

Family and School Environmental Predictors of Sleep Bruxism in Children

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Aims: To identify potential predictors of self-reported sleep bruxism (SB) within children's family and school environments. **Methods:** A total of 65 primary school children (55.4% males, mean age 9.3 ± 1.9 years) were administered a 10-item questionnaire investigating the prevalence of self-reported SB as well as nine family and school-related potential bruxism predictors. Regression analyses were performed to assess the correlation between the potential predictors and SB. **Results:** A positive answer to the self-reported SB item was endorsed by 18.8% of subjects, with no sex differences. Multiple variable regression analysis identified a final model showing that having divorced parents and not falling asleep easily were the only two weak predictors of self-reported SB. The percentage of explained variance for SB by the final multiple regression model was 13.3% (Nagelkerke's $R^2 = 0.133$). While having a high specificity and a good negative predictive value, the model showed unacceptable sensitivity and positive predictive values. The resulting accuracy to predict the presence of self-reported SB was 73.8%. **Conclusion:** The present investigation suggested that, among family and school-related matters, having divorced parents and not falling asleep easily were two predictors, even if weak, of a child's self-report of SB. J OROFAC PAIN 2013;27:135–141. doi: 10.11607/jop.1057

Key words: children, family, school, sleep bruxism

Bruxism is an umbrella term grouping together various jaw muscle motor phenomena that may occur during wakefulness and/or sleep.¹ Efforts have been made during recent years to elucidate as many aspects as possible of bruxism etiology, epidemiology, diagnosis, and clinical consequences by means of several systematic reviews of the available literature.^{2–7} However, it seems that, while much attention has been focused on bruxism in adults, there is a paucity of systematic works on bruxism in children.⁸ In particular, despite the existence of some large-sample investigations on the epidemiology of bruxism in children,^{9–11} understanding of the etiology of bruxism in children has yet to be established.¹²

In particular, the pathophysiology of sleep bruxism (SB) in children is likely different from that of adulthood, and there are suggestions that such phenomena in childhood may be viewed as signs of the ongoing maturation of the central nervous system and stabilization of dopamine levels.¹³ Such suggestions are in line with the frequently observed decrease in SB prevalence from childhood to adolescence and with its high comorbidity with other sleep disorders.¹⁴ In general, despite the epidemiology of the phenomenon suggesting that it may lead to clinical consequences only in a minority of cases, enhanced understanding of SB is needed because of

its potential association with a child's psychological disorders.^{15,16}

The main problem when studying SB in children lies in the difficulties of performing a reliable diagnosis, and the majority of data have come from questionnaire-based studies. Such an approach may not be the diagnostic standard of reference, as suggested by the literature on adults, which often reports different findings between studies adopting different diagnostic strategies (eg, subjective and/or clinical reports vs polysomnographic or electromyographic findings).¹⁷ Nonetheless, it is of value to obtain more insights into the evaluation of the factors that are attributed by one individual as being associated with self-perceived SB. The literature on adults has shown that self-report of SB may be influenced by some psychological factors^{18,19} and by some environmental factors related to an individual's life.^{20,21} In attempts to gather similar data in children for comparison with adults, the environmental factors that may have an impact on children's lives are likely to be identified in the family and school contexts, which are the two most important educational agents. To the authors' knowledge, the influence of the environmental factors belonging to the family and school contexts on the presence of SB in children has never been addressed, and it could be interesting to add such data to the increasing amount of knowledge on bruxism in children.

Considering these premises, the present investigation's purpose was to identify potential predictors of self-reported SB within children's family and school environments. The null hypothesis was that the predictors under investigation were not related with the report of SB.

Materials and Methods

Study Design

The study design involved children aged 8 to 10 years who were administered a 10-item questionnaire. Informed consent by the children's parents and approval by the Institutional Review Board of the University of Padova were obtained prior to the start of the study. The questionnaire was developed specifically for this investigation and contained a question on SB: "Did you wake up during the night while keeping your jaws braced or did your parents tell you that you grind your teeth while asleep?" This item was managed as the primary outcome variable. The other questions addressed some aspects of the family context, the school environment, and the attitude of the child toward the school tasks:

1. "Are your parents still married/do they still live together?"
2. "Do your parents scold you severely for a bad mark/do you feel as they are not happy about your school marks?"
3. "Do you fall asleep easily?"
4. "Do you have a preferred teacher which is important for you as a motivation for coming to school?"
5. "Do you come to school with pleasure?"
6. "Do you do your homework alone without help by an adult?"
7. "Do you do your homework willingly?"
8. "Do you have much attention for your school tasks?"
9. "Do you feel you are doing your best with school-related affairs?"

In the absence of validated screening questionnaires on the topic, and considering that an alternative option should have been the adoption of several different questionnaires specifically addressing each investigation domain, questions were chosen during a panel discussion with the leading investigator, the supervisor, and the schoolteachers. Such a strategy was adopted as the best compromise to warrant an acceptable content validity of the questionnaire by a consensus decision taken by the experts involved in the investigation. The key factors considered in the items' selection were the need to provide exploratory data on the school and family factors and the need to have an optimal cooperation with the children by including easily comprehensible questions. The final list of items was selected from a list of questions that were verbally administered to the children by their teachers during an explanatory meeting some days before the investigation, with the aim to screen for their difficulties in comprehension. All items were categorized into a yes/no answer. The children were instructed to mark "yes" if their actual answer should be "always," "very often," or "often," and to mark "no" if their actual answer should be "sometimes," "seldom," or "never." In the attempt to increase the reliability of findings, the order of questions was changed from one child to another, and the bruxism item was meshed within the others to avoid focusing the children too much on this specific answer. The questionnaire was administered twice to all children at 1 week apart and the test-retest repeatability was good to excellent for all items (0.707 to 1.00).

The correlation between the answers to the nine family- and school-related items and the prevalence/absence of self-reported SB was assessed by means of single variable correlation analysis. Values of

accuracy to predict self-reported SB, defined as the percentage of subjects that were correctly classified by the answers in each single family/school-related item, were assessed on the basis of 2×2 contingency tables (columns: family-related items, school-related items; rows: bruxers, controls). Subsequently, a multiple logistic regression model was used to identify the significant associations, if any, between the family/school-related factors (independent variables) and self-reported SB (dependent variable). As a qualitative strategy to select among potential predictors, only those factors that were significant at $P < .10$ in the single-variable correlation analysis were included in the initial multiple regression model.²² In the case that fewer than two variables were found significant at $P < .10$ in the single-variable analysis, a multiple-variable regression analysis should be performed to identify possible multifactorial models increasing the predictability of self-reported SB with respect to the single variables. Then, the variable with the weakest association with 'recovery' was removed from the multiple regression model. This was repeated in a backward stepwise manner until all variables that were retained in the model showed a P value $\leq .05$. The odds ratios (OR) for SB were assessed for each family/school-related predictor, while simultaneously controlling for the other variables in the model. Nagelkerke's R^2 was obtained as an estimation of the total variance explained by the family/school-related factors included in the model. The accuracy of the final logistic regression model to predict bruxer (sensitivity) or non-bruxer (specificity) status as well as the positive predictive value (PPV) and negative predictive value (NPV) were determined from a 2×2 classification table.

All statistical procedures were elaborated with the Statistical Package for the Social Sciences (SPSS 19.0; SPSS Inc).

Sample Size Calculation

To ascertain whether the size of the study group was suitable to detect statistically significant and clinically relevant differences between bruxers and non-bruxers as for the presence of predictive family- and school-related factors, a priori calculation of the sample size necessary for this investigation was conducted. The values of type I and type II errors were set at 0.05 and 0.20, respectively. Data on the estimated variance of the independent variables were not available in the literature, so it was assumed that approximately a 30% average rate of positive answers could be expected for the questions on predictive items. The difference to detect

has been set at a 40% difference between bruxers and non-bruxers in the frequency rates of positive answers to the predictive items. In consideration of that, to have an 80% statistical power to detect a 40% difference between groups, the needed sample size was 20.5 subjects per group (bruxers vs non-bruxers). Based on this calculation, and considering the high variability range, viz, 6% to 40%, for the reported literature prevalence of positive answers to self-reported bruxism in children,^{10,11,23} a consecutive sample of about 60 children was needed to perform this investigation.

Children Recruitment

This investigation was performed in a primary school at Marina di Carrara, Italy. Children attending grades three, four, and five were administered the questionnaire by their teacher during a morning lesson and were asked to answer within 30 minutes. The administration of the questionnaire was repeated 1 week apart. Some days before completing the questionnaire, the children received an explanation of the study aim and reassurance about the anonymous format of the questionnaire by an investigator with expertise in children's education and teaching (DR). During that session, the children were introduced to the study by a verbal presentation of the potential questionnaire items, which were then selected for inclusion in the final list of items by a consensus decision, based on the children's difficulties in comprehending the questions. The investigator was present while the children completed the questionnaires, and the children were invited to ask for specifications whenever an item of the questionnaire was judged to be unclear. The investigator's explanations were given aloud to all children. In all cases in which a child answered differently to an item in the two administrations of the questionnaire, the child was asked for an explanation and for a decision on which answer to mark definitively. The parents' consent to have their children take part in this investigation was obtained in written format 1 week before the investigation took place, and the school headmistress gave her approval to the study.

Results

A total of 69 children attending the three primary school grades took part in the investigation. Two children were excluded because of comorbid psychiatric disorders, and two additional children did not take part in the study because they were absent on both days of the questionnaire's administration.

Table 1 Comparison of the Prevalence of the Different Predictors in Self-Reported Sleep Bruxers and Controls, Significance in the Single Regression Analysis, and Accuracy to Predict Sleep Bruxism

Variables	Bruxers	Controls	Significance	Accuracy
Divorced parents	50%	26.5%	.084	67.7%
Scolding parents	18.8%	16.3%	.826	67.7%
Not having a preferred teacher	43.8%	34.7%	.522	60%
Not coming to school with pleasure	43.8%	36.7%	.623	58.5%
Not falling asleep easily	50%	30.6%	.164	64.6%
Doing homework with help	50%	48.9%	.945	50.8%
Not doing homework with willingness	68.7%	63.2%	.696	44.6%
Not having much attention for school tasks	62.5%	48.9%	.355	53.8%
Not doing the best in school-related affairs	62.5%	48.5%	.355	53.8%

Table 2 Significant Variables Remaining in the Final Logistic Regression Model and Assessment of the Model's Prediction of Self-Reported Sleep Bruxism

Variable in the final logistic regression model	Significance	Odds ratio	Expected β (95% CI)	Model's features					Total R^2
				Accuracy	Specificity	Sensitivity	PPV	NPV	
Divorced parents	.046	1.291	0.257 (0.078–0.976)						
Not falling asleep easily	.081	1.123	0.325 (0.092–1.148)	73.8%	93.8%	12.5%	40%	76.6%	13.3%

CI, confidence interval.

Five children were absent on one of the two days, and they were asked to give verbal confirmation of the answers they gave in the only questionnaire they completed. Thus, data were assessed for 65 children (55.4% males, mean age 9.3 ± 1.9 years). A positive answer to the self-reported SB item was endorsed by 18.8% of subjects, with no significant sex differences.

Single variable correlation analysis showed that self-reported SB was not significantly related with any of the potential predictors (ie, having divorced parents, being frequently scolded by the parents for any school marks, not falling asleep easily, not having a favorite teacher motivating the student to go to school, not coming to school with pleasure, doing homework with the help of an adult, not having too much attention for school tasks, not doing the best in school-related affairs, not doing homework willingly), with P values ranging from .084 to .945. Accuracy values for the single predictors of self-reported SB ranged between 44.6% and 67.7% (Table 1).

Using the above findings from the single-variable analysis revealed only one variable that was eligible for entering the multiple-variable regression analysis, according to the quality-based strategy of including only those factors that were significant at $P < .10$ (ie, having divorced parents, $P = .084$). Thus,

the multiple variable regression analysis was performed by including all predictive factors in the first step of the analysis. The factors remaining in the final multiple-variable model were having divorced parents ($P = .046$) and not falling asleep easily ($P = .081$). The percentage of explained variance for SB by the final multiple regression model was 13.3% ($R^2 = 0.133$). Although this model that included only the two remaining factors had a high specificity and a good NPV, it nonetheless showed unacceptable sensitivity and PPV. The resulting accuracy to predict the presence of self-reported SB was 73.8% (Table 2).

Discussion

Data from the literature have suggested that, compared to adults, children have a higher frequency and intensity of movement disorders.²⁴ SB has been advocated as a very common disorder, but unfortunately, very few aspects of its etiology are well-known.¹² The available findings do not conclusively suggest potential pathophysiological mechanisms. Indeed, they come from several isolated papers dealing with various aspects of SB etiology, such as the search for neurochemical patterns, the identification

of personality traits, the existence of microbiological infections, and the study of morphological profiles.²⁵⁻²⁷ An interesting field of research is the assessment of psychological traits of SB subjects. For instance, the role of stressful events and conditions has been repeatedly hypothesized to influence bruxism in adults.^{28,29} In particular, personality traits related to the way one individual reacts to stress, viz, the so-called stress sensitivity, seem to be important predictors of self-reported bruxism¹⁸ and of electromyography-diagnosed masticatory muscle activity within the first hours of sleep.³⁰

Based on these premises, it would be interesting to go deeper into the assessment of psychological factors as predictors of SB in children. At present, there is a paucity of studies on this topic, with few case studies and expert opinions.^{12,15} In particular, there is some evidence that children with high levels of social vulnerability and anxiety are more prone to report SB.^{16,31,32} The literature has also suggested that SB may be associated with emotional symptoms related to peer problems³³ and that the family context influences the sleep-time behavior of the child.³⁴ The investigation of the SB-psychological factors association in children is difficult, due to the absence of validated diagnostic criteria for bruxism in children and the difficulties in performing a reliable measure of several aspects of the psychological sphere. In particular, while efforts should be made to design psychometric instruments that give a reliable measure of a child's psychological distress, it must be remembered that the family and school are the two environments in which the child spends most of his or her time. Thus, it could be hypothesized that the family and school contexts, as well as the child's attitude toward school-related affairs and tasks, may be the most important sources of potential discomfort.

In the present investigation, a questionnaire-based approach was used to investigate for the correlation between self-reported SB and family- and school-related factors. The items to be included in the questionnaire were proposed by the authors and discussed with the children's teachers on the basis of literature suggestions that living in stressful situations (eg, having divorced parents)³² and/or having peculiar personality traits (eg, various symptoms of the anxiety spectrum)¹⁶ may be associated with SB in children. Such a strategy to approach SB diagnosis and to assess the association with risk factors is less than optimal, and its shortcomings with respect to quantitative measurements of jaw muscle activity lie in its reliance on patients' preconceived ideas.^{3,5,17} A recent consensus statement suggested that questionnaires and interviews may help in identifying possible bruxism behaviors to be investigated with second-

level diagnostic approaches.¹ Notwithstanding this, self-report–diagnosed bruxism still remains the most suitable approach to gather data for epidemiological reasons and to provide preliminary suggestions on uncovered bruxism topics. Also, based on the child psychology literature suggesting that administering a questionnaire to children 8 to 10 years of age increases the risk for having poorly consistent findings,³⁵ this investigation performed an assessment of test-retest repeatability to rule out this adverse event, and a good to excellent consistency was described. As a recommendation for future research on this topic, it can also be suggested that investigations be performed on larger samples, possibly including subjects of different social classes, and adopt strategies to optimize the internal consistency and the content validity of the questionnaires. In any case, the hypothesis-driven strategy and the consensus refinement of the instrument adopted in the present study allowed providing exploratory data on the topic.

The present investigation found an 18.8% prevalence of self-reported SB, which is within the wide range described in the literature.^{13,36-38} Several issues concerning the family (ie, divorced parents, parents' attitude toward the children's school marks, difficulties falling asleep), the school (ie, presence in the school of a favorite teacher, children's pleasure in going to school), and the attitude of the children toward school-related affairs (ie, need/willingness to be helped by an adult when doing homework, doing homework willingly, attention for school tasks, self-consciousness about doing the best in school-related affairs) were investigated for possible correlation with self-reported SB. Despite the single-variable analysis showing that the measured factors were not significantly related with SB, two of the study variables, viz, having divorced parents and not falling asleep easily, were found to be predictors of self-reported SB with multiple-variable regression analysis. The statistical significance of the relationships was weak, and the model's ability to predict SB was low. In particular, while having a high specificity and a good NPV, it showed unacceptable sensitivity and PPV. The resulting accuracy to predict the presence of self-reported SB was 73.8%.

On one hand, these findings may be interpreted as a confirmation of the role of environmental-related issues in children's self-report of SB and, on the other hand, as a suggestion that much has yet to be done before elucidating the many aspects underlying SB onset in children. Indeed, while this investigation allows for the suggestion that some features of the familiar and scholastic contexts may influence a child's report of SB, the percentage of the total amount of variance in self-reported SB explained by the model

featuring the significant variables was quite low. From a clinical viewpoint, this means that several other predictors have to be included in the model to increase the predictability of self-reported SB in children and that the present investigation provides a basis for future investigations on this topic. Possible strategies to go deeper into the prediction of SB in children include the assessment of other psychological (eg, personality traits, cognitive skills), social (eg, relationship with peers), and neurological (eg, neurochemical, laboratory markers) aspects. Also, the importance of some health-related issues or other cognitive-related factors in determining the difficulty in falling asleep easily, which was found to be one of the predictors of SB in this study, are worthy of further exploration. Based on this investigation, the importance of family matters for the psychological and behavioral development of a child cannot be underestimated. Findings from this study suggest that familiar contexts in which the child may feel less safe and quiet than normal, such as those situations in which the parents are divorced and/or those conditions for which a child does not fall asleep easily, are likely to increase the child's self-perception of SB.

Some strategies to increase the clinical impact of these findings may be adopted in future studies; for instance, important clinical implications are related to the field of psychology rather than dentistry, since the detection of self-reported SB behavior in children may be viewed as a warning sign for possible psychological distress. The clinical impact of these findings on the dental profession could be increased by a concurrent assessment of the symptoms, if any, associated with the bruxism finding. Indeed, SB may be just a clinical finding and not a disorder per se, and relying on self-reported diagnosis alone may lead to problems of overdiagnosis and over-treatment.³⁹ Thus, strategies allowing quantitative diagnosis of bruxism-related electromyographic activity of the jaw muscles are strongly recommended to go deeper into the several controversial issues and to increase the internal validity of the bruxism literature.

Conclusions

The present investigation suggested that, among family and school-related matters, having divorced parents and not falling asleep easily were two predictors, even if weak, of a child's self-report of SB. Future investigations on the etiology of SB are recommended to take proper account of the potential risk factors associated with some unfavorable aspects of the family and school environments.

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