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Impact of the COVID-19 pandemic on sleep quality and sleep bruxism in children eight to ten years of age

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Abstract: This study aimed to determine the impact of the COVID-19 pandemic on sleep quality and possible sleep bruxism (SB) in children eight to ten years of age. The study hypothesis was that sleep disturbances influenced a higher occurrence of bruxism during the COVID-19 pandemic. A longitudinal study was conducted at two time points: in person prior to the COVID-19 pandemic (T1), and online during the pandemic (T2). The sample comprised 105 children. Parents/caregivers answered a questionnaire addressing sociodemographic characteristics, the use of electronic devices, reported (vs. clinical) SB, and the Sleep Disturbance Scale for Children (SDSC) at both T1 and T2. McNemar's and Wilcoxon's tests were used to compare SB and sleep disorders at both time points. Poisson regression analysis determined the relative risk (RR) among the variables, and the incidence of possible SB ($p \leq 0.05$). The comparison of the two time points (T1 and T2) revealed a significant increase in possible SB ($p < 0.01$) and sleep disorders ($p < 0.04$). Children whose parents had a lower schooling level (RR: 2.67; 95%CI: 1.19–6.01), those with their own electronic devices (RR: 1.97; 95%CI: 1.09–2.50), and those with sleep disorders during the pandemic (RR: 1.74; 95%CI: 1.35–2.24) were at greater risk of developing SB during the pandemic. Moreover, the incidence of bruxism and sleep disorders was greater during the pandemic. The factors influencing SB incidence during the pandemic were a lower level of mothers' schooling, greater access to electronic devices, and the occurrence of sleep disorders.

Keywords: Incidence; Bruxism; COVID-19; Child; Sleep Quality.

Introduction

COVID-19 is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and was discovered in Wuhan, China.[1] The outbreak of this disease led to a public health emergency in all countries,[2] and the World Health Organization (WHO) declared it a pandemic on March 11, 2020.[3] The communicability of COVID-19 is greater than that of similar respiratory diseases, such as SARS and Middle East Respiratory Syndrome (MERS). Droplets of saliva and aerosols seem to be the two main mechanisms of propagating SARS-CoV-2.[1]

The COVID-19 pandemic has had a massive impact on human health, causing sudden changes in lifestyle effected by measures of social

distancing and isolation at home, with significant social and economic consequences.[4] Countries have adopted measures, such as social isolation in the form of curfews or lockdowns, a reduction in business hours, and the closing of public places, schools and clinics for periods of time. Each period of the epidemiological curve of the disease is characterized by different applications of public health measures in different countries.[5,6]

Studies warn of the possible negative impact of confinement on mental health and sleep quality in the general population,[6] particularly children, who are at an age of heightened cognitive, emotional and social development.[7] Sleep disorders can affect physical, behavioral and cognitive functioning, and children are vulnerable to the effects of an inadequate quantity or low quality of sleep.[8] Moreover, the excessive use of electronic devices (blue light) during a pandemic characterized by a greater restriction of group activities can alter one's circadian rhythm.[9] Sleep deprivation leads to higher levels of cortisol, which may be a trigger for sleep bruxism.[10]

Another adverse effect is the greater prevalence of orofacial problems, such as dental caries, temporomandibular disorder and bruxism, brought about by a greater incidence of anxiety, stress, and consequent negative impact on self-care.[11] Sleep bruxism (SB) is defined as the activity of masticatory muscles during sleep, which may either be rhythmic (phasic) or non-rhythmic (tonic).[12] This behavior has a multifactorial etiology, and investigations into such factors extrapolate a strictly dental context.[13]

During a pandemic, the closure of schools and excessive technology (online classes, videogames and television programs) can increase the level of anxiety in children, thereby heightening the prevalence of adverse oral conditions.[14] Moreover, social isolation has affected the practice of physical activities among children, hence representing a risk factor for SB.[11]

Studies on the mental health challenges that children and adolescents face during the pandemic have reported an increase in the prevalence of fears and uncertainties, as well as a high level of parental stress.[6,7] However, no studies with a longitudinal design have addressed aspects regarding sleep in children, or the association between the period of social isolation and related clinical dental factors. Therefore, the aim of this study was to determine the association between sleep disorders and the incidence of SB during the COVID-19 pandemic in children eight to ten years of age.

Methodology

Setting

This study received the approval of the institutional review board (certificate number: 10514619.2.0000.5187). The study was conducted in the city of Campina Grande, Paraíba, Brazil, which is considered a major industrial center in the country, and which receives students from different regions of the country. The city has an estimated population of 407,472 inhabitants, including 18,288 students (School Census/INEP 2018). The GINI index (0.5859) is similar to that estimated for Brazil overall (0.515).[15]

Sample and study design characteristics

A prospective longitudinal cohort study was conducted at two time points: in person in November 2019 (T1), prior to the COVID-19 pandemic, and online between August 10 to September 30, 2020 (T2), during the first wave of the virus in Brazil. At this latter time, the epidemiological curve reflected the same seasonal pattern as that displayed at the onset of the community transmission in the country.[16]

Parents/caregivers of children who had participated in a cross-sectional study (T1, n = 739)[17] were contacted after 10-11 months. The children of parents/caregivers who could be located (after a maximum of three attempts), who agreed to participate, and who answered the online questionnaires were included in the longitudinal evaluation (T2, n = 105). It is common in Brazil for individuals with greater socioeconomic vulnerability to change their telephone numbers and addresses more often, making it harder to locate them over time.

We conducted a post hoc power analysis based on the sample size used (children with sleep disturbance = 74, children without sleep disturbance = 31), and on the levels of bruxism incidence in children with and without sleep

disturbance (47% and 9.6%, respectively). The site http://www.openepi.com/Power/PowerCohort.htm was used to calculate the study power, considering a confidence interval of 95%. This calculation is crucial to obtaining more reliable results, because a higher power decreases type II error probability. The results showed that the sample size was adequate for the proposal of this study (power of 93.42%).

Eligibility criteria (T1)

Male and female children eight to ten years of age, enrolled at public and private schools, were included in the study. Children with physical, cognitive or sensory disabilities, those with behavioral problems, and those who required greater care and special attention (in the opinion of teachers and/or guardians) were excluded.

Data collection

Prior to the COVID-19 pandemic (T1)

The questionnaires were delivered to the children in the classroom, to take home for their parents/caregivers to answer. The average reported time needed to answer the questionnaires was 12 minutes.

Sociodemographic and behavioral questionnaire

The parents/caregivers answered a questionnaire with closed-ended questions addressing sociodemographic characteristics (child's sex, family income, caregiver's marital status, caregiver's schooling and number of residents in the home), the child's use of electronic devices, and the child's parafunctional habits and behavior during sleep (drool on pillow).

Sleep disturbance scale for children

Sleep quality was assessed using the *Sleep Disturbance Scale for Children* (SDSC),[18] which comprises 26 items, and is used to identify different sleep-related behavioral patterns in individuals between three and 18 years of age. The scale is divided into six dimensions: disorders of initiating and maintaining sleep, sleep breathing disorders, disorders of arousal, sleep-wake transition disorders, disorders of excessive somnolence, and sleep hyperhidrosis. Each item has a five-point frequency scale (never, occasionally, sometimes, often, and always), with higher scores indicating a greater impact on sleep.

Diagnosis of bruxism

The diagnosis of bruxism was based on the criteria of the American Academy of Sleep Medicine, and the most recent international consensus on bruxism.[12] Parents/caregivers residing in the same home as the child answered the following question: "Does your child grind his/her teeth during sleep?" The response options were never, occasionally, sometimes, often, and always.

During the COVID-19 pandemic (T2)

In the second phase of the data collection, the SDSC and the question about SB were once again sent to the parents/caregivers, but in online form. The link to the online questionnaire available on the Survey Monkey® platform was informed to the parents/caregivers by WhatsApp (WhatsApp, Mountain View, USA). The average time required to complete the questionnaires was 10 minutes.

Statistical analysis

The absolute and relative frequencies of the variables before and during the pandemic were determined. The incidence of SB was considered the occurrence of the condition at T2 in children who did not have the condition at T1. McNemar's chi-square test was used to compare the dependent variables (SB), and the Wilcoxon test, to compare the sleep disorders before and during the COVID-19 pandemic. Bivariate and multivariate Poisson regression analyses were conducted to determine the relative risk (RR) and respective 95% confidence intervals (CI) for the incidence of SB at T2, among the categories of the independent variables. All variables with a p-value ≤ 0.20 in the unadjusted analysis were incorporated into the multivariate regression model. In the final model, the variables with a p-value <0.05 after the adjustments were considered significantly associated with the outcome. All the data were analyzed using the Statistical Package for the Social Sciences (SPSS for Windows, version 21.0, SPSS, Chicago, USA).

Results

Table 1 displays the socioeconomic characterization of the sample. Fifty-seven (54.3%) of the children were girls, 66 (62.9%) had parents with more than eight years of schooling, and 88 (83.8%) did not have access to their own electronic devices. Sixty-six children (62.9%) had sleep disorders prior to the pandemic, and this number increased to 74 (70.5%) during the pandemic. The incidence of SB between T1 and T2 was 36.2%. In addition, Figure shows that the dimensions of the Sleep Disturbance Scale for Children had higher levels (worse performance) during the COVID-19 pandemic than the period preceding this event. McNemar's and Wilcoxon's tests for dependent samples revealed statistically significant differences between T1 and T2 for SB ($p = 0.01$) and sleep disorders ($Z = -2.38$; $p = 0.01$), respectively.

Children whose parents had a lower schooling level (RR: 2.67; 95%CI: 1.19–6.01; $p < 0.01$), those with their own electronic devices (RR: 1.97; 95%CI: 1.09–2.50; $p = 0.04$), and those with sleep disorders during the pandemic (RR: 1.74; 95%CI: 1.35–2.24; $p < 0.01$) were at greater risk of developing SB during the pandemic (Table 2).

Table 1. Socioeconomic characterization of the sample (n = 105).

Variable	n (%)
Sex	
Male	48 (45.7)
Female	57 (54.3)
Ethnicity	
Non-White	67 (63.8)
White	38 (36.2)
Mother's schooling	
≤ 8 years of study	39 (37.1)
> 8 years of study	66 (62.9)
Mother's age	
≤ 35 years	60 (57.1)
> 35 years	45 (42.9)
Number of residents in home	
≥ 6	89 (84.8)
≤ 5	16 (15.2)
Monthly family income	
≤ R$ 1000	56 (53.3)
> R$ 1000	32 (30.5)
Child's position in family	
Youngest child	46 (43.8)
Middle child	22 (20.0)
Oldest child	37 (35.2)
Access to own electronic devices	
No	88 (83.8)
Yes	17 (16.2)
Sleep disorder prior to pandemic	
Yes	66 (62.9)
No	39 (37.1)
Sleep disorder during pandemic	
Yes	74 (70.5)
No	31 (29.5)
Incidence of bruxism	
Yes	38 (36.2)
No	67 (63.8)

Discussion

The hypothesis of the present study was that the increase in SB incidence during the COVID-19 pandemic is associated with sleep disorders in children eight to ten years of age. This association has not been investigated previously. However, the psychological impact of the current pandemic as a possible cause of SB and temporomandibular disorder was suggested in a previous study.[19] Moreover, in situations of public health emergencies and social vulnerability, such as intolerance to uncertainty, an individual's concerns about becoming infected, and his fear of death impact basic activities and sleep quality.[1,20]

All psychological problems related to pandemics can trigger a cascade of events that culminate in high levels of stress.[20] This situation can also lead to an increase in the sympathetic nerve impulse, and a sensation of overexcitement that causes sleep disorders.[21] Therefore, the occurrence of harmful orofacial muscle behavior, such as bruxism, which may or may not be associated with chronic orofacial pain, is expected in a situation of post-traumatic stress.[19]

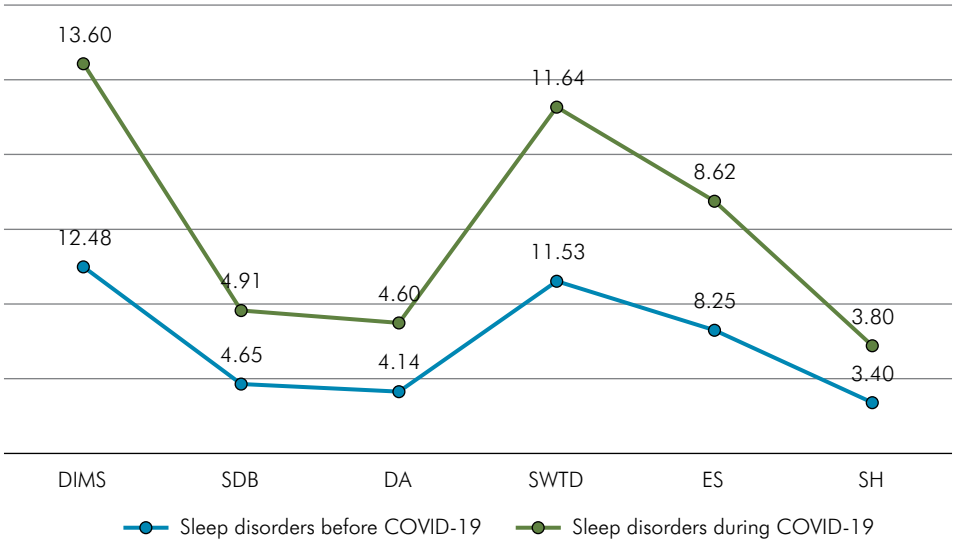

Figure 1. Score on each domain of *Sleep Disturbance Scale for Children* before and during pandemic (n = 105).

Some studies have addressed psychological issues in children and adolescents during the pandemic and social isolation.[11,14] However, no previous studies have investigated the association of these issues with dental conditions, such as bruxism, and there are no studies with a longitudinal design comparing these conditions before and after the onset of the pandemic.

In the present study, significant differences were found between the two time points analyzed regarding the frequency of SB and of sleep disorders; the incidence of SB was 29.5%. This difference may be related to the reduction in contact with other children, an increase in the pressure stemming from the novel context of online classes, and the absence of group sports in this period of social confinement.[22]

Moreover, the uncertainty toward factors like the origin of SARS-COV-2, the ability of the government to prevent the dissemination of the disease, and the severity of the risks, causes considerable familial stress, with emotional and financial consequences that children often perceive.[18,23] Studies reveal a high level of perception of family support on the part of children.[23,24] In the present investigation, a low parent schooling level was a major risk factor for the development of SB in the age group analyzed. Thus, the increase in anxiety due to financial problems, and the reduced access to healthcare services during this period may be aggravating factors for this behavior in children.[25]

Children with greater access to their own electronic devices were at greater risk of developing SB after the onset of the pandemic, compared with the pre-pandemic period. Other studies have reported changes in lifestyle during the pandemic, characterized by an increase in screen time ranging from 65%[26] to 74%.[27] Moreover, high levels of dependence on smartphones were associated with possible SB.[9,28] Factors such as lack of tolerance, social withdrawal, difficulty performing activities of daily living, and impulse control disorders related to the use of smartphones[26,29] may contribute to an increase in bruxism (both the sleep and awake forms), especially during a pandemic.[11] Moreover, the blue light of electronic devices can interfere with sleep[30] and circadian physiology.[31] In turn, sleep deprivation and interference in one's circadian rhythm can exert a negative impact on one's mental, social and physical wellbeing.[31] In the dental context, the change in routine, as of the onset of the pandemic, was a factor that led to an increase in the number of individuals with oral problems.[5] Therefore, public health care during this pandemic must be optimized. However, this requires knowledge not

Table 2. Poisson regression between incidence of sleep bruxism during the COVID-19 pandemic and independent variables.

Variable	Incidence of sleep bruxism		Bivariate		Multivariate	
	Yes	No	Unadjusted RR*		Adjusted RR**	
	n (%)	n (%)	p-value	(95%CI)	p-value	(95%CI)
Sex						
Male	17 (35.4)	31 (64.6)	0.88	-	-	-
Female	21 (36.8)	36 (63.2)		-		-
Ethnicity						
White	13 (34.2)	25 (65.8)	0.75	-	-	-
Non-White	25 (37.3)	42 (62.7)		-		-
Monthly family income						
≤ R$ 1000	18 (32.1)	38 (67.9)	0.27	-	-	-
> R$ 1000	14 (43.8)	18 (56.3)		-		-
Mother's age						
≤ 35 years	17 (28.3)	43 (71.7)	0.07	-	-	-
> 35 years	20 (45.5)	24 (54.5)		-		-
Mother's schooling						
≤ 8 years of study	20 (51.3)	19 (48.7)	0.01	1.88 (1.14–3.09)	0.01	2.67 (1.19–6.01)
> 8 years of study	18 (27.3)	48 (72.7)		1		1
Number of residents in home						
≤ 5	35 (39.3)	54 (60.7)	0.11	–	–	–
>5	3 (18.8)	13 (81.3)		–		–
Child's position in family						
Oldest child	13 (35.1)	24 (64.9)	0.87	–	–	–
Middle child	7 (33.3)	14 (66.7)		–		–
Youngest child	18 (39.1)	28 (60.9)		–		
Access to own electronic devices						
Yes	18 (62.1)	11 (37.9)	< 0.01	1.90 (1.09–3.90)	0.04	1.97 (1.09–2.50)
No	20 (26.3)	56 (73.7)		1		1
Sleep disorder at T1						
Yes	29 (43.9)	37 (56.1)	0.03	1.90 (1.01–3.59)	–	–
No	9 (23.1)	30 (76.9)		1		–
Sleep disorder at T2						
Yes	35 (47.3)	39 (52.7)	< 0.01	4.88 (1.62–14.71)	< 0.01	1.74 (1.35–2.24)
No	3 (9.7)	28 (90.3)				1

*Poisson regression analysis unadjusted for independent variables and incidence of sleep bruxism; ** Poisson regression analysis adjusted for independent variables and incidence of sleep bruxism; Variables with $p < 0.20$ in bivariate analysis incorporated into multivariate model.

only of the medical and biological sciences, but of all sciences, and then harnessing it to elucidate the human problems that may arise, become aggravated or be perpetuated by the social isolation imposed by the COVID-19 pandemic.

The methods employed in the present study to measure the outcome variable were based on the most recent international consensus on bruxism, which encourages the assessment of possible SB in longitudinal studies, using reports that include

frequency.[12] Although a convenience sample was used, and the data collection took place online, compelled by pandemic-imposed restrictions, there is evidence that there is no significant difference between data collected in person and data collected remotely. Moreover, the longitudinal design of the study enables establishing a coherent sequence between exposure and outcome, and the multivariate analysis makes the findings statistically more robust.

Conclusion

In conclusion, the percentage of children with sleep disorders and sleep bruxism increased during the COVID-19 pandemic. Moreover, a lower parent schooling level, greater access to one's own electronic devices, and the occurrence of sleep disorders exerted an influence on developing sleep bruxism during the pandemic.

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