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The Association between Sleep Disorders and Dental Caries Index in Children Aged 7 to 12 Years Referring to Babol Dental School

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ABSTRACT

Background and Objective: Sleep disorders in children are prevalent and can have an adverse effect on the child's growth and development. Recently, hypotheses have been formed regarding the association between sleep disorders and dental caries. Therefore, the present study was conducted with the aim of investigating the association between sleep disorders and dental caries index.

Methods: In this cross-sectional study, 224 children aged 7 to 12 years who visited the clinic of Babol Dental School were enrolled. The data collection tool was the Children's Sleep Habits Questionnaire, which was completed by the children's parents. This questionnaire consists of 33 questions across 8 domains, including bedtime resistance, sleep-onset delay, sleep duration, sleep anxiety, night wakings, parasomnias, sleep-disordered breathing, and daytime sleepiness. Clinical examination was performed to assess the dental caries index (DMFT/deft).

Findings: Sleep disorder was observed in 197 children (89.7%), and the mean dental caries index in children with sleep disorder was 5.63±3.67. No statistically significant association was found between the dental caries index and any of the sleep problem domains except sleep anxiety (p=0.04). Additionally, no statistically significant association was observed between bruxism and parental education level with the dental caries index and sleep problems.

Conclusion: The results of the study showed that the prevalence of sleep disorders was considerably high, and an association exists between sleep anxiety and the dental caries index.

Keywords: *Child, Dental Caries, Sleep Disorders.*

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Introduction

Dental caries is one of the most common chronic multifactorial diseases (arising from biological, social, and psychological factors) that affects individuals of all ages worldwide and carries destructive consequences, including toothache, tooth loss, and interference with physical growth and development (1). The increasing consumption of sweet foods, improper toothbrushing habits, poor oral hygiene, and low awareness regarding the prevention of dental caries are among the factors that contribute to increased levels of dental caries (2). Sleeping less than 9 hours per day and maternal dental caries are also risk factors for caries in children (3). The study by de Lima et al. on children aged 8-10 years showed that children with more caries had more sleep disorders, anxiety, and obesity (4); furthermore, children's sleep duration, screen time, and parental smoking status are associated with early childhood caries. Poor sleep status of children and their parents is also associated with dental caries in preschool children (5). Alawady et al. showed that individuals over 16 years of age who slept less than 7 hours had more dental caries (6). In a study in Iran, the prevalence of caries in primary teeth, permanent teeth, and all teeth among children aged 7 to 12 years was reported as 75.5%, 41.1%, and 89.8%, respectively (7).

Sleep disorders in children and adolescents can cause serious medical and psychological conditions. For example, severe respiratory disorders during sleep may lead to left ventricular hypertrophy, arrhythmia, heart failure, and death (8). Sleep disorders are among the most common phenomena in children and refer to a decrease or increase in sleep beyond what is appropriate for age, or various abnormal behaviors during sleep, which can affect children's body, behavior, and cognitive function (9). According to the classification of the International Association, sleep disorders can be categorized into sleep-related breathing problems, circadian rhythm sleep disorders, insomnia, sleep-related hypoxemia disorders, sleep-related movement disorders, and parasomnias (10).

Many social and demographic factors are influential on sleep disorders, among which parental education level and residence in urban areas can be mentioned. Socioeconomic status, medication side effects, psychological factors, environmental factors, and child-parent interactions can also affect sleep. Another factor that can influence sleep disorders is pain following untreated dental caries, which can cause the child to awaken from sleep during the night (10-12). Additionally, sleep disturbance and irritability are among the consequences of severe and untreated caries, which also affect growth and glucocorticoid production (13).

The prevalence of sleep disorders in international studies varies from 1% to 43% (14-16). In Iran, the rate of sleep disorders has a varied range across different studies. Panaghi et al. reported the rate of sleep disorders in the studied children as 41.6%, Nafeiy et al. as 32.3%, Hoseini as 52.4%, and Ghaneian et al. as 41.14% (17-20). Following improper sleep habits jeopardizes the adult life process as well as the health of the individual and society, and causes anxiety, depression, decreased self-esteem, decreased memory and learning, impaired attention and concentration, and behavioral disorders (9).

Given the existence of a bidirectional relationship between sleep disorders and oral and dental health status in studies, the aim of this research is to investigate the association between sleep disorders and the dental caries index in children aged 7 to 12 years.

Methods

This cross-sectional study was conducted after approval by the Ethics Committee of Babol University of Medical Sciences under code IR.MUBABOL.REC.1402.083 and after obtaining parental consent, on 224 children aged 7-12 years referring to Babol Dental Clinic. The sample size was calculated based on similar

studies related to the prevalence of sleep disorders (11) and considering a study precision of 95% (α=0.05). Sampling was performed as stratified sampling with equal numbers selected from the age groups of 7 to 9 and 10 to 12 years. The inclusion criterion was age 7 to 12 years, and the exclusion criteria were systemic diseases affecting the dental caries index (such as diabetes, gastrointestinal disorders, etc.) and known psychiatric disorders under pharmacological treatment (such as autism, ADHD, etc.) based on parental report. To conduct the study, the children were examined for dental caries status (dmft/DMFT) by a trained final-year dental student using a dental mirror and probe under similar conditions.

To assess sleep disorders in children, the Persian version of the Children's Sleep Habits Questionnaire with a reliability of 0.80 and validity of 0.88 was used (21). This questionnaire contains 33 questions to assess the quality and habits of children's sleep, which was completed by the parents. Owens et al. designed this questionnaire for children aged 4 to 12 years and classified it into eight domains: 1) bedtime resistance, 2) sleep-onset delay, 3) sleep duration, 4) sleep anxiety, 5) night wakings, 6) parasomnias, 7) sleep-related breathing problems, and 8) daytime sleepiness. The questionnaire is scored on a Likert scale; each question has a value between 1 and 3 (from rarely to usually), with the exception of questions (1, 2, 3, 10, 11, 26), which are scored in reverse. Consequently, the score range is between 33 and 99. The score for each domain is obtained from the sum of the questions in that domain. The total score of sleep disorders is the sum of the scores of all domains. A score above 41 indicates the presence of a sleep disorder (22).

The collected data were analyzed using descriptive and analytical statistical methods in SPSS software version 26 with the chi-square test, T-test, ANOVA, and Pearson correlation coefficient, and $p < 0.05$ was considered significant.

Results

The prevalence of sleep disorders in the study population was 89.7%. The mean DMFT/dmft index was 5.64±3.69 for the 197 children with sleep disorders and 5.52±3.57 for the 27 children without sleep disorders. There was no statistically significant difference in the mean dental caries index between children with and without sleep disorders. Regarding parental education, 76.8% of mothers had a diploma or lower, 19.6% had an associate or bachelor's degree, and 3.6% had a master's degree or higher. Regarding fathers' education, 74.2% had a diploma or lower, 18.1% had an associate or bachelor's degree, and 7.7% had a master's degree or higher. No association was observed between the DMFT/dmft index or sleep disorders based on parental education. No significant association was found between the dental caries index and sleep disorders in the overall population or in any of the age groups (Table 1). No significant association was observed between the mean DMFT/dmft index and the mean bruxism in all children or by age group (Table 2).

Table 1. Association between DMFT/dmft index and sleep disorders in the study population

Age Group	N	DMFT/dmft	Sleep Problems	Pearson Correlation Coefficient	p-value
7-9 years	112	7.45±3.42	49.72±7.78	0.025	0.79
10-12 years	112	3.83±2.93	49.73±6.51	0.021	0.828
Total	224	5.63±3.67	49.73±7.16	0.02	0.765

Table 2. Association between DMFT/dmft index and bruxism in the study population

Age Group	N	Bruxism	DMFT/dmft	Pearson Correlation Coefficient	p-value
7-9 years	112	1.38±0.63	7.45±3.42	-0.065	0.497
10-12 years	112	1.16±0.46	3.83±2.93	-0.037	0.7
Total	224	1.27±0.56	5.63±3.67	0.054	0.425

The results showed that 78.6% of children rarely had bruxism, 15.6% often, and 5.8% sometimes had bruxism. The mean DMFT/dmft had no relationship with bruxism severity. According to Table 3, among the subscales of sleep disorders, bedtime resistance had the highest prevalence and sleep-disordered breathing had the lowest prevalence. Among the different domains of sleep problems, only the sleep anxiety domain showed a significant correlation with the DMFT/dmft index (p=0.04) (Table 4).

Table 3. Mean and standard deviation of sleep disorders scores by domain

Sleep Problem Domain	Score Range	Mean±SD	Mean±SD (%)
Sleep Resistance	6-18	10.43±3.03	57.94±16.83
Sleep Onset Delay	1-3	1.57±0.75	52.33±25
Sleep Duration	3-9	4.71±1.58	52.33±17.55
Sleep Anxiety	4-12	6.53±2.19	54.41±18.25
Night Wakings	3-9	4.25±1.28	47.22±14.22
Parasomnia	7-21	8.73±1.58	41.57±7.52
Sleep Disordered Breathing	3-9	3.66±1.14	40.66±12.66
Daytime Sleepiness	8-24	13.21±2.92	55.04±12.16

Table 4. Association between DMFT/dmft index and different sleep disorder domains

Sleep Problem Domain	DMFT/dmft Pearson Correlation Coefficient	p-value
Sleep disorders	0.02	0.765
Sleep Resistance	0.074	0.27
Sleep Onset Delay	0.001	0.984
Sleep Duration	0.016	0.810
Sleep Anxiety	0.137	0.04
Night Wakings	0.012	0.856
Parasomnia	-0.045	0.501
Sleep Disordered Breathing	0.033	0.625
Daytime Sleepiness	0.064	0.34

Discussion

In this study, the prevalence of sleep disorder was 89.7%, which is consistent with the study by Jalilolghadr et al. (89.6%) (23). However, the prevalence of these disorders was higher than in the study by Panaghi et al. (41.6%), Goldman et al. (33%), and Rzepecka et al. (42%) (17, 24, 25). Additionally, the prevalence of sleep disorders in this study is higher than the results of studies conducted on children in

Australia (24.6%), Saudi Arabia (37.5%), and India (42.7%) (26-28). The results of the study by Ozgoli et al. in Iran showed that 63.25% of children had moderate to severe sleep disorders (11). The difference in the rate of sleep disorders across studies may be due to differences in the study population and the instrument used to assess sleep disorders. An unhealthy lifestyle, the absence of a fixed sleep schedule, and sleep disorders in parents predispose children to sleep disorders (5).

In the present study, the mean score obtained from sleep disorders is higher compared with other studies conducted in this field, such as van Litsenburg et al. and Lucas-de la Cruz et al. (29, 30). Contrary to the present study, Jalilolghadr et al. reported a higher mean of sleep problems in children (23). The reason for the difference between the study by Jalilolghadr et al. and the present study may be justified by the difference in the study population, the type of questionnaire, the number of questions used, and the scoring method in assessing children's sleep habits.

Regarding the different domains of sleep problems, bedtime resistance had the highest prevalence compared with other domains, which is consistent with the results of the studies by Panaghi et al. and Iwadare et al. (17, 31). In the study by Rahimi Derazi et al., bedtime resistance had the lowest score compared with other domains of sleep problems (9). Possible reasons for bedtime resistance may include the absence of a fixed schedule for going to bed, different behavioral patterns of parents, sleeping in a shared room with parents, and fear and worry before sleep (2). Among all the domains of sleep problems in this study, the score of sleep-disordered breathing was lower than the other domains. The results of the studies by van Litsenburg et al. and Iwadare et al. in this regard are consistent with the present study (29, 31). The findings of Gupta et al. on preschool children mentioned parasomnias, sleep apnea, and daytime sleepiness as the most common domains of sleep disorders (32).

According to the results of the study, the mean dental caries index in children aged 7 to 12 years is higher compared with the study by Alami et al. and Babaei Hatkehlouei et al. (33, 34). The mean dental caries index by age group in children aged 7 to 9 years was higher compared with the study by Bashirian et al., which was conducted on children aged 7–8 years (35). Additionally, the mean of this index in the 10 to 12-year group was similar to the result of the study by Hysi et al. on 12-year-old children (36). The reason for the difference in the mean dental caries index across studies may be differences in the fluoride content of drinking water in different regions, differences in children's diet, geographical, cultural, and genetic differences, and the provision of necessary educational courses on oral and dental health to children in schools (37).

In this study, sleep disorders had no significant relationship with the dental caries index in all children or by age group, which was inconsistent with the result of the study by Ogawa et al. (5). Unfortunately, limited studies exist in this field, and no similar study has been reported in Iran. The difference in the results of these studies may be due to the use of different domains of sleep problems than the present study, the use of a different instrument to assess sleep problems, and the different age range of the study participants. Moreover, in the study by Topaloglu-Ak et al., dental caries was assessed merely based on its presence or absence (12). On the other hand, perhaps if the relationship of the D, M, and F components of the dental caries index were examined separately with sleep problems, the results might have changed.

According to the results of the present study, among the different domains of sleep problems, only sleep anxiety had a positive and significant relationship with the dental caries index. Individuals with sleep anxiety probably have other anxiety disorders that can reduce salivary flow and increase the number of Streptococcus mutans bacteria in the mouth, ultimately leading to an increased risk of caries development (4). In the study by Obied Majhool et al., dental caries also had a negative correlation with salivary flow rate (38). Contrary to the present study, in the study by Topaloglu-Ak et al., the amount of dental caries showed a positive and significant relationship with night waking and sleep fragmentation (12). Additionally,

in the study by Sardana et al., irregular or late bedtime was a risk factor for early childhood caries in children (39). The inconsistency of the results of these studies with the present study may be due to family environmental stress, cultural differences, and disciplinary principles common among families in different societies for regulating sleep schedules (11). The prevalence of bruxism in this study was similar to the study by Restrepo et al. (40) and also Abou-Khadra (41). The slight difference in the results of studies may be due to the cross-sectional nature of the conducted research and the different age range of the study participants.

No significant relationship was found between the dental caries index and bruxism in all children or by age group, which is in line with the study by Halvani et al. (42). However, in the study by Antunes et al., the relationship between the dental caries index and bruxism was positive and significant (43). Differences in sample size and the assessment of bruxism merely based on parental report may be among the reasons for the difference in the results of the conducted studies. Parental education level had no significant relationship with sleep disorders and the dental caries index, which is in line with the study by Hense et al. and the study by Mohtadinia et al. (44, 45).

Since the data related to sleep disorders were collected through a questionnaire and based on parental reports, the results may not be entirely accurate due to parents' lack of precise awareness of their children's sleep issues. It is recommended that similar studies be conducted on samples of children from different age groups and from all social and economic strata of society, and the results be compared. Additionally, the relationship between the different components of the caries index (decayed, filled, and extracted teeth) and sleep disorders should be examined separately.

Given the high prevalence of sleep disorders and their role in children's health, it is important to recognize sleep as an important factor in overall well-being and to pay more attention to its role in health outcomes. The results of the study showed that the prevalence of sleep disorders was considerably high, and among the different domains of sleep disorders, only an association exists between sleep anxiety and the dental caries index.

Conflicts of Interest: The authors declare no potential conflicts of interest regarding the authorship or publication of this article.

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