Sleep and Breathing (2019) 23:935–941
https://doi.org/10.1007/s11325-018-1771-y

PEDIATRICS • ORIGINAL ARTICLE

Poor sleep quality and prevalence of probable sleep bruxism in primary and mixed dentitions: a cross-sectional study

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Received: 28 August 2018 / Revised: 24 October 2018 / Accepted: 10 December 2018 / Published online: 19 December 2018

Abstract

Purpose To investigate the prevalence of probable sleep bruxism (SB) in the primary and mixed dentitions using non-instrumental approach and evaluate whether sleep quality is associate with probable SB in different age ranges.

Methods School-based cross-sectional study with children aged 2–5 (primary dentition, $n = 372$) and 8–10 years old (mixed dentition, $n = 563$) enrolled in public schools at Florianopolis and their parents. The sleep characteristics, socioeconomic status, and presence of probable SB were assessed using questionnaires. Seven trained examiners (Kappa > 0.7) assessed tooth wear. Children were selected following a stratified sample (2–5); and a system of the proportionality, first the schools of the sanitary districts and after the classrooms (8–10). Unadjusted and adjusted Poisson regression was performed with probable SB as a dependent variable. Independent variables were as follows: family income, parent schooling, drooling, tooth wear, and sleep quality. The independent variables presenting p value ≤ 0.20 were included in the adjusted model.

Results The prevalence of probable SB was 22.3% in primary and 32.7% in mixed dentition. Probable SB was significantly associated with poor sleep quality ($p < 0.001$) in mixed dentition (PR 1.80; 95% CI 1.34–2.44) adjusting for age and drooling. In the primary dentition, the adjusted regression did not show association between analyzed characteristic and probable SB. Sex, socioeconomic, head of the household educational status, drooling, and tooth wear were not associated with probable SB in both dentitions.

Conclusion Prevalence of probable SB is higher in mixed than in primary dentition and poor sleep quality is associated with probable SB in children aged 8–10 years.

Keywords Sleep bruxism · Preschool · Child and prevalence

Introduction

A recent panel of experts had defined sleep bruxism (SB) as a masticatory muscle activity during sleep that is described as rhythmic (phasic) or non-rhythmic (tonic) [1]. The repetitive jaw-muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible occurring during sleep [2] is not a movement disorder or a sleep disorder in otherwise healthy individuals [1]. The document also discussed the diagnostic grading system as an attempt to

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qualify SB for clinical and research purposes [1]. Self-reported assessment of sleep bruxism continues to be the primary tool in bruxism research and clinical practice. The evaluation of probable SB could be based on non-instrumental approaches by means of questionnaires or oral history [1] and in case of non-instrumental probable SB screening in children, parents report could be used [3, 4]. Besides, although the instrumental approach—polysomnography—is the reference standard to assess SB [1], questionnaires could be used as screening method [5].

SB signs and symptoms differ according to the patient and could include abnormal tooth wear, tongue indentations, line alba along the biting plane, increase in muscle activity (recorded by the polysomnograph), hypertrophy of masseter muscles, grinding of teeth accompanied by a characteristic sound, pain in the masticatory and/or cervical muscles, pain in temporomandibular joint, and headache [6]. However, it is important to emphasize that some bruxists do not experience any of these adverse effects [7].

The prevalence of SB in children presents a very high variability and is reported to be between 5.9 and 49.6% in a recent systematic review [8]. A previous study related 3.5% to 40.6% with decrease with age and no gender differences [9]. Studies conducted in Brazil had shown a prevalence of SB varying from 14.0 [10] to 35.3% [11] among children.

As a multifactorial behavior [2], there are multiple conditions related with bruxism. A systematic review, conducted with randomized clinical trials, cohort, and case control studies, that aimed to establish the risk factors associated with bruxism in children, found that gender, age, inheritance, secondhand smoke, anxiety, nervous personality, high psychological reactions, high sense of responsibility, move a lot during sleep, sleep with mouth open, snore loudly, restless sleep, sleep less than 8 h, sleep with light on, noise in room, headache, object biting, peer problems, emotional symptoms, and mental health problems were associated with bruxism [12].

The evidence suggests the importance of screening for sleep characteristics and SB especially considering that the incidence of parasomnias, that include sleep bruxism, is believed to increase with age [13], which could influence children's sleep quality along time.

Therefore, the aim of the study was to investigate the prevalence of probable SB in the primary and mixed dentitions using non-instrumental approach and evaluate the association with sleep characteristics in different age ranges.

Methods

The recommendations of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) was followed to guide and report this study [14].

Ethical aspects

The project was reviewed and approved by the Institutional Ethical Committee at Federal University of Santa Catarina under numbers 343,658/2013 and 902,633/2015 and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Parents and children signed a free and informed consent before the beginning of the data collection.

Participants

A cross-sectional study was planned to estimate the prevalence of probable SB in children aged 2–5 (primary dentition) and 8–10 years old (mixed dentition) and associated sleep characteristics. The age range was selected based on the validated quality of life questionnaires, since this is part of a comprehensive oral health survey. All children were enrolled in public schools at Florianópolis/SC, south Brazil. The estimated population in the city is 485,838 people, 6349 children aged 2–5 in 72 public municipal preschools, and 16,234 children aged 8–10 in 36 public municipal fundamental schools [15]. The city has a human development index of 0.847 [15]. The study was conducted between March and September 2014 with children aged 2–5 and September to December 2015 with children aged 8–10 years old. Each child participated only once.

To be part of the study, children aged 2–5 years had to present primary dentition. Those with erupted permanent teeth or uncooperative behavior were excluded. Children aged 8–10 had to present at least one erupted permanent tooth and those who were illiterate were excluded.

The sample size calculation was based on a previous study [11] and considered 35.3% prevalence rate of SB reported by parents in both age ranges. The G*Power 3 analysis (version 3.1, University Dusseldorf, Germany) was used. The calculus was made separately for the age ranges in two moments apart. For 2–5 years, the standard error taken was 0.03 and the power (1-ß error probability) 0.80. The required sample size was 349 and to balance for possible losses, 10% was added reaching 384 pairs of children/parent. This was because all preschools were invited to participate. For the 8–10 age range instead, the standard error taken was 0.05, the power (1-ß error probability) 0.80, and the sample size was 302. Because of the sampling design, first the schools and after the classrooms in each school, a 1.5 correction factor was applied to compensate for the cluster effect. To balance for possible losses, 10% was added requiring a sample size of 499 pairs of children/parent.

Sample recruitment

After the contact, those that accepted to participate were enrolled in the study, 46 preschools and 24 fundamental schools.

In 2–5 age range, children were randomly selected following a system of the proportionality. In the 8–10 age range, a cluster sampling plan in two stages was used. At the first stage; schools were randomly selected based on the proportionality of the population on each sanitary district of the city. At the second stage, classrooms were randomly selected at each grade of the fundamental school and all the children in the classroom were invited and those that accepted participated.

All children from both age ranges were invited and received the informed consent forms and the questionnaires with the instructions to give to their parents. With the forms signed, children were examined.

A total of 7 trained examiners (Kappa inter and extra examiner > 0.7) participated in the data collection. All them received theoretical training and participated in the pilot study (42 children). None of the children of the pilot study participated in the final sample. Children were examined in the school, sitting on a chair in front of the examiner. The oral examination consisted of tooth wear; teeth were dried with sterile gauze and examined with a clinical mirror with the aid of a flashlight. The World Health Organization (WHO) standards were followed [16]. The criteria for tooth wear were as follows: (1) wear of anterior teeth on incisal border; (2) wear of occlusal posterior teeth (in both conditions, with anatomical change of the teeth and the worn borders of teeth fit the antagonist arch) [17]. For children aged 2–5 years, both criteria were followed and all primary teeth were evaluated. For children aged 8–10, only primary molars were considered because the permanent teeth have had erupted recently, and there was probably not enough exposure to wear for gauging. Tooth wear was categorized as present and absent.

Questionnaires consisted of the following: (1) a socioeconomic inventory formulated by the Brazilian Association of Research Companies [18]. The index classifies the families in classes as relating to the goods owned and was categorized from the more favorable (A), intermediate (B), and to the less favorable (C–D) economic status. It also classifies the head of the household in educational level and was dichotomized as equal or more than 8 years of study or less than 8 years; and (2) questionnaire related to SB and sleep characteristics. The diagnostic criteria for probable SB were based on non-instrumental approach [1]. Parents answered if their children had ground their teeth while sleeping in the past 30 days, causing the parent to hear the noise of the friction of one tooth scraping the other, based on the Brazilian version of the Pittsburgh Sleep Questionnaire Index scale (PSQI-BR) [19]. The index question is based on the report from the last 30 days and has already been used as a diagnostic approach in another study [20]. The probable SB based on non-instrumental approach was categorized as present and absent. Moreover, children received oral examination on tooth wear. Other information assessed sleep quality evaluated with a question based on the parents' opinion: "In your opinion, how would you classify the quality of your child sleep? With the possible answers: He/she sleeps well, good quality sleep or He/she sleeps not well, poor quality sleep. For the statistical analysis, it was classified as well (adequate sleep quality) or not well (poor sleep quality) [21]. Also, parents' observation of drooling during sleeping time (yes/no) was assessed.

Statistical analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS version 21.0; SPSS Inc., Chicago, IL, USA). The dependent variable was probable SB and the associations with independent variables were tested using the chi-squared test. Unadjusted and adjusted Poisson regression was performed for the analysis of factors associated with probable SB separately for primary (2–5 years) and mixed (8–10 years) dentitions and then compared. Adjustments were made for the independent variables presenting p value ≤ 0.20 in the unadjusted model, avoiding this form adjusting for mediating factors. The level of significance was set at 5%. Prevalence ratios (PR) and 95% confidence intervals (CI) were calculated.

Results

The study consisted of 935 children, 372 with primary and 563 with mixed dentition. The response rate between children aged 2–5 was 96.8%, from the 384 invited children, 12 did not return the questionnaires or had missing data. More children than the 499 needed were invited among those aged 8–10. This was because of the sampling design; all children in each classroom were invited to participate. From the 575 invited, 12 did not return the questionnaire; nevertheless, the sample size was maintained. The reason for the missing data was that some children were absent on the day that researchers collected data or children forgot to bring the filled questionnaires and/or signed informed consent. Table 1 shows the characteristics of the sample. Participants' average age in primary dentition was 3.6 (± 1.0) years and in mixed dentition was 9.0 (± 0.8) years. The prevalence of SB based on non-instrumental approach was 22.3% in primary and 32.7% in mixed dentition. The majority of the families were from a lower socioeconomic status with the head of the household with less than 8 years of study. Almost a quarter of children had poor sleep quality according to their parents' perceptions. Adjusted Poisson regression showed that probable SB was significantly associated with sleep quality observed by parents ($p < 0.001$) in mixed dentition (8–10 years). The prevalence of probable SB was 80% higher among those that did not sleep well (PR 1.80; 95% CI 1.34–2.44). Drooling was associated with probable SB in mixed dentition in the unadjusted model ($p = 0.010$; PR 1.47; 95% CI 1.09–1.98); however, in the adjusted model, the significance was lost ($p = 0.081$; PR 1.13; 95% CI

Table 1 Frequency distribution of non-instrumental probable sleep bruxism in primary and mixed dentition. Florianopolis/SC ($n = 935$)

	Frequency	
	Primary dentition (372) *N* (%)	Mixed dentition (563) *N* (%)
Non-instrumental probable sleep bruxism	92 (22.3)	184 (32.7)
Sex		
Female	200 (53.8)	327 (58.1)
Male	172 (46.2)	236 (41.9)
Age		
2–3 or 8	195 (52.4)	209 (37.1)
4–5 or 9	177 (47.6)	196 (34.8)
10		158 (28.1)
Family income		
A	68 (18.3)	13 (2.4)
B	233 (62.6)	150 (26.6)
C–D	71 (19.1)	400 (71.0)
Parent schooling		
≥ 8 years	70 (18.8)	407 (72.3)
< 8 years	302 (81.2)	156 (27.7)
Drooling		
No	210 (56.5)	271 (48.1)
Yes	162 (43.5)	292 (51.9)
Tooth wear		
No	280 (77.7)	379 (67.3)
Yes	92 (22.3)	184 (32.7)
Sleep quality[a]		
Adequate	316 (84.9)	395 (70.7)
Poor	56 (15.1)	164 (29.3)

[a] Missing data: mixed dentition–sleep quality 4 (0.7%)

0.96–1.78). In the primary dentition (2–5 years), the adjusted regression did not show association between analyzed characteristic and probable SB. Sex, socioeconomic, head of the household educational status, and tooth wear were not associated with probable SB in both dentitions (Table 2).

Discussion

The results of the study suggest that the prevalence of probable SB was higher among children with mixed dentition (8–10 years) when compared with children with primary dentition (2–5 years) in the studied population and support the assumption that poor quality sleep is associated with probable SB, observed in the 8–10 years age range.

Data on the sleep quality and the associations with probable SB are important because they provide bases for the diagnosis and management of probable SB and may help clinicians and researchers to understand the role of the conditions and how the poor sleep quality may affect children's health and development [13]. In addition, these findings are important for clinicians since they signalize that older children may present more SB than the younger ones, contrary to expectations [9].

Findings of this investigation are not in agreement with those of previous studies [9, 22, 23] showing a higher prevalence of SB in older ages, probably because of the differences in the investigated age ranges and in the questionnaires used for diagnostics approaches in the studies. The school-based study conducted in Taiwan involved children aged 6–15 years and used the Sleep Habit Questionnaire. Results showed decreased linear trend in SB prevalence in children from different grades, as age increased [21]. The Finish study was conducted with younger children aged 3–6 years, used the Sleep Disturbance Scale for Children and showed that older children 5–6 years were more likely to have SB when compared to 3–4 years old [22]. Both studies had a cross-sectional design and did not accompany children along time. Indeed, despite the nature of this trend, studies involving parasomnias from childhood to early adolescence had shown a prevalence of grinds teeth weekly at 11–12 years old to be 13.9% [13] and that SB was still highly prevalent at age 13 years [24].

Interestingly, when analyzing previous studies with Brazilian children, the SB prevalence is similar with the

Table 2 Unadjusted and adjusted logistic regression models for independent variables associated with non-instrumental probable sleep bruxism. Florianopolis/SC

Variables	Non-instrumental probable sleep bruxism primary dentition						Non-instrumental probable sleep bruxism mixed dentition					
	Unadjusted PR			Adjusted PR			Unadjusted PR			Adjusted PR		
	PR	CI	*p* value	PR	CI	*p* value	PR	CI	*p* value	PR	CI	*p* value
Sex			0.372						0.240			
Male	1.00						1.00			1.00		
Female	1.20	0.80–1.78					1.19	0.89–1.59		1.24		
Age			0.098*			0.110			0.072*			0.083
2–3 or 8	1.00			1.00			1.00			1.00		
4–5 or 9	1.40	0.93–2.10		1.38	0.92–2.07		1.17	0.84–1.62		1.17	0.85–1.63	
10							0.74	0.50–1.10		0.76	0.51–1.12	
Family income			0.983						0.228			
A	1.00						1.00			1.00		
B	0.95	0.57–1.59					1.70	0.53–5.43		1.69		
C–D	0.96	0.50–1.80					1.32	0.42–4.15		1.31		
Parent schooling			0.483						0.623			
≥ 8 years	1.00						1.00					
< 8 years	0.84	0.52–1.35					0.92	0.66–1.28				
Drooling			0.153*			0.261			0.010**			0.081
No	1.00			1.00			1.00			1.00		
Yes	1.33	0.90–1.96		1.25	0.84–1.86		1.47	1.09–1.98		1.13	0.96–1.78	
Tooth wear			0.200*			0.234			0.394			
No	1.00			1.00			1.00					
Yes	1.46	0.81–2.63		1.42	0.79–2.56		1.17	0.81–1.70				
Sleep quality			0.133*			0.191			< 0.001**			< 0.001**
Adequate	1.00			1.00			1.00			1.00		
Poor	1.43	0.89–2.29		1.37	0.85–2.22		1.93	1.44–2.59		1.80	1.34–2.44	

*p value ≤ 0.20 was included in the adjusted model

**p value < 0.05 indicates statistical significance

findings of this investigation with 15.2% in the age of 3–6 years [25] increasing to 35.3% in the age of 7–10 [11]. A possible explanation for this increase in the prevalence is that in this phase, older children start gradually having more responsibilities in school; this, in turn, may lead to stress and evidence suggests an association between psychological factors and SB in children older than 6 years [26]. This data are important since SB may lead to the occurrence of tooth wear and if persists for a long time may increase progressively the severity of this tooth wear involving permanent teeth.

Conversely, parental perception of poor sleep quality was remarkably common in the 8–10-year-old range and lower in the 2–5-year-old range. It was supposed that younger children's parents could report more problems with sleep as it could be expected that the younger would need a more vigilant supervision. Farther, crying at night is believed to be associated with SB [27]. Instead, the findings had shown that older children had poorer quality sleep as well as more prevalent probable SB. Maybe parents of the younger children are used to waking up frequently with possible crying and consider the fact that children who had poor sleep quality as normal so they do not think this could be a problem to report.

This result calls attention on the necessity to guide parents to help their children to sleep. For this purpose, sleep hygiene has been suggested [28]. The practice has been used to try to alleviate the sleep problems and involves restriction on electronic media before bedtime, routine, same hour to go to sleep and wake up every day, comfortable room regarding temperature, light, and noise, and avoid heavy food and drinking too much liquids before bedtime favoring a deeper sleep [28].

Drooling was associated with probable SB in older ages in the unadjusted model, although the significance was lost in the adjusted. It is important to address that parents noticed and reported the fact that their children drool in the pillow. Pediatric dentists should refer children to a medical specialist independently of the association with bruxism, as drooling could suggest mouth-breathing patterns and is part of clinical recognition of mouth-breathing children [29]. In addition, the presence of nasal obstruction seems to be associated with SB [30].

Although there are efforts to strengthen the study with an adequate sample size calculation and sampling method, standard error and confidence intervals calculation, use of the validated diagnostic tool allowing obtaining valid and reliable information regarding probable SB and trained examiners, it was not possible to find associated sleep factors with probable SB in primary dentition (2–5 age range), even though the verified prevalence was in accordance with the literature for this age range. Nevertheless, another strength was the fact that all children in both age ranges were from the same population base, with similar socioeconomic characteristics and from public schools making it possible to compare probable SB prevalence in different age ranges with good reliability. This study has limitations, mainly represented by the cross-sectional design making it impossible to address cause-effect conclusions. Furthermore, parents were not asked about if they sleep with open doors or if their room is near with children's room facilitating them to hear teeth grinding. Also, information like light and noise in the room that could interfere with sleep were not asked. The investigated children were only from public schools so that generalizations should be made carefully. Future studies are needed to collect data on the prevalence of probable SB in different age ranges, especially in older children with mixed dentition, preferably using longitudinal designs to a better comprehension of the aspects involved in SB. In addition, studies should accompany children along time and evaluate sleep bruxism and an objective measure of children's breathing with the aid of a specialist; and investigate the possible association between SB and breathing patterns to try to establish a cause-effect relation. This possible association may indicate that children do not sleep well, so health professionals could work together to establish the correct diagnosis in an effort to diminish the problem.

Conclusion

The results of this investigation suggest that the prevalence of probable SB based on non-instrumental approach is higher in mixed than in primary dentition and poor sleep quality is associate with probable SB in children aged 8–10 years.

Acknowledgments The authors received financial support from the Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina (Foundation for Research and Innovation Support of Santa Catarina State) (FAPESC) and the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Coordination of Improvement of Higher Level Personnel) (CAPES) that allowed this study to be performed.

Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that they have no conflict of interest

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