



The relationship between prevalence of dental anxiety and dental caries: cross-sectional study

A relação entre a prevalência da ansiedade de tratamentos odontológicos e cárie dentária: estudo transversal

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ABSTRACT

Objective: This cross-sectional study aimed to assess level of DA among dental students in different grades and patients and to evaluate associations between DA and presence of dental caries. **Material and Methods:** Both four hundred all-grade dental students of Istanbul University and patients of Istanbul University Hospital were included in the study after random selection. Data regarding gender, oral hygiene habits, frequency of dental visits, and educational level were obtained via questionnaire. DA of participants were measured using both Modified Dental Anxiety Scale (MDAS) and Dental Fear Survey (DFS). The prevalence of caries was determined using International Caries Detection and Assessment System Criteria (ICDAS). Data were analyzed using Kruskal-Wallis, Mann-Whitney U and Chi square tests. **Results:** Female patients and female 4th-year students had significantly higher MDAS scores ($p < 0.05$). First-year students had significantly higher MDAS and DFS scores than 4th and 5th-year students ($p < 0.05$). Patients who had caries and brushed their teeth less than twice a day had significantly higher MDAS scores ($p < 0.05$). Among 3rd-year students, individuals who visited dentist regularly had lower MDAS scores ($p < 0.05$). **Conclusion:** DA among senior dental students was lower than that in younger students with an increase in knowledge about dentistry. Tooth brushing frequency and caries prevalence was associated with DA in patient group. No association was found between DA and frequency of dental visits, except in 3rd-year students.

KEYWORDS

Dental anxiety; Dental caries; Dental student; Prevalence.

RESUMO

Objetivo: Este estudo transversal teve como objetivo avaliar o nível de DA entre estudantes de odontologia de diferentes anos de graduação, pacientes e associações entre DA e presença de cárie dentária. **Material e Métodos:** Quatrocentos estudantes de odontologia de todas as anos da Universidade de Istambul e pacientes do Hospital Universitário de Istambul foram incluídos no estudo após randomização. Dados sobre sexo, hábitos de higiene bucal, frequência de consultas odontológicas e escolaridade foram obtidos por meio de questionário. DA dos participantes foram medidos usando dois questionários: Modified Dental Anxiety Scale (MDAS) e Dental Fear Survey (DFS). A prevalência de cárie foi determinada usando os critérios do Sistema Internacional de Detecção e Avaliação de Cárie (International Caries Detection and Assessment System Criteria - ICDAS). Os dados foram analisados usando os testes Kruskal-Wallis, Mann-Whitney U e Qui quadrado. **Resultados:** Pacientes do sexo feminino e estudantes também do sexo feminino do 4º ano apresentaram scores de MDAS significativamente maiores ($p < 0,05$). Os alunos do primeiro ano tiveram pontuações MDAS e DFS significativamente mais altas do que os alunos do 4º e 5º ano ($p < 0,05$). Pacientes que tinham cárie e escovavam os dentes menos de duas vezes ao dia apresentaram scores de MDAS significativamente maiores ($p < 0,05$). Entre os alunos do terceiro

ano, os indivíduos que visitavam o dentista regularmente apresentaram menores scores de MDAS ($p < 0,05$). **Conclusão:** A DA entre os alunos do último ano de odontologia foi menor do que entre os alunos mais jovens, devido ao aumento do conhecimento sobre odontologia. A frequência de escovação e a prevalência de cárie foram associadas à DA no grupo de pacientes. Não foi encontrada associação entre DA e frequência de consultas odontológicas, exceto em alunos do 3º ano.

PALAVRAS-CHAVE

Ansiedade odontológica; Cáries dentárias; Estudante de odontologia; Prevalência.

INTRODUCTION

Dental anxiety (DA) is an important problem for both patients and clinicians. DA refers to a state of irrational expectation of something dreadful occurring in relation to dental treatment, while dental fear is described as a normal emotional reaction to threatening stimuli in dental treatment [1,2]. DA is a complex phenomenon that includes somatic, cognitive, and emotional elements [2] and is based on several factors including traumatic dental experiences, personality factors, influence of family, and social environment [3]. Distressing experiences that can cause DA include lack of empathy in dental practice, extreme embarrassment during dental treatment, and painful treatment [4].

It is important to identify patients with DA since DA can lead to avoidance of dental treatment [5-9], deterioration of dental health [5,9,10], and avoidance of dental self-care [6,7,9]. Moreover, assessing the patient's anxiety level before treatment provides invaluable insights into patient behavior causing resistance to dental treatment. This information can be used to manage DA [11]. The presence of DA makes successful treatment challenging for the dentist, leading to dentists themselves also becoming anxious when dealing with patients with DA [12].

The prevalence of DA varies from 2% to 30% depending on the variation in method, population, and cut-off scores [1,13]. These epidemiological studies usually use self-reported questionnaires to assess DA; Corah's Dental Anxiety Scale (DAS) [14], the Modified Dental Anxiety Scale (MDAS) [15], and Kleinknecht's Dental Fear Survey (DFS) [16] are the most commonly used questionnaires to assess DA in adults [17].

Studies have reported that young individuals are more likely to have DA [8] due to the greater effects of psychological factors at a younger age [18]. Consequentially, most studies on DA are just focused on university students [11,17-25].

However, information about dental fear among the general population cannot be obtained from such studies. In addition, most studies about dental anxiety among dental students include only assessment of DA via dental anxiety scales. Thus, there is a lack of studies that include both intra-oral examination and anxiety level determination in dental students. To our knowledge, only one study investigated the relationship between anxiety scores and clinically assigned oral health in dental students [17]. They found that anxiety score in dental students was positively associated with a higher number of missing teeth due to caries.

The aims of this study were to (1) evaluate the degree of DA in dental students of Istanbul University in different grades and patient population of Istanbul University Hospital, (2) assess the association between DA and the presence of dental caries by using ICDAS, (3) evaluate the association of DA with gender, dental visit frequency, education level, and oral hygiene status, and (4) assess the correlation between DFS and MDAS. We hypothesized that 1) DA affects both patient population and dental students but senior dental students have a lower DA level than junior dental students with an increase in knowledge about dentistry, that 2) there is an association between anxiety scores and caries prevalence among both dental students and patients, 3) poor dental visit frequency, poor oral hygiene, and low educational level correlate positively with DA, and that 4) there is a correlation between DFS and MDAS.

MATERIALS & METHODS

The present study was cross-sectional in design and the guidelines of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) were followed in reporting this study. The study was undertaken at the Istanbul University, Faculty of Dentistry in the 2018-2019 academic year for 3 months.

Figure 1 contains flow diagram depicting the design of this cross-sectional study.

The study protocol was approved by the Ethics Committee at the Faculty of Dentistry, Istanbul University (No:225 at 30/11/2017). To determine the number of samples, power analysis was performed using the software G * Power (v3.1.9). The power of the study was expressed as $1 - \beta$ (β = type II error probability). We estimated that a difference of 2.5 could occur in our study based on the MDAS scores in the Erguven study [26]. To obtain 90% power at an α level of 0, it was calculated that there should be at least seventy three individuals in each subgroup when the acceptable sampling error (d) was 2.5. Thus, both four hundred all-grade dental students of Istanbul University (n=80 for each year) and patients of Istanbul University Hospital (with both the student and the patient groups comprising half male and half female individuals) were included in the study following random selection in order to prevent selection bias. Participant age ranged from 18 to 24 years in both the student and the patient groups. Thus, the inclusion criteria consisted of willingness to participate in the study and being in age of 18-24 years and the absence of any systemic syndromes. Patients undergoing orthodontic treatment and

individuals with psychological disorders were also excluded from the study.

Data regarding gender, oral hygiene habits, frequency of dental visits, and educational level were obtained via a questionnaire. In addition, dental students were asked to state their grade of study. The frequency of tooth-brushing was categorised as less than twice a day, or twice a day or more. Individuals who reported visiting their dentist at least once every 3-6 months or at least once a year were categorized as having regular dental visits, and those reporting dental visits more than once a year or visits for dental problems only were categorized as having irregular dental visits. Lastly, the education level of the patients was assessed based on responses of “lower than university” or “university or higher than university”.

DA levels of the participants were assessed using both MDAS and DFS. MDAS consists of five questions with five choices. Thus, the overall score of MDAS ranges from 5 to 25; a score of 19 or above is considered high DA [5,27]. MDAS is the modified version of the widely used DAS, and includes an additional question regarding local anesthetic injection [15]. The DFS consists of twenty questions with five possible scores for each. The overall DFS score ranges from 20 to 100 [16]. In the present study, turkish translations of both anxiety scales were used.

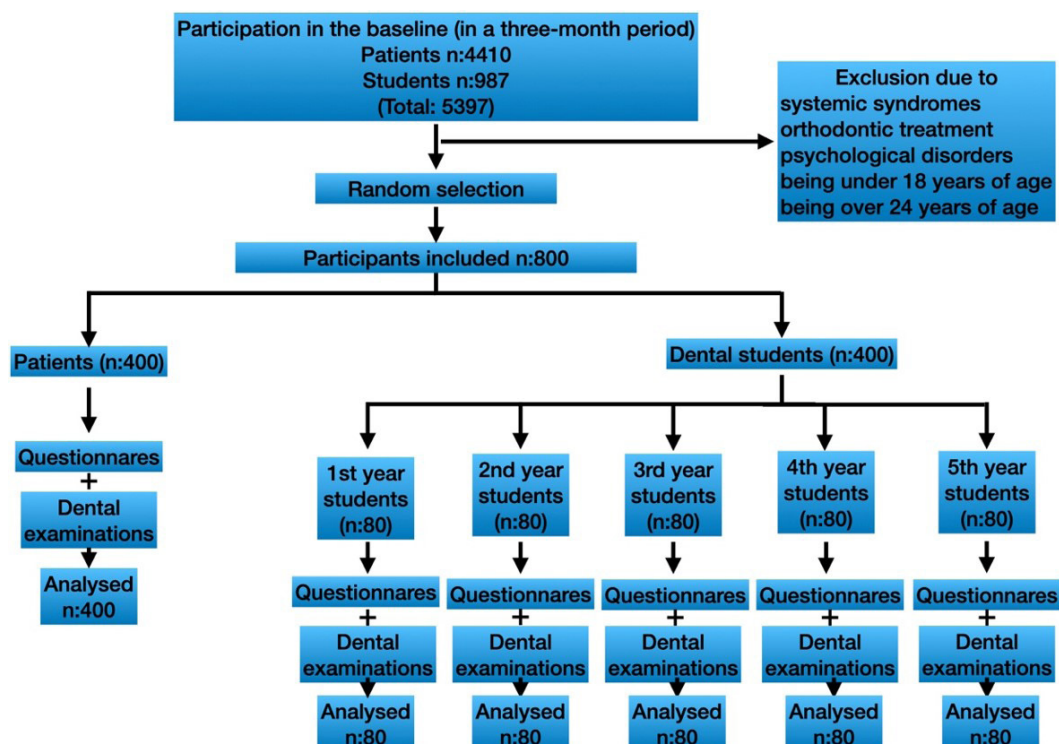


Figure 1 - Flow diagram of the study.

The prevalence of caries lesions was determined using International Caries Detection and Assessment System Criteria (ICDAS) [28]. Teeth with obvious caries (ICDAS score 4 or higher) were considered as carious teeth in this study. One researcher who completed the ICDAS e-learning program conducted all clinical examinations. This researcher was unaware of the results of the general and anxiety questionnaires to prevent evaluation bias.

The data were analyzed using Statistical Package for Social Science (SPSS, Inc, Chicago, IL USA), version 21. Kolmogorov-Smirnov and Shapiro-Wilks tests was used to determine if the data was normally distributed. The Kruskal-Wallis test was used to compare parameters between the groups and the Mann-Whitney U test was used to identify the group causing the difference. To compare parameters between two groups, the Mann-Whitney U test was used. Chi-square and Fischer's Exact chi square tests were used to compare qualitative variables. Correlation between MDAS and DFS was assessed using Spearman's rho. P-values less than 0.05 were considered statistically significant.

RESULTS

Among 4410 patients and 987 dental students in a three-month period, 400 patients

and 400 dental students were included in the study by random selection.

The mean age of patients (n, 400) was 21.61 ± 2.48 y and the mean ages of dental students (n, 400) in different grades were as follows; first-year, 18.40 ± 0.61 y; second-year, 19.45 ± 0.55 y; third-year, 20.63 ± 0.60 y; fourth-year, 21.99 ± 0.99 y; and fifth-year, 23.06 ± 0.92 y.

The mean MDAS and DFS scores based on gender are shown in Table I. Women showed higher DA scores in both anxiety questionnaires among all the participants. First-year students scored significantly higher on MDAS and DFS than 4th and 5th-year students ($p < 0.05$) and 5th-year students had significantly lower DFS scores than 2nd-year students ($p < 0.05$) regardless of gender. Among patients and 4th-year students, women showed significantly higher MDAS scores than men ($p < 0.05$) whereas DFS scores showed no significant differences between females and males among all the participants ($p > 0.05$).

Table II shows the frequency distribution of individuals with high DA ($MDAS \geq 19$) and caries prevalence ($ICDAS \geq 4$) by gender. There was a significant difference in caries prevalence between students in different grades ($p < 0.01$). First-year students had the highest caries prevalence (86.3%) whereas 4th-year students had the

Table I - Anxiety scores of MDAS and DFS both in patients and students by gender (brackets contain median unless otherwise indicated)

		MDAS	DFS
		Mean	Mean
Patients	Female	12.85 \pm 5.65 (11.5)	39.71 \pm 18.55 (35)
	Male	10.95 \pm 5.06 (10)	36.32 \pm 15.91 (33)
	All subjects	11.9 \pm 5.44 (11.0)	38.01 \pm 17.3 (33.0)
1st year student	Female	13.28 \pm 5.89 (12.5)	37.1 \pm 13.96 (32)
	Male	10.43 \pm 2.72 (11.0)	34 \pm 8.55 (35)
	All subjects	11.8 \pm 4.77 (11.0)	35.5 \pm 11.6 (33.5)
2nd year student	Female	9.95 \pm 2.8 (10)	36.3 \pm 12.21 (34.5)
	Male	10.45 \pm 3.84 (10)	33.05 \pm 12.55 (27.5)
	All subjects	10.2 \pm 3.3 (10.0)	34.67 \pm 12.4 (31.5)
3rd year student	Female	10.13 \pm 3.11 (10)	32.7 \pm 11.03 (30.5)
	Male	10.08 \pm 4.29 (8.5)	34.35 \pm 13.66 (29.5)
	All subjects	10.1 \pm 3.72 (9.0)	33.5 \pm 12.3 (30.0)
4th year student	Female	10.03 \pm 2.82 (10)	31.25 \pm 9.13 (29)
	Male	8.6 \pm 3.31 (8)	28.93 \pm 10.56 (24.5)
	All subjects	9.3 \pm 3.14 (9)	30.08 \pm 9.87 (26.0)
5th year student	Female	9.03 \pm 3.45 (8.5)	29.45 \pm 8.61 (26.5)
	Male	8.93 \pm 2.93 (8)	27.73 \pm 8.53 (24)
	All subjects	8.97 \pm 3.17 (8)	28.58 \pm 8.56 (26.0)

Table II - The frequency distribution of individuals with high DA (MDAS \geq 19) and caries prevalence (ICDAS \geq 4) by gender (brackets contain percentage unless otherwise indicated)

MDAS		Women n	Men n	All subjects n	ICDAS	Women n	Men n	All subjects n
Patients	With high DA	39 (19.50%)	19 (9.50%)	58 (14.50%)	C +	152 (76%)	156 (78%)	308 (77.00%)
	Without high DA	161 (80.5%)	181 (90.5%)	342 (85.50%)	C -	48 (24%)	44 (22%)	92 (23.00%)
1st year students	With high DA	10 (25%)	0 (0%)	10 (12.50%)	C +	37 (92.50%)	32 (80%)	69 (86.3%)
	Without high DA	30 (75%)	40 (100%)	70 (87.50%)	C -	3 (7.50%)	8 (20%)	11 (13.8%)
2nd year students	With high DA	0 (0%)	2 (5%)	2 (2.50%)	C +	30 (75%)	34 (85%)	64 (80%)
	Without high DA	40 (100%)	38 (95%)	78 (97.50%)	C -	10 (25%)	6 (15%)	16 (20%)
3rd year students	With high DA	0 (0%)	2 (5%)	2 (2.50%)	C +	28 (70%)	33 (82.5%)	61 (76.3%)
	Without high DA	40 (100%)	38 (95%)	78 (97.50%)	C -	12 (30%)	7 (17.50%)	19 (23.8%)
4th year students	With high DA	0 (0%)	1 (2.50%)	1 (1.30%)	C +	21 (52.50%)	26 (65%)	47 (58.8%)
	Without high DA	40 (100%)	39 (97.5%)	79 (98.80%)	C -	19 (47.50%)	14 (35%)	33 (41.3%)
5th year students	With high DA	1 (2.50%)	0 (0%)	1 (1.30%)	C +	24 (60%)	30 (75%)	54 (67.5%)
	Without high DA	39 (97.50%)	40 (100%)	79 (98.80%)	C -	16 (40%)	10 (25%)	26 (32.5%)

With high DA = Individuals with high DA (MDAS \geq 19); Without high DA = Individuals without high DA (MDAS $<$ 19); C+ = caries present (ICDAS \geq 4); C- = caries absent (ICDAS $<$ 4).

lowest caries prevalence (58.8%). There was no significant difference in caries prevalence between genders, among students or patients ($p > 0.05$).

Individuals with an educational level of university or higher than university were significantly more likely to have regular dental visits (44.9%) and to brush their teeth twice a day or more (81.8%) compared to those with education levels lower than university (16.6% and 49.8%, respectively; $p < 0.05$).

Table III shows anxiety levels among patients and dental students based on tooth-brushing frequency, dental visit frequency, and educational level.

A positive correlation was found between MDAS and DFS scores at an α level of 0.01 ($p < 0.01$). Caries prevalence among patients and dental students based on tooth-brushing frequency, dental visit frequency, and educational level is shown in Table IV. The correlation of MDAS and DFS scores with caries prevalence in patients and dental students is shown in Table V.

DISCUSSION

The results of our study show that lower DA level and caries prevalence were found among senior dental students than younger students. Patients with an education level of university or higher than university were more likely to have regular dental visits and to brush their teeth twice

a day or more. There was no association between anxiety scores and education level among patients. No association was found between anxiety scores and dental visit frequency, except among 3rd-year students. While patients with caries and brushed their teeth less than twice a day showed higher MDAS scores, there was no association between anxiety scores and caries prevalence or tooth-brushing frequency among dental students.

We selected two commonly used anxiety questionnaires, MDAS and DFS, to measure DA in our study. MDAS was shown to be valid, reliable, comprehensive, easy to use, brief, and consistent [11,23]. High reliability and validity of the MDAS in Turkish populations were reported previously [27,29]. DFS, another DA assessment scale, has been used in studies.²¹ Newton and Buck [30] reported that DFS is reliable and valid for the measurement of DA. In addition, Firat et al. [31] showed that the Turkish version of the DFS was internally consistent and reproducible. We also found a significant correlation between DFS and MDAS.

Consistent with previous studies [3,11,15,21,23], we found that women were more likely to have DA, as seen in the results among patients and 4th-year students. Further, even among students in other grades, at least one of the anxiety scores was higher in females than males. This may be because women are more susceptible to anxiety [20,23]. In addition, men are more likely to hide their feelings. Overall, the higher DA score

Table III - Anxiety levels of patients and dental students according to the frequency of tooth brushing, dental visit and educational level (brackets contain median unless otherwise indicated)

		Dental attendance		P	The frequency of tooth-brushing		P	Educational level		P
		Irreg. dv. Mean	Reg. dv. Mean		≥X2/day Mean	<X2/day Mean		< university Mean	≥ university Mean	
Patients	MDAS	12.16 ± 5.51 (11)	10.89 ± 5.07 (10)	0.058	11.45 ± 5.37 (10)	12.46 ± 5.49 (12)	0.040	12.07 ± 5.44 (11)	11.38 ± 5.45 (10)	0.207
	DFS	38.42 ± 16.85 (35)	36.46 ± 19.16 (29)	0.091	37.36 ± 17.33 (33)	38.32 ± 17.37 (33)	0.238	38.11 ± 16.79 (35)	37.75 ± 19.02 (31)	0.416
1st year students	MDAS	11.05 ± 3.78 (11)	12.78 ± 5.64 (11)	0.333	11.89 ± 4.92 (11)	11.33 ± 2.73 (11.5)	0.847	-	-	
	DFS	34.14 ± 9.28 (35)	37.19 ± 13.78 (32)	0.530	35.57 ± 12.02 (33)	35.33 ± 4.13 (35.5)	0.728	-	-	
2nd year students	MDAS	10.13 ± 3.56 (10)	10.4 ± 2.7 (10)	0.498	10.31 ± 3.39 (10)	10 ± 3.33 (10)	0.572	-	-	
	DFS	34.45 ± 12.73 (32)	35.35 ± 11.69 (31.5)	0.563	35.19 ± 12.7 (33)	33.71 ± 12.02 (28.5)	0.639	-	-	
3rd year students	MDAS	10.56 ± 3.41 (10.5)	9.33 ± 4.14 (8)	0.033	10.31 ± 3.85 (10)	9.2 ± 3.05 (8)	0.330	-	-	
	DFS	35.16 ± 12.67 (32)	30.8 ± 11.54 (27)	0.165	33.35 ± 12.42 (30)	34.27 ± 12.53 (33)	0.848	-	-	
4th year students	MDAS	9.59 ± 3.84 (8.5)	9.21 ± 2.86 (9)	0.922	9.39 ± 3.15 (9)	7.33 ± 2.31 (6)	0.257	-	-	
	DFS	32.45 ± 11.96 (30.05)	29.19 ± 8.92 (26)	0.315	30.25 ± 9.94 (26)	26 ± 8.66 (21)	0.304	-	-	
5th year students	MDAS	8.52 ± 3.13 (8)	9.13 ± 3.2 (9)	0.189	9.13 ± 3.3 (8.5)	7.9 ± 1.97 (7.5)	0.366	-	-	
	DFS	27.7 ± 8.64 (24)	29.21 ± 8.54 (27)	0.318	28.99 ± 8.82 (26)	25.8 ± 6.11 (24.5)	0.297	-	-	

p<0.05, Mann Whitney U test; Irreg. dv. = Irregular dental visits; Reg. dv. = Regular dental visits.

Table IV - Caries prevalence of patients and dental students according to the frequency of dental visit, tooth brushing and educational level (brackets contain percentage unless otherwise indicated)

	ICDAS	Dental attendance		The frequency of tooth-brushing		Educational level	
		Irreg. dv. n	Reg. dv. n	≥X2/day n	<X2/day n	< university n	≥ university n
Patients	C +	248(78%)	60(73.2%)	160(72.7%)	148(82.2%)	245(81.4%)	63(63.6%)
	C -	70(22%)	22(26.8%)	60(27.3%)	32(17.8%)	56(18.6%)	36(36.4%)
p		0.355*		0.025*		0.000*	
1st year students	C +	36 (83,7%)	33(89,2%)	64(86.5%)	5(83.3%)	-	-
	C -	7(16,3%)	4(10,8%)	10(13.5%)	1(16.7%)	-	-
p		0.479*		1.000**			
2nd year students	C +	50(83,3%)	14(70%)	40(76.9%)	24(85.7%)	-	-
	C -	10(16,7%)	6 (30%)	12(23.1%)	4(14.3%)	-	-
p		0,211**		0.348*			
3rd year students	C +	37(74%)	24(80%)	47(72.3%)	14(93.3%)	-	-
	C -	13(26%)	6(20%)	18(27.7%)	1(6.7%)	-	-
p		0.542*		0.103**			
4th year students	C +	15(%68,2)	32(55,2%)	44(57.1%)	3(100%)	-	-
	C -	7(31,8%)	26(44,8%)	33(42.9%)	0(0%)	-	-
p		0.291*		0.264**			
5th year students	C +	20(60,6%)	34(72,3%)	47(67.1%)	7(70%)	-	-
	C -	13(39,4%)	13(27,7%)	23(32.9%)	3(30%)	-	-
p		0.270*		1.000**			

C+ = caries present (ICDAS≥4); C- = caries absent (ICDAS<4); Irreg. dv. = Irregular dental visits; Reg. dv. = Regular dental visits; *p<0.05, Chi-square test; **p<0.05, Fischer's Exact chi square.

Table V - The relationship between anxiety scores and caries prevalence (brackets contain median unless otherwise indicated)

	ICDAS	MDAS Mean	DFS Mean
Patients	C +	12.19±5.3 (11)	38.8±17.53 (35)
	C -	10.93±5.8 (9)	35.39±16.54 (31)
	P	0.008	0.052
1st year students	C +	11.86±4.88 (11)	35.01±11.67 (33)
	C -	11.82±4.31 (11)	38.91±11.14 (40)
	P	0.877	0.200
2.nd year students	C +	10.34±3.48 (10)	35.2±13.01 (30.5)
	C -	9.63±2.8 (10)	32.56±9.74 (32.5)
	P	0.671	0.617
3rd year students	C +	9.87±3.87 (9)	32.8±12.73 (28)
	C -	10.84±3.18 (11)	35.84±11.09 (34)
	P	0.158	0.122
4th year students	C +	9.49±3.28 (9)	30.87±10.07 (27)
	C -	9.06±2.97 (9)	28.97±9.63 (25)
	P	0.612	0.350
5th year students	C +	9.43±3.38 (9)	29.07±9.15 (25.5)
	C -	8.04±2.52 (7)	27.58±7.25 (26.5)
	P	0.081	0.793

C+ = caries present (ICDAS≥4); C- = caries absent (ICDAS<4); p<0.05, Mann-Whitney U test.

among women may indicate that women express their feelings more freely than men do [12].

Our results showed that senior dental students had lower DA levels and caries prevalence than younger ones. Thus, our hypothesis that DA levels among senior students is lower than younger students was accepted. Our results are consistent with previous studies [18-20,22-24,32]. One possible explanation is that the level of knowledge about dentistry increases with each successive year of study. Students are more professional in later years, they treat patients, and also learn to manage DA among patients, which may result in better understanding of their own DA [17,20].

In addition, behavioral techniques are commonly used to overcome phobias. In these techniques, anxiety due to stimuli decreases after removing avoidance behaviors with repeated exposure. As in behavioral techniques, dental students are gradually exposed to fear-provoking stimuli during their education. Thus, they are able to overcome their own anxiety [24]. Another explanation may be the general anxiety level among younger dental students. Thus, younger students may have problems adapting to a new life and thereby have a higher general anxiety level resulting in higher specific anxiety such as DA [24] however, the association of general anxiety with

DA is unclear, with some studies finding such an association [33] but not others [6,34].

The prevalence of DA in the Turkish population has been reported to range from 8.8-23.5% [27,29,31]. Our findings revealed that 14.5% of the patients suffered high DA, consistent with the above reports. The prevalence of high DA among dental students in the present study (2.5% in 2nd and 3rd-year students; 1.3% in 4th and 5th-year students) is supported by previous studies [17,18,20]. However, Storjord et al. [24] reported that 11.8% of dental students had high DA levels. The main reason for this high prevalence relative to our results may be the low cut-off point they selected (≥13).

Patients who reported an education level of university or higher than university were more likely to have regular dental visits and brush their teeth twice a day or more. However, anxiety levels of the patients did not change based on education level. This finding is surprising, because earlier studies have claimed that a low education level correlates positively with DA [7,35]. Thus, our hypothesis that a low education level correlates positively with DA should be rejected. These results can be explained by the low number of patients who visit dentists regularly in Turkey. Although patients with higher educational levels

visited dentists more regularly than patients with lower educational levels, the frequency of such visits among Turkish patients (44.9%) is far lower than in many other societies [36,37]. During the evaluation of the findings of dental anxiety studies, the most important limitation is the difference in oral health knowledge levels of different societies in which the study was conducted. Thus, these differences should be taken into consideration when assessing the results.

Although patients with caries and brushed their teeth less than twice a day showed significantly high MDAS scores, there were no associations between anxiety scores and caries prevalence or frequency of tooth-brushing among dental students. Therefore, the hypothesis that poor oral hygiene and presence of dental caries correlate positively with DA can be partially accepted. There are many studies reporting high DA scores in patients with poor oral hygiene [6,7,9] and high caries prevalence [5,8,10]. One possible explanation for the lack of such associations among dental students is their knowledge of dentistry. Even if students with dental problems tend to have high DA, their knowledge could be a factor helping them to overcome their DA.

Our hypothesis that individuals who have regular dental visits show lower DA should be rejected, because no relationship was found between anxiety scores and the frequency of dental visits, except among 3rd-year students. MDAS levels among 3rd-year students who had regular dental visits were lower than among those with irregular dental visits. Although some studies found no relationship between dental visits and anxiety levels [8,12], many other studies have claimed that individuals who visit dentists regularly show lower DA levels [5,6,8,17]. As mentioned above, no relationship between anxiety scores and the frequency of dental visits in our study can be explained by lower frequency of dental visits among Turkish patients than in many other societies.

Interestingly, while patients who brushed their teeth less than twice a day had higher caries prevalence, there was no association between tooth-brushing frequency and caries prevalence among dental students. This can be explained by the cariogenic eating habits of students; they are more likely to eat processed food because of their living conditions. Although the important role of diet in dental caries is discussed in dental

education, dietary habits acquired in childhood and is difficult to change. These dental students also confirm this situation.

The main limitation of our study was its cross-sectional design, preventing identification of causal relationships. Future such studies with longitudinal designs are needed to establish causality.

CONCLUSION

Our study provides valuable information about the association between dental anxiety and oral health among dental students which is not investigated by other studies on DA in detail. Patients with high DA should be identified at the earliest opportunity and suitable interventions should be formulated to help them overcome anxiety. Dentists should receive training in management of DA. Imparting oral health education to the general population may help control DA and dental health, because DA levels decrease with an increase in knowledge about dentistry.

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Conflict of Interest

There is no conflict of interest

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Regulatory Statement

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