

The Relationship Between Nasal Septal Deviation, Daytime Sleepiness and School Performance Among Iranian High School Students: A Pilot Cross-Sectional Study

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Background: The most important factors affecting students' learning ability are attention and concentration, which are impaired by daytime sleepiness in classroom.

Objectives: This study was conducted to determine the effect of nasal septal deviation on daytime sleepiness and school performance among high school students.

Patients and Methods: This study comprised 172 high school male students, who were examined for septal deviation by a practitioner. Daytime sleepiness was determined by school consultants. Grade point average (GPA) was considered as an index for school performance.

Results: Nasal septal deviation was significantly more prevalent among sleepy students (46.8%) compared to their attentive peers (22.8%, $P < 0.05$). Although the GPAs in students with septal nasal deviation were lower than other students, the difference was not statistically significant.

Conclusions: It is not unlikely that nasal cavity deformities such as septal deviation that results in sleep disturbances would lead to poor school performance in students. However, the question to be answered is whether deviated nasal septum is the only cause of poor performance of students or it involves some other mechanisms. Further studies are needed to confirm this relationship and whether reconstruction of structural anomalies of the nasal cavity in students prevents daytime sleepiness and subsequently improves their school performance.

Keywords: Student; Nasal Septum; School

1. Background

The academic success of the adolescents is strongly linked with their health. This comes while academic success is in turn an excellent indicator for the overall well-being of the child. Health-related factors such as hunger, physical and emotional abuse, and chronic illness can lead to poor school performance (1). Another most important factor that plays an important role in the development and improvement of students' learning abilities is their attention and concentration skills in the class. In addition to health-related concerns, there are several factors that reduce the student's attention and concentration in the school setting, affecting their performance and lowering their achievement outcomes. Among them, sleep problems, mainly daytime sleepiness, is of great importance.

Several mental and medical disorders may result in sleepiness; these factors include disturbed nocturnal sleep pattern, the consumption of stimulants and simi-

lar drugs, hypothyroidism, apnea associated structural deformities, stress, depression and etc. (2).

Among them, septal nasal deviation is a prevalent anatomical malformation in adolescents which can result in apnea. A deviated septum can remain undetected for years and thus does not necessarily need correction. Some people, however, are concerned about the diminished airflow through the effectively smaller nostril caused by septal deviation (3).

While it is expected that deviated nasal septum would affect school performance by altering sleep patterns or other similar pathways, no investigation has been conducted prior to this study. The high prevalence of this deformity and daytime sleepiness among students, and understanding the relationship between these two disorders pave the way for the development of new therapeutic approaches to help improve the students' school performance.

2. Objectives

Accordingly, research is needed to better understand the negative impacts of nasal septum deviation on students' sleeping pattern and to measure its negative effects on building practices. This pilot study was therefore conducted to determine the relationship between nasal septal deviation and daytime sleepiness and subsequently school performance in a group of high school students. The results of this research will help ensure optimal learning abilities of students through identifying their simple anomalies.

3. Patients and Methods

This pilot cross sectional study comprised 172 high school male students aged between 15 and 17 years. The students were all selected from a single high school and thus were believed to be from a nearly similar socioeconomic class (Table 1). The participants had no sleeping disorders and no history of using any hypnotic or narcotic drugs at least one month before and during the study period.

Table 1. Demographic Characteristics of Participants ^a

Characteristics of Participants	Frequency
Number of students	172
Mean age of students	15.8 ± 0.2
Time spent in school, Hours per day	8.5
Time spent in school, Hours per week	51
Average family income, USD per month	2078.7

^a Abbreviation: USD, US Dollar.

3.1. Nasal Septal Deviation

Students were examined by a single physician who was blinded to the objectives of the study or the students' sleepiness and school performance, and were divided into positive and negative nasal septal deviation groups according to ICD-9-CM: 470 - Deviated Nasal Septum; physical examination.

3.2. Assessment of School Performance

The Grade point average (GPA) during the semester, in the course of the study, was reported by the education office of the high school, and was considered as an index for the students' school performance.

3.3. Evaluation of Sleepiness

A consultancy group consisting of three school consultants who were aware of the students' educational status was selected to evaluate the students' sleepiness during the study period. Each consultant followed the students for two weeks, when the students were observed in class three times a day (at 8, 11 and 14 hours) and based on the results, the students, who were unaware of being followed by the consultants, were classified as normal or

sleepy. The consultants were also blinded to the possible nasal cavity deformities of the students. At the end of the observational period, two of the consultants classified the students into the sleepy and non-sleepy group based on the summation of the results. In the event of inconsistency between the viewpoints, a third consultant was asked to express his opinion. The results showed an acceptable inter-rater agreement ($Kappa > 0.6$).

This project was approved by the Ethical Board Committee of the Endocrinology and Metabolism Research Institute in accordance with Helsinki declaration and the guidelines of the Iranian Ministry of Health and Medical Education. Written informed consent to participation of the children in the study was obtained from all the parents or legal guardians of the students.

3.4. Data Analysis

All the data were analyzed using SPSS version 16. A descriptive data analysis was performed to assess the subjects' socioeconomic status, academic performance, and sleepiness. Quantitative variables were presented as mean ± standard deviation whereas frequency and percentage was used for qualitative analysis. Student's t-distribution or its nonparametric equivalent was used whenever necessary. Point estimation with a confidence interval of 95% was used to compare the average grades of the participants and other quantitative variables between study groups. P-values less than 0.05 were considered statistically significant.

4. Results

The study included 172 male students with mean age 15.8 years, of whom 47 (27.3%) had Nasal septal deviation and 125 (72.7 %) were normal. According to the consultants' reports, 32 students (18.6%) suffered from daytime sleepiness and 140 were considered as non-sleepy (Table 2).

The prevalence of nasal septal deviation among the sleepy students (46.8%) was significantly higher than non-sleepy students (22.8%) based on the ϕ^2 test results (P value < 0.05) (Table 3).

Also sleepy students had significantly lower GPA scores (15.9) compared to non-sleepy subjects (17.1); P value < 0.05. On the other hand, GPA scores were similarly lower among students with septal nasal deviation; the difference, however, was not statistically significant (Table 4).

Table 2. The Number of Students in Each Study Group

	No. (%)
Nasal septal deviation	
Positive	47 (27.3)
Negative	125 (72.7)
Sleepiness	
Positive	32 (18.6)
Negative	140 (81.4)

Table 3. The Prevalence of Nasal Septal Deviation in Sleepy and Non-Sleepy Students

	Number	Prevalence of Nasal Septal Deviation
Non-sleepy students	140	(22.8) 32
Sleepy students	32	(46.8) 15
Total	172	(27.3) 47

Table 4. GPAs in Different Groups^a

	Mean GPAs	Std. Deviation
Sleepy students	15.91	1.43
Nonsleepy students	17.16	1.39
Students with deviated nasal septum	16.83	1.69
Normal students	16.97	1.39

^a Abbreviation: GPA, grade point average.

5. Discussion

Our results confirmed the findings of previous studies regarding the effects of deviated nasal septum on the sleep pattern of children and adolescents. Also it was revealed that the two conditions could negatively affect the child's school performance; however the casual relationship between deviated nasal septum and poor school performance remained unclear due to the cross-sectional nature of the study.

Daytime sleepiness is a prevalent problem among children and adolescents. Some studies have shown that more than half of the children in Japan suffer from daytime sleepiness (4). In this regard, Pagel et al. reported that nearly 45.7% of the students complained from daytime sleepiness at least once per week and that nearly 15.2% of students had sleep problems nearly every day (5).

Sleep disorders such as daytime sleepiness is an influential factor in cognition and learning abilities as they can negatively affect the students' concentration and memory functions, (6-8) conditions resulting in educational problems if not diagnosed on time or remained untreated (9). Salcedo Aguilar et al. also showed that the incidence of educational failure and poor school performance is higher in sleepy students compared with non-sleepy age-matched peers (10). Shin et al. similarly reported that daytime sleepiness is inversely related to school performance (11). Teixeira et al. conducted a study on students in an afternoon shift high school and found that reduced sleeping time caused sleepiness of the students with negative impacts on their quality of life and school performance (12).

According to these studies, it could be concluded that the development and implementation of certain strategies to address daytime sleepiness, alongside checking for and treating possible nasal septal deviation, among

students can help improve their school performance and thus used as an effective measure for educational purposes. This is because many studies have linked sleepiness secondary to nasal septal deviation and obstructive sleep apnea syndrome (OSA) 1. Mekhitarian Neto et al. studied the relationship between structural deformity of the nasal cavity and OSA and showed that nasal septal deviation is more common in people with OSA (13). Zonato et al. also showed that OSA patients are more likely to develop skeletal and soft tissue anomalies of head and neck than non-apneic patients (14). Silvioniemi et al. similarly showed that nasal obstruction due to septal deviation is one of the most important etiologies of sleep-associated apnea (15). In this context, Schwentner, et al. reported that septoplasty improves quality of life in patients with nasal septal deviation (16).

These evidences all confirm our findings reporting that structural deformity of the nasal cavity such as nasal septal deviation is an important factor interfering with school performance due to sleep disturbances and sleepiness in the students. The question which remains unanswered in this our study, however, is whether deviated nasal septum affects school performance only through causing sleepiness or it may involve some other mechanisms. Therefore, further studies are needed to not only confirm the results of this study but also to show that sleepiness and its associated low school performance are related to nasal deviation or other factors. Moreover, further studies should also focus on the effectiveness of surgical repair of the structural anomalies of the nasal cavity in improving daytime sleepiness and subsequently school performance in the students.

Scientific reviews have documented that school health programs can have positive effects on educational outcomes, adding that programs that are primarily designed to improve academic performance are also considered as important public health interventions (17). As a result, if these investigations reveal the beneficial effects of these interventions, it would be of great importance to develop and implement new strategies and protocols to identify and treat the anomalies of children with nasal septal deviation before it negatively affects their school performance. In this regard, school health practitioners would play a vital role in screening nasal cavity anomalies in sleepy students and apply early treatment in order to prevent the subsequent poor school performance of students.

5.1. Limitations

The main limitation of this pilot study is the method used to assess sleepiness. Multiple sleep latency tests are generally considered as the gold standard for assessing excessive daytime sleepiness. While such tests are cumbersome and costly, many studies have indicated the association between them and simple subjective scales, such as the Epworth Sleepiness Scale. As a result, we decided to assess sleepiness using subjective scaling system but

as the test was being conducted in the school setting, an issue to be resolved was sleepiness during school hours. Thus it was concluded that a self-administered questionnaire would not be reliable, and the teachers were then asked to complete the questionnaires.

This study was carried out in only one school and could not be generalized. Also ruling out the effect of confounding variables on sleepiness should be considered in future studies.

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Authors' Contributions

Ata Pourabbasi: Idea development and study design
Mahbubeh Ebrahim Negad Shirvani: Sampling and data gathering
Sirous Tayebi: Data Analysis
Patricia Khashayar: scientific writhing and manuscript preparation.

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