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Reliability and Validity of the Modified Dental Anxiety Scale in Turkish Patients

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We aimed to determine dental anxiety among Turkish patients and assess the sensitivity, specificity, positive/negative predictive values and reliability of the Modified Dental Anxiety Scale (MDAS) and Corah's Dental Anxiety Scale (DAS). Patients referred to our clinic for dental treatment who had a history of dental anxiety were included in the study. 294 randomly selected patients (mean age 38.8 years) completed a questionnaire combining Corah's DAS and MDAS. They were retested 15 days later. The prevalence of dental anxiety was found to be 9.9% (29/294) for Corah's DAS at the cut-off point ≥ 15 and 8.8% (26/294) for the MDAS at the cut-off point ≥ 19. Both dental anxiety scales gave acceptable sensitivity, specificity, positive and negative predictive values at these cut-off points.

KEY WORDS: DENTAL ANXIETY; RELIABILITY; SENSITIVITY; SPECIFICITY

Introduction

Fear and anxiety about dental treatment is a problem for many patients and can be a barrier to treatment: some patients avoid dentists altogether because of their extreme fears.[1 – 3] Dentists can also become anxious when dealing with anxious patients: dentally anxious patients are more difficult to manage, take longer to treat, and are a major source of stress for the dental practitioner.[2] Previously painful or negative experiences during visits to a dentist are the most common origins of dental anxiety. For the dental team, a patient's anxiety also poses major management problems, because an anxious patient may require more time for treatment and is very likely to miss appointments. Dental fear has been the subject of many investigations, examining various factors such as prevalence, aetiology and treatment. The assessment of dental anxiety has led to the development of a variety of measures, and several psychometric scales have been designed to quantify dental anxiety.[3 – 5] Corah's Dental Anxiety Scale (DAS) is probably the most widely used, consisting of a four-item, multiple-choice questionnaire (Table 1) designed to measure the degree of anxiety associated with dental treatment on a scale from 4 (no anxiety) to 20 (high anxiety). It takes less than 5 min to administer, is highly reliable and has demonstrated predictive validity.[6,7] It is widely used for both survey and clinical purposes, but has been criticized for not covering all aspects of dental fear and because its response alternatives differ between items.[2]

Alternative scales have been proposed to overcome the shortcomings of the DAS, one

TABLE 1:
The Corah's Dental Anxiety Scale[5] that formed part of the study questionnaire

1. If you had to go to the dentist tomorrow, how would you feel?
   (1) Look forward to it as a reasonably enjoyable experience
   (2) I wouldn't care one way or the other
   (3) I would be a little uneasy about it
   (4) I would be afraid that it would be unpleasant and painful
   (5) I would be very frightened of what the dentist might do
2. When you are waiting in the dentist's office for your turn in the chair, how do you feel?
   (1) Relaxed
   (2) A little uneasy
   (3) Tense
   (4) Anxious
   (5) So anxious that I sometimes break out in a sweat or almost feel physically sick
3. When you are in the dentist's chair waiting while he gets his drill ready to begin working on your teeth, how do you feel?
   (Same alternatives as Q.2)
4. You are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he will use to examine your teeth around the gums, how do you feel?
   (Same alternatives as Q.2)

of them being the Modified Dental Anxiety Scale (MDAS) introduced by Humphris *et al.*[8] This scale has standardized responses and a fifth item relating to anaesthetic injections (Table 2).[7] The MDAS can have values from 5 (no anxiety) to 25 (high anxiety), therefore. Other small but important changes to the answering scheme were also made, making the MDAS a quick and efficient instrument for dental researchers and clinicians. The scale has also exhibited favourable psychometric properties compared with the original DAS. The reliability and validity of MDAS have been reported to be acceptable.[6,7]

We aimed to determine dental anxiety among patients in Turkey using Corah's DAS, which has been used previously in Turkey,[9 – 11] and the MDAS, which has not. We also investigated the reliability and validity of the MDAS at cut-off points of ≥ 16 and ≥ 19, and Corah's DAS at cut-off points of ≥ 13 and ≥ 15.

Patients and methods

PATIENTS

The study group consisted of adult patients aged 18 – 70 years, who were referred to our clinic for dental treatment. All participating patients gave informed consent. Patients had a history of dental anxiety, and were asked to complete the study questionnaire on two occasions, with a 15-day interval between. The gender, age and education levels of the study respondents was also noted.

QUESTIONNAIRE DESIGN

The questionnaire comprised two previously designed dental anxiety scales: Corah's DAS (already translated into Turkish) and MDAS. The MDAS was translated into Turkish, and a pilot test performed using 30 patients; it

TABLE 2:
The Modified Dental Anxiety Scale[5] that formed part of the study

1. If you went to your dentist for treatment tomorrow, how would you feel?
   (1) Not anxious
   (2) Slightly anxious
   (3) Fairly anxious
   (4) Very anxious
   (5) Extremely anxious
2. If you were sitting in the waiting room (waiting for treatment), how would you feel?
   (Same alternatives as Q.1)
3. If you were about to have a tooth drilled, how would you feel?
   (Same alternatives as Q.1)
4. If you were about to have your teeth scaled and polished, how would you feel?
   (Same alternatives as Q.1)
5. If you were about to have a local anaesthetic injection in your gum, above an upper back tooth, how would you feel?
   (Same alternatives as Q.1)

was then retranslated back to the original version by an experienced bilingual researcher. The questions asked and possible answers are given in Tables 1 and 2.

STATISTICAL ANALYSIS

Simple Likert scoring (e.g. 1 – 5) was assigned to the response to each question, and the items summed to derive the total score for each scale. A high score denoted a high anxiety response.

Statistical analysis was performed using GraphPad Prism V.3 (GraphPad Prism Software, San Diego, CA). A one-way ANOVA test was used to compare multiple groups; the unpaired *t*-test was used to compare dual groups. Relationships between variables were assessed using the Spearman correlation test. These tests were used to determine the internal consistency, reliability, intraclass correlation and the confidence intervals (95%) of the MDAS. In addition, the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were determined using cut-off points of ≥ 13 and ≥ 15 for DAS and ≥ 16 and ≥ 19 for MDAS. A *P*-value < 0.05 was considered to be significant.

Results

A total of 294 patients completed the questionnaire; their mean age was 38.78 ± 14.39 years. There was a negative correlation between age and dental anxiety, with the level of anxiety varying significantly with age ($P < 0.05$), and less anxiety observed among older patients.

The gender and educational level of the respondents is given in Table 3. For females, the mean DAS score was 9.95 ± 3.81 and mean MDAS score was 12.22 ± 4.91. These results were significantly higher than for male respondents, who scored 8.65 ± 3.30 using the DAS and 10.74 ± 4.12 with MDAS ($P < 0.01$).

In the pilot study of the MDAS Turkish questionnaire, Cronbach's alpha was 0.81 and the distribution of answers to each question was found to be normal.

The prevalence of dental anxiety was

TABLE 3:
Gender and education level of the patients with dental anxiety who completed the study questionnaire

		n	%
Gender	Male	122	41.5
	Female	172	58.5
Education	Elementary	27	9.2
	Junior high school	13	4.4
	High school	101	34.4
	University	153	52.0

9.9% (29/294) for DAS using a cut-off value of ≥ 15 and 8.8% (26/294) for MDAS (cut-off value ≥ 19). No statistically significant correlation was found between level of education and dental anxiety ($P > 0.05$).

Table 4 shows the mean values and standard deviations of the individual items in the questionnaire, and total scores (derived by adding the individual item scores) for Corah's DAS (9.41 ± 3.65) and the MDAS (11.60 ± 4.65). The most anxiety provoking item was injection (mean score of 2.89 ± 1.29) and the item provoking least anxiety was a scale and polish (mean score = 1.70 ± 0.96).

The test–retest reliability (intraclass correlation), Spearman correlation and internal consistency of the MDAS are shown in Table 5. The intraclass correlation coefficients show statistically significant correlation between items, indicating that individuals gave similar responses at test and retest. The first and fourth items displayed low values (0.91) of intraclass correlation coefficient, but this result was not significant because all items had values above 0.70.[12] MDAS had a high overall internal consistency and high reliability, as indicated by the Cronbach's alpha and Spearman correlation results (Table 5). Using Cronbach's alpha, the internal consistency of DAS and MDAS were found to be 0.85 and 0.88, respectively. (A

TABLE 4:
Means and standard deviations (SD) of Corah's Dental Anxiety Scale (DAS) and the Modified Dental Anxiety Scale (MDAS) results obtained using the study questionnaire

		DAS		MDAS	
	n	Mean	SD	Mean	SD
Visit tomorrow	294	2.88	1.00	2.28	1.06
Waiting room	294	2.24	1.11	2.31	1.12
Drill	294	2.33	1.16	2.44	1.22
Scale and polish	294	1.96	1.15	1.70	0.96
Injection	294	–	–	2.89	1.29
Total	294	9.41	3.65	11.60	4.65

TABLE 5:
Statistical analysis of the Modified Dental Anxiety Scale test and retest results obtained in this study

	Test–retest reliability (intraclass correlation)	Spearman correlation	Internal consistency (Cronbach's alpha)
Visit tomorrow	0.91 (0.88 – 0.92)	0.91	0.95
Waiting room	0.93 (0.92 – 0.95)	0.89	0.94
Drill	0.96 (0.96 – 0.97)	0.94	0.96
Scale and polish	0.91 (0.89 – 0.92)	0.91	0.95
Injection	0.93 (0.91 – 0.94)	0.93	0.93
Total	0.95 (0.91 – 0.96)	0.95	0.96

higher value is given in Table 5 [0.96], which is the test–retest result and indicates that the questions were better understood.)

Statistically significant correlation was found between DAS and MDAS scores for convergent/discriminant validity ($P < 0.0001$; Table 6). Table 7 shows that the prevalence of sensitivity decreased for both DAS and MDAS, while specificity increased when changing from lower to higher cut-off points. Values for PPV and NPV for both scales using the two cut-off values are also shown in Table 7. The highest PPV for MDAS we obtained was 0.46 at the cut-off ≥ 19, implying that one out of two individuals identified as positive by the scale were true-positives given the criteria of this study.

Discussion

The dental anxiety scales used in this investigation have been shown to give reliable and valid results using the original and a number of translated versions.[7,8,13,14] We used Turkish translations and found that the internal consistency of the MDAS was greater than 0.70[12] and comparable to previous reports.[13,15,16]

Humphris *et al.*[8] found that dental injection was the most anxiety-provoking item, with a mean score of 2.45 ± 1.23 in all samples, and that the least anxiety-provoking procedure was a scale and polish (1.90 ± 1.35). Our results are consistent with this study.

Previous studies showed that the prevalence of dental anxiety using the MDAS were 19.5% in Belfast,[8] 6.0% in Dubai,[8] 8.8% in Jyväskyla[8] and 12.0% in Norway.[7] The prevalence using DAS was 10.9% in Canada,[15] 10.2% in the USA,[16] 6.7% in Sweden[17] and 4.2% in Norway.[18] These results indicate that when Corah's DAS is used for assessment of dental anxiety, there are wide variations between countries. In our study, the overall levels of dental anxiety for the MDAS and Corah's DAS were 8.8% and 9.9%, respectively, slightly lower than in previous studies.

Hallstrom and Halling[19] found that the prevalence of dental phobia was higher among individuals of lower education level and social class. In our study, no relationship was found between the level of education and dental anxiety, consistent with the findings of Thomson *et al.*[20]

Cohen *et al.*[21] found that 75% of patients who requested dental treatment with sedation were dentally phobic, according to the MDAS scores, and that dental anxiety

TABLE 6:
Convergent/discriminant validity of the Corah Dental Anxiety Scale (DAS) and Modified Dental Anxiety Scale (MDAS) results obtained from this study

			MDAS				
			Question 1	Question 2	Question 3	Question 4	Total
DAS	Question 1	*r*	0.76	0.69	0.60	0.48	0.73
		P	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Question 2	*r*	0.67	0.71	0.57	0.41	0.69
		P	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Question 3	*r*	0.61	0.70	0.69	0.50	0.71
		P	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Question 4	*r*	0.56	0.67	0.64	0.64	0.70
		P	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	MDAS total	*r*	0.78	0.84	0.76	0.61	0.85
		P	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

TABLE 7:
Sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) according to dental anxiety scale used and cut-off score

	Cut-off score	TP	FP	FN	TN	Sensitivity	Specificity	PPV	NPV
DAS	≥ 13	13	47	1	233	0.93 (0.66 – 0.99)	0.83 (0.78 – 087)	0.22 (0.12 – 0.34)	1.00 (0.97 – 0.99)
DAS	≥ 15	11	18	3	261	0.79 (0.44 – 0.92)	0.94 (0.89 – 0.96)	0.38 (0.20 – 0.57)	0.99 (0.96 – 0.99)
MDAS	≥ 16	12	50	2	230	0.86 (0.57 – 0.98)	0.82 (0.77 – 0.86)	0.19 (0.10 – 0.31)	0.99 (0.96 – 0.99)
MDAS	≥ 19	12	14	5	263	0.71 (0.44 – 0.89)	0.95 (0.91 – 0.97)	0.46 (0.26 – 0.66)	0.98 (0.95 – 0.99)

DAS, Corah Dental Anxiety Scale; MDAS, Modified Dental Anxiety Scale; TP, true positive; FP, false positive; FN, false negative; TN, true negative.

affected people's personal and working lives.

Our finding of a greater prevalence of dental anxiety in females than males is generally consistent with those from previous studies.[20,22 – 24] The observed difference between females and males may be due to differences in pain thresholds between genders. Males may also find discussing anxiety emotionally upsetting and be unwilling to express their anxiety.

Younger individuals have been found to exhibit higher levels of dental anxiety.[25]

Dental anxiety is generally considered to have its origins in childhood, and to develop as a result of aversive conditioning experiences and family influences. Negative dental experiences acquired in childhood increase the level of dental fear,[26] as do anecdotes about negative dental experiences from family and friends and negative, menacing portrayals of dentists in movies, on television, and in newspapers and magazines.[22] Our results showed a negative correlation between dental anxiety and age, and this result is similar to previous studies. Preventive dentistry is not at a desirable level in Turkey, so individuals are likely to visit dentists for treatment at an early age. This may lead to tolerance of dental anxiety or reduced anxiety over time. Individuals without dental experience may have acquired the fear through a variety of observational and instructional experiences that communicate negative information.[27]

Where to set a cut-off point on the dental anxiety scales is controversial. The cut-off point recommended by Corah for DAS to indicate those who were dentally anxious was ≥ 13,[27] and those scoring ≥ 15 have been rated as highly anxious.[28] Humphris *et al.*[8] found that as well as dental anxiety prevalence differences among the three countries in their study (Northern Ireland, United Arab Emirates and Finland), the groups from two admission centres in Finland had different dental anxiety levels. Comparisons with other reports using the DAS, mindful of the cautions expressed already, suggest that Scandinavian respondents report lower levels of dental anxiety than English-speaking participants. This result confirms that linguistic variations play an important role in evaluating the reliability of a scoring test, and care should be taken to ensure that the test used is reproducible in every language, to prevent possible misinterpretations. Cut-off points may also need to be varied to suit individual studies.

Employing cut-off points of ≥ 15 for Corah's DAS and ≥ 19 for the MDAS, means that we used a higher DAS cut-off point than the value stated in previous recommendations. We found that these cut-off values still had high sensitivity and specificity, however. The higher cut-off point we found for DAS may also be attributed to linguistic variations. The cut-off for the MDAS at ≥ 19 refers to dental phobic respondents,[8] and our results (sensitivity and specificity analyses) are consistent with those found by Humphris *et al.*[8]

Both studies need to be translated into the native language, but as the responses are the same in the MDAS, this is relatively simple. The Corah's Scale demands searching for a greater variety of words (for example tense, anxious) to match Corah's original categorization.[7,8] MDAS was found to be a reliable method of assessing dental anxiety because of its easy and definite translation.

We conclude that both Corah's DAS and the MDAS give acceptable sensitivity, specificity, PPV and NPV at the cut-off points of ≥ 15 for DAS and ≥ 19 for MDAS used in this study.

Conflicts of interest

No conflicts of interest were declared in relation to this article.

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References

1 Chadwick BL: Assessing the anxious patient. *Dent Update* 2002; **29:** 448 – 454.
2 Corah NL: Dental anxiety. *Dent Clin North Am* 1988; **32:** 779 –790.
3 Skaret E, Raadal M, Berg E, Kvale G: Dental anxiety among 18-year-olds in Norway. Prevalence and related factors. *Eur J Oral Sci* 1998; **106:** 835 – 843.
4 Corah NL, Gale EN, Illig SJ: Assessment of a dental anxiety scale. *J Am Dent Assoc* 1978; **97:** 816 – 819.
5 Corah NL: Development of a dental anxiety scale. *J Dent Res* 1969; **48:** 596.
6 Schuurs AHB, Hoogstraten J: Appraisal of dental anxiety and fear questionnaires: a review. *Community Dent Oral Epidemiol* 1993; **21:** 329 – 339.
7 Haugejorden O, Klock KS: Avoidance of dental visits: the predictive validity of three dental anxiety scales. *Acta Odontol Scand* 2000; **58:** 255 – 259.
8 Humphris GM, Freeman R, Campbell J, Tuuti H, D'Souza V: Further evidence for the reliability and validity of the Modified Dental Anxiety Scale. *Int Dent J* 2000; **50:** 367 – 370.
9 Duran S, Cambazoğlu M, Tuğcu F: Dental anksiyetenin oral cerrahi ve diş hekimliğindeki önemi. *Ankara Üniv Diş Hekim Fak Derg* 1999; **26:** 215 – 223 (in Turkish; English abstract).
10 Görgün S, Öztaş B, Babadağ M: Hasanoğlan atatürk anadolu öğretmen lisesi hazırlık sınıfı öğrencilerinde dental anksiyete skalası belirlenmesi. *AÜ Diş Hekim Fak Derg* 1994; **21:** 127 – 131 (in Turkish; English abstract).
11 Sarı Ş, Şen T, Bilgin Z: Çocuklarda dental kaygının farklı test yöntemleri ile değerlendirilmesi: Karşılaştırmalı bir çalışma. *Ankara Üniv Diş Hekim Fak Derg* 2002; **29:** 127 – 135 (in Turkish; English abstract).
12 Cronbach LJ: Coefficient alpha and the internal consistency of tests. *Psychometrica* 1951; **16:** 297 – 334.
13 Humphris GM, Morrison T, Linday SJ: The Modified Dental Anxiety Scale: validation and United Kingdom norms. *Community Dent Health* 1995; **12:** 143 – 150.
14 Berggren U, Calsson SG: Usefulness of two psychometric scales in Swedish patients with severe dental fear. *Community Dent Oral Epidemiol* 1985; **13:** 70 – 74.
15 Locker D, Shapiro D, Liddel A: Who is dentally anxious? Concordance between measures of dental anxiety. *Community Dent Oral Epidemiol* 1996; **24:** 346 – 350.
16 Milgrom P, Fiset L, Melnick S, Weinstein P: The prevalence and practice management consequences of dental fear in a major US city. *J Am Dent Assoc* 1988; **116:** 641 – 647.
17 Hakeberg M, Berggren U, Calsson SG: Prevalence of dental anxiety in an adult population in a major urban area in Sweden. *Community Dent Oral Epidemiol* 1992; **20:** 97 – 101.
18 Vasend O: Anxiety, pain and discomfort associated with dental treatment. *Behav Res Ther* 1993; **31:** 659 – 666.
19 Hallstrom T, Halling A: Prevalence of dentistry phobia and its relation to missing teeth, alveolar bone loss and dental care habits in an urban community sample. *Acta Psychiatr Scand* 1984; **70:** 438 – 446.
20 Thomson WM, Stewart JF, Carter KD, Spencer AJ: Dental anxiety among Australians. *Int Dent J* 1996; **46:** 320 – 324.
21 Cohen SM, Fiske J, Newton T: The impact of dental anxiety on daily living. *Br Dent J* 2000; **189:** 385 – 390.
22 Levin RP: Helping your patients overcome dental phobia. *Compend Contin Educ Dent* 2003; **24:** 8 – 12.
23 Hakeberg M, Berggren U, Gröndahl HG: A radiographic study of dental health in adult patients with dental anxiety. *Community Dent Oral Epidemiol* 1993; **21:** 27 – 30.
24 Neverlien PO: Normative data for Corah's Dental Anxiety Scale (DAS) for the Norwegian adult population. *Community Dent Oral Epidemiol* 1990; **18:** 162.
25 Thomson WM, Locker D, Poulton R: Incidence of dental anxiety in young adults in relation to dental treatment experience. *Community Dent Oral Epidemiol* 2000; **28:** 289 – 294.
26 Locker D, Thomson WM, Poulton R: Onset of and patterns of change in dental anxiety in adolescence and early adulthood: a birth cohort study. *Community Dent Health* 2001;**18:** 99 – 105.
27 Rachman SJ: *Fear and Courage*, 2nd edn. New York: Freeman and Company, 1990.
28 Locker D, Liddel A, Burman D: Dental fear and anxiety in an older adult population. *Community Dent Oral Epidemiol* 1991; **19:** 120 – 124.

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