

PREVALENCE AND SEVERITY OF TEMPOROMANDIBULAR DISORDERS AMONG THE TURKISH DENTAL STUDENTS USING FONSECA'S ANAMNESTIC INDEX

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ABSTRACT

Background and Aim: This study aimed to assess the prevalence and severity of temporomandibular disorders (TMDs) among 1533 dental students at a Turkish State University using Fonseca's Anamnestic Index (FAI). It also examined the association of TMD symptoms with gender and academic year to support early recognition and awareness of TMDs in dental students.

Materials and Methods: A total of 1533 dental students were asked to fill out Fonseca's questionnaire. The results were analyzed for students from first grade to fifth grade, and the percentage values were compared between males and females, across different levels of education and presence of TMDs.

Results: The overall prevalence of TMD was 58.6%. Females were more affected (62.6%) than males (37.4%). TMD prevalence increased progressively across academic years: first-year (36.7%), second-year (46%), third-year (65.5%), fourth-year (79.6%), and fifth-year (82.3%) ($p < 0.001$). Among students with TMD, 73% of females and 66.8% of males described themselves as tense; 74.5% of females reported neck pain. Females had higher risks of headache (OR=1.566, $p < 0.001$) and awareness of limited mouth opening (OR=1.677).

Conclusion: TMD symptoms were commonly observed among Turkish dental students, particularly in females and those in advanced academic years, potentially reflecting cumulative psychosocial stress and functional strain. These findings underscore the importance of early identification and incorporation of preventive measures into dental education to minimize the risk of long-term orofacial dysfunction.

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INTRODUCTION

Temporomandibular disorders (TMDs) are a large and heterogeneous group of musculoskeletal and neuromuscular diseases that include temporomandibular joint (TMJ), muscles and bony components.¹⁻⁵ TMDs are commonly related to the anomalies of the intra-articular discal position and/or structure and the dysfunction of the neuromuscular system.^{2,4-6} The etiology of TMDs is multifactorial involving biological factors, genetic factors, cognitive causes, psychosocial factors, disc displacement, degenerative joint disease, bruxism, trauma, occlusal factors and hormonal factors. The TMD patients suffer from pain in the TMJ, pre-auricular region, cervical spine, face, and/or head, fatigue of cervical muscles, craniofacial muscles, and/or masticatory muscles, limitation in the TMJ movements, jaw deviation, clicking and crepitation.⁴⁻⁷ TMD is accepted to be the second major musculoskeletal condition resulting in pain and disability after chronic lower back problem and may affect up to 50% of the overall population. Previous studies revealed that 85% to 95% of the population will suffer from at least one TMD symptom in their lives.⁸⁻¹⁰ Patients with TMD symptoms present over a broad age range; however, peak incidence is seen between 20 and 40 years of age.^{2,7,10-14} Females are more affected by the TMD which is found to be highly associated with the hormones. As TMD is a multifactorial dysfunction, its diagnosis becomes very complex and controversial. Therefore, it is recommended that it should be conducted by a multidisciplinary team composed of several allied-health professionals.¹⁴⁻¹⁶

A correct diagnosis of TMJ dysfunction is essential to properly treat the affected individual. Therefore, different methodologies have been introduced for the diagnosis of TMD and the generally accepted clinical evaluation of TMD is based on the research diagnostic criteria for the TMD (RDC/TMD) protocol which consists of advanced series of tests and questions. RDC/TMD has been the gold standard for the diagnosis of TMD. However, despite being accurate, reliable and precise, this is a difficult and time-consuming protocol and it should be performed by well trained professionals.^{9,10,16}

Schiffman et al.¹³ proposed a new version of RDC/TMD known as diagnostic criteria for TMD (DC/TMD), however this is also complex and difficult to apply to large group of participants.^{13,17} For this reason, Fonseca Anamnestic Index (FAI) was introduced in 1994 to evaluate the severity of TMD based on its signs and symptoms. FAI is a quick,

straightforward and low-cost questionnaire.^{6,16} Basically, the FAI is a patient-reported outcome in which a participant answers questions on the questionnaire. Thus, FAI would serve as a preliminary screening method to assess the intensity of the TMD. It consists of 10 questions that classify the individual into 4 categories according to the severity of symptoms: (a) without TMD, (b) mild TMD, (c) moderate TMD, and (d) severe TMD. This formula is a simple, easy, and low-cost method that displays the signs and symptoms of TMD and classifies the situation according to its intensity. Because of its simplicity, the use of FAI has been common and recommended for screening patients with TMD in public health.¹³ The initial forms were in Portuguese and English and thereafter FAI was translated into other languages including Turkish.^{14,16,18,19}

In this study, the prevalence and severity of TMD in undiagnosed Turkish dental students were examined using the Fonseca's questionnaire. The characterization of volunteers with undiagnosed TMD would guide understanding its prevalence among the Turkish young generation according to age, gender and level of education. Dental students were selected as the study population because their intensive academic and clinical training is associated with high levels of psychological stress, a recognized predisposing factor for temporomandibular disorders, and they represent an accessible and cooperative group for questionnaire-based prevalence studies. The aim of this study was to evaluate the prevalence and severity of temporomandibular disorder (TMD) symptoms among dental students and to examine their association with gender and academic year. The null hypothesis assumed that there was no association between the prevalence/severity of TMD and gender or academic level.

MATERIALS AND METHODS

Study Design

The participants were selected among the students of Hacettepe University Faculty of Dentistry. The analyzed group consisted of 581 male and 952 female students with ages ranging from 18 to 26. A total of 1533 dental students from first to fifth grades were asked to fill Fonseca's questionnaire. All participants were priorly informed about the objectives of the current research and a fully informed written consent was obtained from each participant. Students with age over 18 and no presence of systemic disorders and history of orofacial trauma were

included in the current study. All subjects diagnosed as having neurological or stomatognathic system handicaps, being under any type of TMD treatment and/or orthodontic treatment, presenting orofacial pain or clinical alterations, immunosuppressed patients were excluded. Ethical approval was obtained from Hacettepe University Ethical Committee (GO 17/116-29). The design of the current study is in accordance with the Declaration of Helsinki.

Fonseca's Questionnaire

Fonseca's questionnaire (1994) was used in this study and the index involved 10 questions with three possible answers. The FAI evaluates the presence or absence of symptoms caused by TMD and their severity according to the answers of each participant. The Turkish adaptation and reliability study of the scale, which was conducted in 2020, consists of 10 questions, to which the possible answers are "yes" (10 points), "sometimes" (5 points), or "no" (0 points). The positive answers were calculated. The total score is clarified as follows: 0–15 points=no TMD, 20–40 points=mild TMD, 45–65 points=moderate TMD, and 70–100 points=severe TMD.¹⁴⁻¹⁸ The questions are shown in Table 1.

Statistical Analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 24.0. Chi-square test, logistic regression and Pearson correlation analyses were used to test the statistical significance. Significance level was set at 5%. The results were analyzed for dental students from first to fifth grades, and the percentage values were compared between males and females across different levels of education and presence of TMDs.

RESULTS

The results showed that 58.6% of the subjects exhibited some degree of TMD, with females being the most affected (Table 2). A statistically significant difference was found between education and TMD status ($p<0.001$). The probability of TMD was 36.7% in the first grade, 46% in the second grade, 65.5% in the third grade, 79.6% in the fourth grade and 82.3% in the fifth grade. It was observed that the probability of TMD increased as the education level increased (Table 3). Each question was fit to multiple logistic regression model using gender, education and TMJ status as exploratory variables (Table 4). However, 'age' was not included in the model because there is a multicollinearity

between education and age ($r=0.80$; $p<0.001$). All questions except 9, there was a significant difference between answers of females and males. The probability of choosing 'yes' is more likely in females than males. The effect of education was significant for questions 2 and 8 (Table 4). The probability of choosing 'yes' increases by 1.15 times for question 2 and 1.28 times for question 8 as education level increases. Furthermore, TMJ status has a significant effect on the answers of questions 1, 2 and 6 (Table 4). There is a significant relationship between TMJ status and question 7 ($p=0.035$). 61.1% of those who say yes to question 7 also aware of TMJ disease. Among subset choosing 'yes' to question 7, awareness of TMJ disease increases as the education level increases ($p<0.001$). The probability of TMJ status was 33.98% in the first grade, 47.54% in the second grade, 71.53% in the third grade, 83.55% in the fourth grade and 86.05% in the fifth grade (Figure 1). The proportions of males and females who answered 'YES' to question 8 did not differ significantly between education levels ($p=0.987$) (Figure 2). Similarly, the proportions of males and females who answered 'YES' to question 10 did not differ significantly between education levels ($p=0.567$) (Figure 3). Correlation coefficients between the questions 3, 6 and 7 and other questions were calculated, and statistically significance but low correlations were found for each (Table 5).

Students with any level of TMD showed certain features such as: 73% of female and 66.8% male subjects described themselves as tense people; 74.5% of female subjects complained from neck pain. Females subjects experienced headache 1.566 times more than male subjects ($p<0.001$). When considering awareness of the limitation of the mouth opening, females were approximately 1.677 times more affected than males.

DISCUSSION

TMD is an umbrella term covering pain and dysfunction of the masticatory muscles and the TMJ. The most distinctive feature of TMD is pain, followed by restriction of mandibular movements, and noises from the TMJ during jaw movements.^{20,21} Previous studies revealed that TMD may affect up to 50% of the general population.^{6,22} Although TMD is not a life-threatening disease, it may considerably affect the quality of life of an individual; as the symptoms can become chronic and difficult to manage if they remain undetected.²¹ In order to address effective therapies individually or preventive public health projects,

Table 1. Fonseca's questionnaire

Q. No.	Question responses: Yes, Sometimes and No.
1	Is it hard for you to open your mouth?
2	Is it hard for you to move your mandible (jaw) from side to side?
3	Do you get tired/muscular pain while chewing?
4	Do you have frequent headaches?
5	Do you have pain on the nape or stiff neck?
6	Do you have earaches or pain in craniomandibular joints?
7	Have you noticed any TMJ clicking while chewing or when you open your mouth?
8	Do you clench or grind your teeth?
9	Do you feel your teeth do not articulate well?
10	Do you consider yourself a nervous (tense) person?

Table 2. Descriptive statistics of demographic information (n=1533)

Variable		N	(%)
Gender	Female	952	62.1
	Male	581	37.9
Education	1	390	25.4
	2	363	23.7
	3	278	18.1
	4	265	17.3
	5	237	15.5
TMJ Status	Yes	898	41.4
Age		Mean Std. Deviation	
		21.14	2.058

a correct diagnosis of TMD is essential especially in the early phases of the disease.¹⁶ Various diagnostic systems have been described. RDC/TMD was first introduced in 1992 by Dworkin and Le Resche in an attempt to classify temporomandibular disorders by etiology and apply universal standards for research into TMD. This was followed by DC/TMD, an updated version of RDC/TMD.^{13,23,24} Medical imaging diagnostic methods were introduced such as plain radiography, panoramic imaging, computerized tomography (CT), magnetic resonance imaging (MRI) and ultrasound.²⁵⁻²⁹ However, these screening methods are difficult, time-consuming and expensive. In 1994, FAI which was based on Helkimo Index was first introduced and thereafter became

one of the most popular diagnostic methods for TMD research due to its fast, efficient and low-cost features.¹⁶ In the present study, the prevalence and severity of TMD in a Turkish State University population were evaluated using the FAI method. A total of 1533 dental school students with age range of 18-26 were included. Young volunteers were selected as they represent the peak occurrence age for TMDs. In the current study, 58,6% of overall participants reported TMD prevalence and this finding is similar to the findings of Yap et al.¹⁶ who found 59.3% of the subjects had some TMD, when evaluating a sample of 501 university students and using the same questionnaire.¹⁶ In recent studies, 41.8% and 53.3% of the subjects were reported to

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Table 3. Descriptive statistics for choosing 'yes' in all questions.

Question	Gender		Education					TMJ Status		Age
	Female n (%)	Male n (%)	1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)	Yes n (%)	No n (%)	Mean Std. Dev.
Q1 (Yes)	259 (27.7)	106 (18.2)	82 (21.0)	84 (23.1)	66 (23.7)	63 (23.8)	70 (29.5)	240 (26.7)	125 (19.7)	21.30 2.02
Q2 (Yes)	175 (18.4)	77 (13.3)	46 (11.8)	50 (13.8)	44 (15.8)	65 (24.5)	47 (19.8)	180 (20.0)	72 (11.3)	21.58 2.03
Q3 (Yes)	497 (52.2)	225 (38.7)	172 (44.1)	188 (51.8)	139 (50.0)	113 (42.6)	110 (46.4)	418 (46.5)	304 (47.9)	21.06 1.95
Q4 (Yes)	497 (52.2)	239 (41.1)	192 (49.2)	188 (51.8)	133 (47.8)	120 (45.3)	103 (43.5)	417 (46.4)	319 (50.2)	21.05 2.10
Q5 (Yes)	709 (74.5)	337 (58.0)	265 (67.9)	261 (71.9)	193 (69.4)	177 (66.8)	150 (63.3)	604 (67.3)	442 (69.6)	21.04 2.01
Q6 (Yes)	397 (41.7)	163 (28.1)	135 (34.6)	132 (36.4)	109 (39.2)	97 (36.6)	87 (36.7)	355 (39.5)	205 (32.3)	21.16 2.010
Q7 (Yes)	525 (55.1)	282 (48.5)	206 (52.8)	183 (50.4)	137 (49.3)	152 (57.4)	129 (54.4)	493 (54.9)	314 (49.4)	21.11 1.95
Q8 (Yes)	477 (50.1)	223 (50.1)	129 (33.1)	156 (43.0)	136 (48.9)	140 (52.8)	139 (58.6)	440 (49.0)	260 (40.9)	21.39 2.023
Q9 (Yes)	480 (50.4)	304 (52.3)	191 (49.0)	193 (53.2)	153 (55.0)	138 (52.1)	109 (46.0)	456 (50.8)	328 (51.7)	21.17 1.99
Q10 (Yes)	695 (73.0)	388 (66.8)	265 (67.9)	258 (71.1)	193 (69.4)	196 (74.0)	171 (72.2)	638 (71.0)	445 (70.1)	21.21 2.04

Table 4. Multiple logistic regression analysis results

Questions	Gender		Education		TMJ Status	
	Odds Ratio 95% CI	Sig.	Odds Ratio 95% CI	P	Odds Ratio 95% CI	P
Q1	1.677 1.299 - 2.164	<0.001	1.055 0.694 - 1.153	0.246	1.407 1.082 - 1.830	0.011
Q2	1.482 1.106 - 1.987	0.008	1.149 1.037 - 1.273	0.008	1.698 1.241 - 2.324	0.001
Q3	1.730 1.402 - 2.134	<0.001	0.997 0.923 - 1.077	0.931	0.945 0.758 - 1.177	0.612
Q4	1.566 1.270 - 1.929	<0.001	0.946 0.875 - 1.021	0.155	0.903 0.725 - 1.125	0.364
Q5	2.115 1.697 - 2.636	<0.001	0.952 0.876 - 1.034	0.243	0.933 0.735 - 1.185	0.570
Q6	1.833 1.467 - 2.290	<0.001	0.984 0.908 - 1.066	0.692	1.393 1.106 - 1.755	0.005
Q7	1.302 1.058 - 1.601	0.013	1.011 0.937 - 1.092	0.772	1.227 0.986 - 1.528	0.067
Q8	1.644 1.328 - 2.036	<0.001	1.284 1.187 - 1.390	<0.001	1.074 0.859 - 1.343	0.531
Q9	0.927 0.754 - 1.139	0.470	0.986 0.913 - 1.064	0.719	0.981 0.788 - 1.220	0.860
Q10	1.347 1.076 - 1.686	0.009	1.062 0.976 - 1.155	0.165	0.982 0.772 - 1.248	0.880

Table 5. The correlation coefficient between question 3, 6 & 7 with other questions

Questions	Q3		Q7		Q6	
	r	P	r	P	r	P
1	0.350	<0.001	0.337	<0.001	0.390	<0.001
2	0.269	<0.001	0.262	<0.001	0.347	<0.001
3	-	-	0.272	<0.001	0.343	<0.001
4	0.231	<0.001	0.093	<0.001	0.285	<0.001
5	0.234	<0.001	0.091	<0.001	0.224	<0.001
6	0.343	<0.001	0.294	<0.001	-	-
7	0.272	<0.001	-	-	0.294	<0.001
8	0.229	<0.001	0.122	<0.001	0.210	<0.001
9	0.130	<0.001	0.087	0.001	0.121	<0.001
10	0.138	<0.001	0.071	0.005	0.162	<0.001

have TMD related symptoms, which is consistent with the findings of the current research.³⁰⁻³³

In contrast to the present findings, a cross-sectional study conducted among dental students in Ernakulam, India reported no statistically significant difference in TMD prevalence between male and female students, despite a comparable overall prevalence rate (59.3%) based on the Fonseca's Anamnestic Index.³⁴ This discrepancy may be attributed to regional, cultural, or educational differences, as well as variations in stress perception and reporting behavior among students. Moreover, a study conducted among students of a Turkish university demonstrated a high comorbidity rate between sleep bruxism and TMD (96.6%), whereas occlusal factors were not found to be significantly associated with TMD symptomatology.³⁵ Given that the present study did not systematically evaluate parafunctional behaviors such as bruxism or masticatory habits, these variables should be considered in future investigations as potential confounding factors influencing TMD development and severity. In a study of senior dental students in Taiwan, female participants reported a higher frequency of TMD-related symptoms; however, stress-associated complaints were more prevalent among females, while males more commonly reported tooth sensitivity

and occlusal discomfort.³⁶ These findings underscore the potential gender-based variability in the underlying mechanisms and perception of TMD symptomatology, which should be taken into account when interpreting gender-specific outcomes in epidemiological studies.

In many studies, it has been validated that females are more often affected by TMDs than males due to female sex hormone estrogen.³⁷ In this study, 62.6% of the female subjects reported TMD symptoms while this scale was only 37.4% for the male participants. One research suggested that the highest pain in TMD can be related with rapid periods of change in the circulating estrogen level. Several possible mechanisms by which estrogen might be involved in TMD symptoms have been proposed. Estrogen may be the trigger factor for modulating joint inflammation, nociceptive neurons in the trigeminal nerve, muscle reflexes to pain and μ -opioid receptors.³⁸ In this study, female subjects experienced headache 1.566 times more often than male subjects ($p < 0.001$). When considering awareness of the limitation of the mouth opening, females were approximately 1.677 times more affected than males. Furthermore, 74.5% of female subjects complained from neck pain. Female subjects also reported mandibular movement limitations 1.482 times higher than male

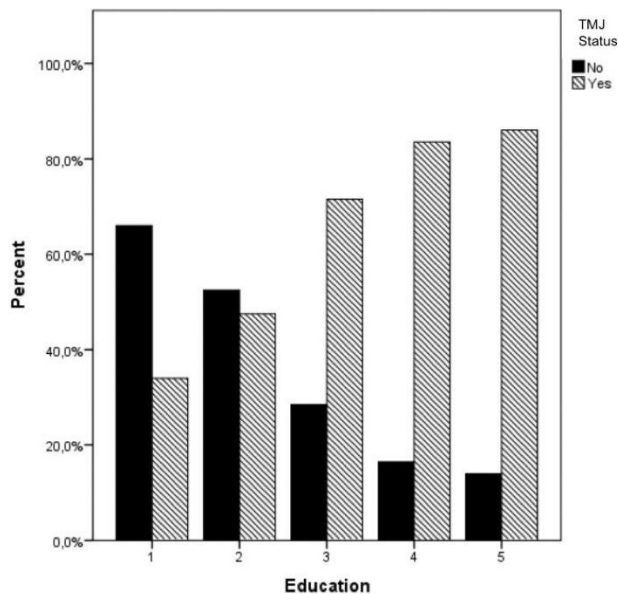


Figure 1. The bar graph of TMJ status and education-subsetted for answering 'yes' in question 7.

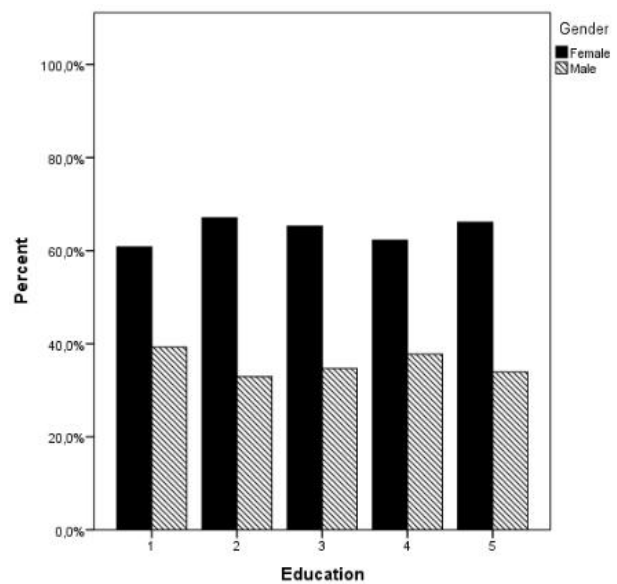


Figure 3. The bar graph of gender and education-subsetted for answering 'yes' in question 10.

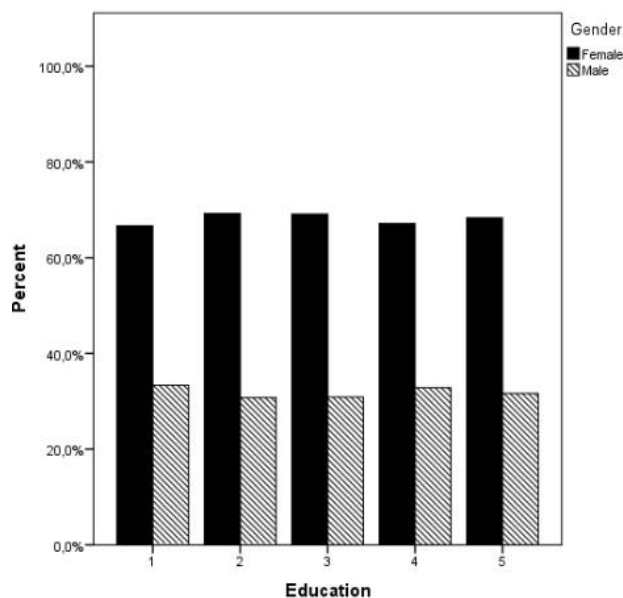


Figure 2. The bar graph of TMJ gender and education-subsetted for answering 'yes' in question 8.

subjects. These findings of this study validate that females are the most affected gender by TMDs.

Another parameter tested in this study was the TMD awareness of the subjects in different levels of dental education. A statistically significant difference was found

between dental education and TMD status ($p < 0.001$). The probability of TMD was 36.7 % in the first grade, 46 % in the second grade, 65.5 % in the third grade, 79.6 % in the fourth grade and 82.3 % in the fifth grade. It was observed that the probability of TMD increased as the education level increased. This fact may be related to the TMJ education of the dental students as they are getting more informed about the signs and symptoms of TMDs and become aware of their problems in their higher grades.

Clinical signs and symptoms of TMD can arise in young adults and this fact is of great importance for the early diagnosis of the TMD. The prevalence of subjects with TMD according to the anamnestic index in the current study verifies that FAI is valid and reliable, has the ability to categorize participants as affected or not affected by the TMD. The index showed itself as a fast, straightforward and acceptable method with easy understanding for the participants, thus allowing a smaller impact of the professional on the individuals and their answers.

This study has some limitations. Its cross-sectional design does not allow the identification of causal relationships between educational stress, gender and TMD symptoms. The assessment of TMD was based solely on the self-reported Fonseca Anamnestic Index without confirmatory clinical examination. Potential confounding factors such as sleep quality, additional parafunctional habits and

psychological comorbidities were not accounted for in the analysis. In addition, the study only included undergraduate dental students from a single institution, which may limit the generalizability of the findings. To validate and extend these results, future multicenter, longitudinal studies including objective diagnostic methods are recommended.

CONCLUSION

1. Temporomandibular disorders are prevalent among Turkish dental students, with higher prevalence and severity observed in females and in students at advanced academic levels.
2. The increasing prevalence and severity of TMD symptoms across academic years may reflect cumulative psychological stress, heightened awareness of orofacial function, and the development of parafunctional habits during dental education.
3. Early identification of at-risk students through routine screening, along with implementation of stress management programs and education on TMD prevention, is recommended within the dental curriculum to reduce potential long-term consequences.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

ETHICS STATEMENT

The present study was approved by the Non-Interventional Clinical Research Ethics Committee of Hacettepe University (GO 17/116-29).

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