ($p<0.05$).

There was association between sleep duration and sleep bruxism, since those children and adolescents with the shortest sleep duration were those with the highest occurrence of proxy sleep bruxism complaints ($p=0.000086$). Furthermore, the effect size that was 0.955, considered large (Table 4).

Table 4. Relationship between average on sleep duration and possible sleep bruxism.

Bruxism	N (%)	Mean	SD	t-test	Cohen's d
Presence	28 (32.9)	7.68	1.020	0.000086**	0.955
Absent	57 (67.1)	8.68	1.072		

The t-test was performed and the statistical significance is represented by the symbol ** ($p<0.01$); The effect size was calculated through Cohen's D test in d(.01) = very small, d(0.2) = small, d(0.5) = medium, d(0.8) = large , d(1.2) = very large and d(2.0)= huge.

Discussion

Emotional issues like anxiety disorders and sleep disorders can influence the onset of behaviors in healthy people such as sleep bruxism [7,15]. Also, from this same perspective, the American Academy of Sleep Medicine (AASM) listed sleep bruxism as a sleep-related movement disorder [16], thus indicating an intimate relationship with emotional and behavioral issues for the involvement of sleep bruxism during the period of sleep as demonstrated in the studies by Oliveira et al. [6] and Alfano et al. [17].

A study carried out by Serra-Negra et al. [18], demonstrated a prevalence of bruxism in children aged 7 to 10 years of 35.3%, with a predominance of 8 years of age. As in the studies conducted by Lam et al. [19] which demonstrated a prevalence of 5.9%, Insana et al. [20] observed a prevalence of 36.8% in preschoolers. In addition to demonstrating similar results to the present study, it suggests a high rate of this behavior in children. However, the prevalence of bruxism associated with anxiety is rarely found in the literature. Studies [6,17,21] suggest that there is a relationship between the two and, more commonly associated with bruxism, social anxiety disorder.

Each person has their own biological clock with preferred times to sleep, wake up and carry out their activities. This clock changes over the years. Children tend to have a morning circadian cycle and during adolescence they shift progressively more toward the nocturnal type [10]. Based on our findings, it was identified that most participants had neither morning nor night circadian cycle. A possible explanation for this is that they are in the transitional phase between typical childhood and adolescent circadian cycles, as the participants of the present study ranged in age from 7 to 10 years. This supposition should be further investigated in future studies.

Still considering the aspects related to circadian cycle, the absence of association with sleep bruxism accords with the findings of a previous study [10] suggesting that there is not a direct relationship between the circadian cycle and the presence of sleep bruxism. In addition, studies inferring the influence of circadian cycle in children and adolescents with sleep bruxism are still scarce in the dental literature and should be encouraged.

It was observed that some sleep behaviors such as sleeping alone and sleep disorders like waking up during sleep, breath stopping during sleep, talking during sleep and nocturnal enuresis [22] are associated with the presence of bruxism in this study population, as previously mentioned [23]. Our studies are also similar to Restrepo et al. [24] who observed the same behaviors during sleep and altered sleep duration, suggesting an increase with the frequency of proxy-reported sleep bruxism in their study population.

Regarding sleep disorders, sleep bruxism was present in children and adolescents who have fewer hours of sleep, corroborating previous data in which partial or total sleep deprivation, generating a deficit of sleep hours can also generate discomfort and agitation in patients, which may be directly related to the development of sleep bruxism [25,26].

Anxiety symptoms are common among adolescents, as well as in childhood, and may pose a persistent risk to adult mental health. In this sense, further investigations into the biological and psychosocial mechanisms underlying anxiety, as well as other types of behavior, such as bruxism, should be explored. In addition, children and adolescents who reported sleep-related complaints such as nightmares, reduced sleep hours, trouble sleeping, and talking and walking during sleep tend to have anxiety disorders [8,27].

Although psychosocial factors such as stress, depression and anxiety are commonly reported in the etiology of sleep bruxism, the evidence for these factors and their role in the etiology of sleep bruxism is not well understood [28]. In the present study, a lack of association between anxiety disorders and sleep bruxism was observed. It is possible that the non-probabilistic nature of the present convenience sample could have impeded the observation of this association.

Despite the theme's exploration in the literature, sleep bruxism, especially in children and adolescents, is still a challenging area, since most of the available studies refer to the adult population, even though sleep bruxism is more prevalent in children and adolescents. There is therefore an opportunity to explore and learn about this behavior from early childhood to adolescence. Finally, more studies with larger populations need to be carried out so that more information can be obtained on the topic.

Conclusion

It was not possible to identify an association between the circadian cycle, psychological factors, such as anxiety, and the presence of possible sleep bruxism. However, sleep disorders demonstrate a close relationship with the development of sleep bruxism in children and adolescents. In addition, population-based studies are necessary to definitively answer some important questions about the relationship between anxiety disorders, circadian cycle and sleep disorders, and possible sleep bruxism in children and adolescents.

Authors' Contributions

LSS	https://orcid.org/0000-0003-0193-2144	Conceptualization, Methodology, Investigation, Formal Analysis, Data Curation and Writing - Original Draft.
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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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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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