

Use of electronic devices, practice of sports, and awake bruxism in schoolchildren aged eight to ten years

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Abstract: The aim of the present study was to investigate whether possible awake bruxism (AB) is associated with the use of electronic devices and the practice of sports in schoolchildren aged eight to ten years. A cross-sectional study was conducted with 739 students in public and private schools in the city of Campina Grande, Brazil. Parents/guardians answered a questionnaire addressing sociodemographic data. The children answered questions about use of electronic devices, practice of sports, and AB. Statistical analysis involved robust logistic regression for complex samples ($\alpha = 5\%$). The prevalence of possible AB was 14.9%. Being female (OR = 1.71, 95%CI: 1.11–2.63), being the middle child (OR = 2.19, 95%CI: 1.14–3.88), having unmarried parents (OR = 1.73, 95%CI: 1.13–2.65), daily use of a cell phone/tablet/computer (OR = 1.82, 95%CI: 1.19–2.80), use of electronic devices for two or more hours per day (OR = 1.97, 95%CI: 1.35–2.86), and playing sports in and/or out of school (OR = 1.60, 95%CI: 1.18–2.52) remained associated with possible AB in the final model. The presence of possible AB was influenced by the use of electronic devices and the practice of sports among schoolchildren aged eight to ten years.

Keywords: Tooth Wear; Smartphone; Sports; Pediatric Dentistry.

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Introduction

The latest international consensus defines awake bruxism (AB) as a masticatory muscle activity during wakefulness that is characterized by repetitive or sustained tooth contact and/or bracing or thrusting of the mandible and is not a movement disorder in otherwise healthy individuals.¹ Sleep bruxism (SB) is characterized as rhythmic (phasic) or non-rhythmic (tonic) muscle activity that occurs when the individual is sleeping. Accordingly, possible sleep/awake bruxism is based on self-report.¹ Regarding the etiology of AB, biological and psychosocial factors, such as syndromes, stress, and/or anxiety, are commonly reported.² Moreover, exogenous factors such as the use of medications for attention deficit, hyperactivity, and autism are associated with a higher frequency of this condition.^{2,3}

AB can cause intense headache, temporomandibular joint disorders, tooth wear, and tooth fractures, and can impair motor control for basic functions, such as speaking and eating.⁴ Functional limitations caused

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by bruxism can affect children's quality of life and generate an excessive load on muscle function, leading to pain during chewing.⁵ An early diagnosis can help control the habit and prevent harm to components of the masticatory system.⁶ The reported prevalence of bruxism in children varies widely due to difficulties in obtaining accurate information from children and differences in assessment criteria and populations studied.^{7,8} In the specific analysis of AB, a previous study reported the prevalence in adolescents to be 14%.⁹

In the literature, awake bruxism is reported to have multifactorial causes and some divergent etiological aspects.¹⁰ As environmental factors may be related to AB, it is important to consider the excessive use of electronic devices, which the American Academy of Pediatrics has set as more than two hours per day.¹¹ Screen time can alter the circadian cycle due to the emission of blue light, which may suppress the production of melatonin leading to increased levels of mental arousal and stress.¹² Moreover, children present high levels of emotional dysregulation and anxiety when they use social media and electronic devices for hours at a time.^{13,14} It is worth noting children's use of electronic devices has increased considerably in the past decade,¹⁴ which may also trigger AB, but no studies have yet demonstrated this association in children aged eight to ten years.

Playing sports also has a beneficial effect on children's cognitive and emotional functioning and helps control anxiety and stress while stimulating self-esteem and self-confidence¹⁵. Studies have shown that regular physical activity leads to changes in the brain that are positive in child development.¹⁵ However, competitive sports can lead to repeated or prolonged tooth contact.¹⁶ Considering this association between physical activity and psychological elements, studies are needed to investigate the influence of playing sports on AB in children.¹⁷

Previous studies have investigated the association of AB with social and family variables, such as marital status of parents and the child's sex and birth order, but clinical examinations were not always performed and representative samples were not always used.⁸ Thus, there is a knowledge gap regarding the possible influence of the home

environment on the behavior of children and the occurrence of probable AB.

Knowledge on the factors associated with AB is essential for the effective counseling of parents/guardians and the diagnosis of children in the mixed dentition phase. Therefore, the aim of the present study was to investigate whether awake bruxism is associated with the use of electronic devices and the practice of sports in schoolchildren aged eight to ten years who are in the mixed dentition stage.

Methodology

Study design, setting and population

An analytical cross-sectional study was conducted in the city of Campina Grande (northeastern Brazil). Data collection took place between May and September 2019. The sample was composed of male and female schoolchildren aged eight to ten years enrolled in public and private schools, representing approximately 30% of the population of the city.¹⁸ Probabilistic cluster sampling was performed in two stages (schools and children) and stratified by the administrative district of the city (six districts) and type of school (public or private). Children were randomly selected using a lottery system proportional to the number of students and type of school per district. The sample was calculated based on the difference between two different proportions using the G* Power software version 3.1.9.7. The proportion estimates from the pilot study indicated AB rates of 20.1% and 10.1% for those who did and did not practice sports in and/or out of school, respectively. The minimum sample was 394, to which a design effect of 1.6 was applied to increase the variability of the sample, resulting in a total of 631 children. This number was increased by 20% to compensate for possible dropouts, resulting in a desired sample of 789 participants.

This result demonstrated that the sample size was adequate for the power proposed for this study.

Eligibility criteria

Children of both sexes in the mixed dentition phase enrolled in public and private schools in the city of Campina Grande whose parents

provided written consent participated in the present study. Children with cognitive, sensory, or behavioral deficiencies that would compromise the central nervous system and those submitted to orthodontic treatment with a fixed appliance¹⁹ were excluded.

Training and pilot study

Training for the application of questionnaires and interviews with the children was conducted. A pilot study was then conducted with 40 children (20 enrolled in a public school and another 20 from the private school system). The children who participated in this step were not part of the main study. The results of the pilot study revealed no need to alter the methods proposed for the study.

Data collection instruments

The following instruments were used for data collection:

The sociodemographic questionnaire was sent home by the students to be completed by parents/guardians to collect data on type of school, school hours (morning or afternoon), child's schooling, child's sex, self-declared skin color, type of housing, home location (rural or urban area), number of residents in home, birth order among siblings, family income, mother's and father's schooling, and guardian's marital status. Previously, the researchers visited all classrooms and explained the socioeconomic questionnaire to the children with the help of the teacher. We provided a telephone contact of one of the researchers, and illiterate parents were asked to ask the teacher or a trusted relative for help in reading the questions and the consent form. This method has been adopted in previous studies with an excellent response rate.

The questionnaire for report of awake bruxism, use of electronic devices, and practice of sports was completed by the researchers and questions were asked to the children. The diagnosis of awake bruxism was based on the criteria of the international consensus¹. Children were asked to monitor their behavior over a period of 1 or 2 weeks, so that when returning to the school they may more confidently answer the question of whether or not they clench their teeth

together.¹ Children were asked about the practice of sports at and/or out of school at least once a week. This variable included sport modalities. Students who practiced sports in addition to physical education responded positively.

Regarding daily use of electronic devices and time of use per day by children, the questions were based on the American Academy of Pediatrics¹¹ that set two hours per day as excessive for children older than 6 years. The questions were: Do you have your own electronic devices (such as smartphones, notebooks, tablets)? How much time a day do you spend in front of screens? For statistical purposes, responses were categorized as ≥ 2 hours per day < 2 hours per day.

Data processing and analysis

Descriptive and inferential statistical methods were employed. The calculations were performed with the Statistical Package for the Social Sciences (SPSS version 25 for Windows 25.0, SPSS Inc, Chicago, USA). The frequencies of the variables were calculated. Descriptive statistics were performed. Unadjusted and adjusted logistic regression were performed using the stepwise backward method to determine associations between AB and the independent variables considering a design effect for complex samples. The binary multiple logistic regression model was run to test the maintenance of the associations after adjustments for possible confounding variables. Variables with a p-value < 0.20 in the bivariate analysis were incorporated into the multivariate model (sex, skin color, child's birth order, marital status, daily use of electronic devices, screen time on electronic devices, most common activity, practice of sports). Variables that enabled a better fit using the stepwise backward method adopting a significance level of 5% ($p < 0.05$) were maintained in the final model and considered significantly associated with the outcome (possible AB). Multicollinearity between variables was verified.

Ethical aspects

In compliance with Resolution N^o 466/2012 of the National Board of Health, which regulates ethics in research involving human subjects in

Brazil, the present study received approval from the institutional review board of Universidade Estadual da Paraíba (certificate number: 10514619.2.0000.5187) and was conducted in accordance with the principles established in the 2013 Declaration of Helsinki. A document explaining the nature of the study was approved by the State and Municipal Secretaries of Education and by the administration offices of the schools. Only students who signed the consent form and whose guardians signed the informed consent participated in the study.

Results

The final sample included 739 children with a mean age of 8.95 years corresponding to a 93.6% response rate. The losses (6.4%) were due to absence from school after three attempts to interview the children.

Table 1 displays the characteristics of the sample: 367 (49.7%) were boys and 372 (50.3%) were girls; more than 65% self-reported a non-white skin color; 59.5% attended school in the afternoon; more than 46% were the youngest child in the family; 61.4% had married parents; 57.8% had mothers with more than eight years of schooling; slightly more than 50% had mothers aged ≤ 35 years; more than 85% lived in a home with five or less residents; and 57% had a monthly family income of \leq R\$1100 (Brazilian currency, equivalent to US\$ 213).

Regarding the use of electronic devices (cell phone, tablet, and laptop), 450 children (60.9%) used them daily and 251 (34.0%) had more than two hours of screen time per day. The majority of children ($n = 509$; 68.9%) played sports. The prevalence of possible AB was 14.9%.

The multivariate analysis with adjusted binary logistic regression (Table 2) revealed that being female (OR = 1.71, 95%CI: 1.11–2.63), being the middle child (OR = 2.19, 95%CI: 1.14–3.88), having unmarried parents (OR = 1.73, 95%CI: 1.13–2.65), playing sports (OR = 1.60, 95%CI: 1.18–2.52), daily use of a cell phone/tablet/computer (OR = 1.82, 95%CI: 1.19–2.80), and \geq two hours per day of screen time (OR = 1.97, 95%CI: 1.35–2.86) remained associated with AB in the final model.

Table 1. Characterization of the sample ($n = 739$).

Variables	n (%)
Sex	
Male	367 (49.7)
Female	372 (50.3)
Age	
8	269 (36.4)
9	240 (32.5)
10	230 (31.1)
Skin color	
White	255 (34.6)
Non-white	483 (65.4)
School hours	
Morning	299 (40.5)
Afternoon	440 (59.5)
Child's birth order	
Youngest child	340 (46.6)
Middle child	275 (37.2)
Oldest child	115 (15.8)
Guardian marital status	
Married	453 (61.4)
Unmarried	285 (38.6)
Mother's schooling (years of study)	
≤ 8	310 (42.2)
> 8	425 (57.8)
Mother's age (years)	
≤ 35	387 (52.4)
> 35	342 (46.3)
Number of residents in home	
≥ 6	96 (13.2)
≤ 5	634 (86.8)
Monthly family income	
\leq R\$ 1100 (213 US\$)	327 (57.0)
$>$ R\$ 1100 (213 US\$)	247 (43.0)
Awake bruxism	
Yes	110 (14.9)
No	628 (85.1)
Daily use of electronic devices	
Yes	450 (60.9)
No	289 (39.1)
Screen time with electronic devices (hours per day)	
≥ 2	251 (34.0)
< 2	488 (66.0)
Practice of sports at and/or out of school	
Yes	509 (68.9)
No	230 (31.1)

Table 2. Binary logistic regression of possible awake bruxism and associated variables (n = 739).

Variable	Awake bruxism		Bivariate		Multivariate	
	Yes	No	Unadjusted OR		Adjusted OR	
	n (%)	n (%)	p-value	95%CI	p-value	95%CI
Sex						
Female	67 (18.1)	304 (81.9)	< 0.01	1.06 (1.02–1.22)	0.01	1.71 (1.11–2.63)
Male	43 (11.7)	324 (88.3)		1	–	1
Skin color						
White	29 (11.4)	226 (88.6)	0.04	1.05 (1.03–1.11)	–	–
Non-white	81 (16.8)	401 (83.2)		1	–	–
School hours						
Morning	41 (13.8)	257 (86.2)	0.47	1.01 (0.96–1.07)	–	–
Afternoon	69 (15.7)	371 (84.3)		1	–	–
Child's birth order						
Youngest child	55 (16.2)	285 (83.8)	0.02	1.04 (0.95–1.13)	–	–
Middle child	23 (20.2)	91 (79.8)		1.10 (1.01–1.95)	0.01	2.19 (1.14–3.88)
Oldest child	29 (10.5)	246 (89.5)		1		1
Marital status						
Unmarried	56 (12.4)	396 (87.6)	< 0.01	1.68 (1.11–1.82)	0.01	1.73 (1.13–2.65)
Married	54 (18.4)	231 (81.1)		1		1
Monthly family income						
≤ R\$ 1100 (213 US\$)	50 (15.3)	277 (84.7)	0.20	0.96 (0.91–1.02)	–	–
> R\$ 1100 (213 US\$)	29 (11.8)	217 (88.2)		1	–	–
Mother's schooling (years of studt)						
≤ 8	50 (16.1)	260 (83.9)	0.40	0.97 (0.92–1.03)	–	–
> 8	59 (13.9)	365 (86.1)		1	–	–
Daily use of electronic devices						
Yes	66 (18.8)	286 (81.3)	< 0.01	1.07 (1.02–1.34)	< 0.01	1.82 (1.19–2.80)
No	43 (11.4)	334 (88.6)		1		1
Screen time (hours per day)						
≥ 2	48 (23.5)	156 (76.5)	< 0.01	2.09 (1.47–2.98)	< 0.01	1.97 (1.35–2.86)
< 2	53 (11.2)	419 (88.8)		1		1
Most used activity						
Games	59 (17.5)	279 (82.5)	0.11	2.32 (0.76–7.08)	–	–
Videos/social media	35 (12.9)	236 (87.1)	0.34	1.72 (0.55–5.38)	–	–
Studying	3 (7.5)	37 (92.5)		1	–	–
Practice of sports at/out of school						
Yes	71 (16.8)	351 (83.2)	0.09	1.63 (0.94–1.95)	0.04	1.60 (1.18–2.52)
No	39 (12.3)	277 (87.7)		1		1

OR: odds ratio; CI: confidence interval. Control variables: sex, skin color, birth order, practice of physical activity, access to electronic devices, time using electronic devices ($\alpha \leq 0.05$).

Discussion

Few studies have investigated the occurrence of AB in children in the mixed dentition phase,²¹ which corresponds to a period of dentition, hormonal, and behavioral changes. Considering that risk factors for oral conditions can start in childhood, this stage of life is ideal for prevention and modification of unhealthy habits and behaviors. The prevalence of possible AB in the eight-to-ten-year-old age group (14.9%) was considered high compared with the rate in children reported by Junqueira et al.⁹ This divergence may be due to differences in the study population and methods employed. One should also consider the difficulty in establishing the prevalence of childhood AB. Interesting findings of the present study show that female sex, being a middle child, and having unmarried parents were associated with possible AB. Studies show that girls in some families are responsible for household tasks and caring for younger siblings, which can generate a higher level of anxiety and parental pressure that may trigger behaviors such as bruxism.^{20,21}

The same stressful psychological outcome is observed in middle children and in children of divorced parents, who often feel that they receive less attention from their parents.²² This situation can influence on emotional development and may generate anxiety and stress,²³ which are triggers of AB. A psychology study suggests that middle children are more likely to have problems in school or even with the law in adulthood. This may favor triggers for awake bruxism. However, more dental studies are needed to investigate the association of birth order and this muscle activity.²³ Therefore, the family environment must have a positive effect on children's oral health and quality of life.²⁴ Regarding parental marital status, previous studies have shown that divorced parents can contribute to anxiety in children involved in this disruptive family relationship.^{25,26}

The daily use of a cell phone/tablet/computer and their use for two or more hours per day were also associated with AB. A previous study revealed the strong influence of digital games on different aspects of human physiology, such as behavior, cognition, and emotion, and the use of electronic

devices in childhood was considered a possible anxiety-promoting factor.²⁷ As psycho-emotional and social conditions are strongly associated with AB, anxiety and high levels of stress are factors that can increase the occurrence of this behavior.^{28,29} Thus, it is important for dentists to warn parents/guardians of the risks and harms of excessive use of electronic devices by children.

Children who practiced sports at and/or out of school were more likely to have AB. This result contrasts data described in studies reporting that the practice of sports helps control anxiety and stress in children and has only benefits for child development.^{15,16} However, the practice of competitive sports and participation in tournaments can exert a psychological effect, generating a higher degree of anxiety and possibly contributing to the development of AB.³⁰ Bruxism is an unconscious act aggravated by situations of stress, nervousness, anxiety, and competitiveness, as well as by muscular efforts, all of which are involved in different sport modalities.¹⁰

The present study has the limitations inherent to the cross-sectional design, which does not allow the determination of cause-effect relationships. Longitudinal studies that include an evaluation of stress and anxiety levels among children in the mixed dentition phase and the occurrence of awake bruxism are needed to provide more insight into the causative factors and the impact of this condition on the quality of life of schoolchildren. Another limitation is that the frequency of sport practice and whether it was a compulsory or voluntary sport were not considered. This may have weakened the association between this variable and AB. The strengths of this study are the representative probability sample of children in the mixed dentition phase and an adjusted analysis. The present findings can help obtain a more complete patient history and to establish prevention strategies and public policies with a multi-professional, interdisciplinary approach involving joint action by dentists, psychologists, and physical educators in schools, considering the multifactorial etiology of bruxism.

This study indicated predictors for the occurrence of awake bruxism in schoolchildren. The results revealed that girls, middle children, children with

unmarried parents, those who use of electronic devices on a daily basis, those who use such devices

excessively, and those who practice sports are more likely to have awake bruxism.

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