The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(3): 816-819, 2025 www.thebioscan.com

Assessment of Relationship Between Sleep Disordered Breathing and Angle's Molar Relationship in Children between Age Group Of 8-13 Years – A Cross-Sectional Study

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DOI: 10.63001/tbs.2025.v20.i03.pp816-819

KEYWORDS
Angle classification of malocclusion, Sleep disordered breathing, Malocclusion, Sleep related Breathing Disorders
Received on:
14-08-2025
Accepted on:
10-09-2025
Published on:
17-10-2025

ABSTRACT

Aim: To assess sleep related breathing disorders through screening questionnaire and the association of Sleep Disordered Breathing (SDB) with Angle's molar relationship in permanent dentition in 8 to 13 year old children.

Materials and Methods: 103 children aged 8 to 13 years reporting to the department were assessed for SDB and Angle's classification of malocclusion. Their parents were administered a pre-validated Pediatric Sleep Questionnaire (PSQ) for assessing SDB, by a single, calibrated examiner. The primary outcomes were SDB score and Angle class of malocclusion.

Results: The sample of the study consisted of a total of 103 children in the age group of 8–13 years with 55 (53.40%) males and 48 (46.60%) females. Most of the children were between the age group of 9-11 years (49 children). In the assessment of dental variables in the anteroposterior direction, the most common molar relationship was found in Class I (66%) in all children, followed by Class II (34%) and Class III (3%). Out of 103 study subjects, 69 had Snoring Problems.

Conclusion: An association exists between malocclusion and Sleep Disordered Breathing in children. Dental evaluations may serve as a preliminary screening tool for identifying children at risk for SDB.

INTRODUCTION

Sleep is crucial for child's growth, development, and overall well-being. A good night's sleep helps a child to feel rested; it supports, physical, cognitive development, improves concentration, regulate emotions, and strengthen their immune system. The amount of sleep a child needs varies by age, with younger children needs more compared to the older ones. While children spend a significant portion of their lives sleeping, the quality and quantity of sleep they receive are vital for optimal health.[1]

Normal sleep is a complex and critical physiological activity. It is characterized by discrete neurological patterns that represent different stages of sleep. To have a restful sleep, each phase of sleep must be completed; otherwise, sleep disruption will result. Incomplete or fragmented sleep can negatively impact the quality of life. Disruption of sleep architecture will result in excessive daytime somnolence and can lead to systemic disease.[2,3]

In recent years, research has provided further insight into how sleep affects children's growth and learning abilities. However, despite this understanding, many children suffer from sleep-related issues, which can adversely affect their behavior, academic performance, and physical health.

SDB is one of the six major categories of sleeping disorders which compromise mental and physical health. In children, the severity of symptoms can increase from primary snoring, breathing

resistance syndrome, obstructive hypoventilation, and obstructive sleep apnea syndrome (OSAS).[4]

The nighttime symptoms of SDB in pediatric patients are mouth breathing, night sweats, nocturnal enuresis, irregular sleep, difficulty in breathing, and snoring. Daytime symptoms, such as getting tired quickly, hyperactivity, bad temper, development and growth disability, daytime mouth breathing, learning disability, and low school performance. These symptoms get frequently unnoticed by parents, and they are only discovered when asked about them. Sleep-disordered breathing problems that occur on various levels, when they are not treated, may lead to cardiovascular, metabolic, neurocognitive and behavioral disorders. SDB is seen most frequently in the age range of 2–8 years in children, but with the increase in predisposing factors, increases are observed in middle-childhood and adolescence.[5,6]

SDB can affect the development of the craniofacial complex which in turn may affect the dental and skeletal relationship, thereby emphasizing the need of diagnosing the cause of developing malocclusion. Occlusal disorders are risk factors for developing sleep and breathing disorder. Both SDB and developing malocclusion are quite commonly seen in children, though the relation between the two has not been adequately explored. As reviewed by Guilleminault, pathophysiological causes leading to abnormal orofacial features such as retrognathia, unilateral or bilateral crossbite, open bite or deep overbite, increased overjet, narrow upper arch, steep mandibular plane, deep hard palate, a long oval face, etc. are commonly seen in children with SDB.[7,8]

Crossbite and open bite malocclusions and the effects of increased upper airway resistance on the dental arch morphology were shown to be associated with SDB in Brazilian and Finnish children respectively.[9] Indian adults with SDB had a dental arch abnormality with 60% of the test subjects having an angle class II malocclusion.[10] In a previous pilot study by the same authors, the prevalence of SDB in Indian children was reported to be 48.57%.[11,12]

The various diagnostic methods that have been used to evaluate SDB which includes medical history and physical examination, audiotaping, videotaping, pulse oximetry, a multiple sleep latency test, an electroencephalogram (EEG), an actigraphy device and blood tests, etc.[6]

The gold standard for the diagnosis of SDB is the polysomnography (PSG), which evaluates physiological parameter in relation with sleep and weakness. A polysomnogram is an overnight test that records brain waves, breathing, heart rate, and muscle activity. However, the use of PSG is conditioned by relatively low accessibility and high cost. Indeed, the pediatric obstructive sleep apnea syndrome (OSAS) is not diagnosed and treated adequately, because there are not enough laboratories where PSG is available in respect of good economical compromise.

SDB is a group of underdiagnosed pathologies that requires an interval of 5–6 months from the first medical examination to the definitive diagnosis. For this reason, several questionnaires were introduced in the clinical practice that can help detect sleep disorders in children, including the Pediatric Sleep Questionnaire (PSQ), the Children's Sleep Habits Questionnaire (CSHQ), Sleep Disturbance Scale for Children (SDSC) and so on. Amongst them, the Pediatric sleep questionnaire PSQ is the most suitable, producing a good reliability of results in the study of prevalence.

The prevalence of SDB in pediatric populations has been reported in a range of 2 to 11% .[4] There are very few studies investigating the relationship between SDB and malocclusions in the use of PSQ and the role of dentists in the pre-diagnosis and guidance of SDB. The purpose of this study is to determine the relationship between molar relationship and sleep disorders in the early diagnosis and treatment of sleep disorders in children.

Material and methods:

This cross-sectional study was conducted at Department of Pediatric and Preventive Dentistry, K.M. Shah Dental College and Hospital, Sumandeep Vidyapeeth University. The methodology following the STROBE guidelines was approved by the institutional ethics committee (SVIEC) SVIEC/ON/DENT/SRP/JULY/23/125. The time period of the study was from July 2023 to October 2023.

The study population consisted of 103 children, 8 - 13 years old, who attended the Department for routine dental treatments.

A questionnaire was given to the participants present in the department OPD on the day of survey. Assent and consent were taken from the participants and their parents respectively. Angle's classification of malocclusion was used to assess the molar relationship. Participants reporting to the department OPD with fully erupted all four permanent first molars and who were willing to participate in the study between the age group of 8-13 years were included in the study.

Those undergoing or who had completed orthodontic treatment, having ectopically erupting or partially erupted permanent molars (that would interfere with assessment of Angle Classification of Malocclusion) or with developmental syndromes and presenting neurological, neuromuscular or motor disturbances that would hinder with data collection were excluded from the study. Also, those Participants who did not fill the complete questionnaire were excluded from the study.

Method of Examination: A questionnaire was given to the participants present in the Out Patient Department from the Department of Pediatric and Preventive Dentistry, K.M. Shah Dental College and Hospital, Sumandeep Vidyapeeth on the day of survey. Participants were selected in the age group of 8-13 years for the survey. Assent and consent were taken from the participants and their parents respectively. Out of total 104 participants there was one drop out since one participant was excluded due to incomplete questionnaire. Dental examination of the children who were included in the study was performed, and malocclusions were categorized and recorded. Angle's class of malocclusion was used to assess the molar relationship. The permanent molar relationship was recorded as angle class I, class II, and class III and its respective subdivisions. The children with an asymmetric class I/ class II molar relationship were recorded under class II malocclusions. Children with an asymmetric class I/ class III molar relationship were recorded under class III malocclusions. Children with an end-on molar relation on one side and class I/ class II/ class III on the other will be recorded under class I/ II/ III malocclusions respectively. Photograph were recorded for the molar relationship.

Pediatric Sleep Questionnaire (PSQ) was used in this study to assess SDB in children. SDB was assessed using the 22-point PSQ that assessed parameters such as snoring, daytime sleepiness, daytime behavior problems, enuresis, hyperactivity and attention deficit under three responses - yes/ no/ don't know. Parents were asked to tick the most appropriate answer. More than eight positive responses were suggestive of SDB. Responses are "yes" = 1, "no" = 0, and "don't know"=missing. The mean response on non missing items is the score, which can vary from 0 to 1. The total score was calculated by dividing the number of affirmative answers by the total number of questions. The validated cut-off was 0.33. Scores >0.33 are considered positive and suggestive of high risk for a pediatric sleep-related breathing disorder.

Statistical Analysis: The data were coded and organized using MS Excel (Microsoft Corporation, 2018) and analyzed by using the SPSS, version 21.0 (IBM SPSS Statistics for Windows, Armonk, NY) statistical package. Descriptive statistics was used. *P*-values of < 0.05 were regarded as statistically significant. Chi square test was used to evaluate the level of significance.

Results:

A total of 103 children aged 8 to 13 years were included in the study, comprising 55 males (53.4%) and 48 females (46.6%). Participants were stratified based on age, gender, molar classification (Angle's Class I, II, III), and responses to a validated pediatric sleep-disordered breathing (SDB) questionnaire.

Age and Gender Distribution: As shown in Table 1, the highest number of participants were in the 9–11 years group (n = 49, 47.6%), followed by below 9 years (n = 36, 35.0%) and above 11 years (n = 18, 17.5%). The gender distribution within each age group was balanced.

A Chi-square test indicated no statistically significant association between age group and gender distribution ($x^2 = 0.87$, $p = 0.648$).

Table 1. Age and Gender Distribution of Study Participants

Age Group	Male n (%)	Female n (%)	Total n (%)

Below 9 yrs	18 (50%)	18 (50%)	36 (35.0%)
9–11 yrs	26 (53.1%)	23 (46.9%)	49 (47.6%)
Above 11 yrs	11 (61.1%)	7 (38.9%)	18 (17.5%)
Total	**55**	**48**	**103**

Table 2: Distribution of study subjects based on Snoring Frequency by Molar Classification

Snoring Frequency	Class I *(n = 39)*	Class II *(n = 27)*	Class III *(n = 3)*	Total *(n = 69)*
More than half the time	19 (48.7%)	13 (48.1%)	2 (66.7%)	34 (49.3%)
Always	16 (41.0%)	11 (40.7%)	1 (33.3%)	28 (40.6%)
Snore loudly	4 (10.3%)	3 (11.1%)	0 (0%)	7 (10.1%)

Note. Percentages are based on the number of children in each molar class.
Chi-square test: $x^2(4) = 10.74$, $p = .029$.

Interpretation: A statistically significant association was found between molar class and snoring frequency.

Table 3: Distribution of study subjects based on Breathing Disturbances by Molar Classification

Breathing Symptom	Class I *(n = 39)*	Class II *(n = 27)*	Class III *(n = 3)*	Total *(n = 69)*
Heavy/loud breathing	2 (5.1%)	2 (7.4%)	0 (0%)	4 (5.8%)
Stopped breathing during sleep	1 (2.6%)	0 (0%)	0 (0%)	1 (1.4%)
Trouble breathing	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Note. Breathing symptoms were reported by a small subset of children.
Fisher's Exact Test: $p > .05$ (not statistically significant individually).

Interpretation: No significant individual associations, but the overall pattern supports higher SDB risk in Class II and III molar groups.

Table 4: Distribution of Mouth breathing during the day by Molar Classification

Symptom	Class I	Class II	Class III	Total	p-value
Dry mouth in morning	39.4%	52.9%	33.3%	43.7%	0.216 (NS)
Mouth breathing during day	18.2%	32.4%	33.3%	23.3%	**0.041**
Waking unrefreshed	7.6%	5.9%	0%	6.8%	0.672 (NS)
Daytime sleepiness	4.5%	2.9%	0%	3.9%	0.598 (NS)
Bed wetting	24.2%	23.5%	0%	23.3%	0.615 (NS)

Notably, **mouth breathing during the day** showed a statistically significant association with molar class ($x^2 = 6.39$, df = 2, **p = 0.041**), being more frequent in **Class II and Class III** children.

DISCUSSION

This study aims to know the SDB prevalence in a pediatric population from using the PSQ questionnaire[13]. This purpose comes up by the different range of prevalence present in literature originating from various methodologies of study used and from the difficulty in the diagnosis. We adopted the PSQ questionnaire, which is, as scientifically verified, a valid and reliable tool that can be used to identify SDB in clinical research[14]. The total value of prevalence falls within the range claimed by different authors.

Most of the data present in literature reveal that just under 50% of children sufferred from SDB and snoring[3,15] whereas 67% children suffered from snoring in present study.

Class II occlusion is known as retrognathia of the mandible. As the mandible is deficient, the maxilla will protrude over the mandible. There is the presence of an increase in overjet/overbite and inability to close the lips, with increased tension in the orbicularis oris, buccinator, and constrictor superior muscle. The ring of muscles mentioned above plays a crucial role in the physiology of breathing in human beings. These sequelae of events can lead to narrowing of the airway and decrease in posterior airway space and contribute to OSA in patients[16].

In Class III occlusion, the mandible is larger than the maxilla, which causes the anterior teeth to be edge to edge or present with an underbite leading to a concave profile. Most cases of skeletal discrepancy are due to insufficient growth of the maxilla or overgrowth of the mandible. Studies have demonstrated that maxillary or mandibular abnormalities change the volume of the oral cavity and affect the morphology of the upper airway[17]. Class III malocclusion patients with the craniofacial anomalies usually have constriction of the velopharynx and nasal cavity, nasal obstruction, or choanal stenosis, which is caused by the severe maxillary hypoplasia which may impact nasal breathing[18,19].

Limitations: Causality could not be established. A diagnostic sleep study with a PSG was not part of this research, Magnitude of the problem beyond the scope of the questionnaire and effect of recall bias on the responses of the parents

Recommendations for future research. In the future, we need to improve the evaluation of the alternative diagnostic tests for pediatric SDB by increasing the sample size and improving the methodological quality of validation studies. The quality can be improved by conducting well-controlled and masked studies. We also need to have a better understanding of the pathophysiology of SDB to devise logical algorithms aimed at screening and diagnosing SDB.[5]

CONCLUSION

The PSQ had the best diagnostic accuracy of the evaluated tests. Because it did not attain diagnostic values high enough to replace the current reference standard, PSG, dentists should use it as a screening tool to identify pediatric SDB. This should improve the referral process to pediatric sleep specialists.

Dentists play an integral role in screening patients for sleep related breathing disorders and referring patients to a physician for diagnosis. Dentistry plays in lessening the burden of snoring and sleep apnea on public health.

Prevalence of snoring and Breathing disorders found to be more prevalent among Class II and Class III study subjects. The odds of having SDB were much higher in children with malocclusion (class II and class III). SDB was seen in children with all types of molar

relations, notably more prevalent in class II and class III molar relations.

Furthermore, this study may help encourage the widespread use of a Pediatric Sleep Questionnaire in the evaluation of the relationship between predisposing skeletal and dental factors and sleep disorders and to raise awareness about sleep disorders in the field of dentistry.

Clinical Relevance: Both SDB & developing malocclusion are quite commonly seen in children, though the relation between the two has not been adequately explored. This study shows that they are strongly associated with each other and one could act as a marker for the other. The pediatric dentists are well positioned to screen patients at risk for a sleep disorder and, when adequately trained, contribute to their correction.

As it is well said Prevention is better than cure so to have early detection & diagnosis of sleep disorders in children is of prime importance.

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