

# The Association between Dental Anxiety, General Clinical Anxiety and Depression among Finnish University Students

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## Abstract

**Background:** Few studies have examined the association between dental fear, anxiety and depressive disorders. The aim of this study was to evaluate the association between dental anxiety, general clinical anxiety and depression among Finnish university students.

**Methods:** During autumn 2007, a Modified Dental Anxiety Scale (MDAS) questionnaire was emailed to 1,551 new students at four Finnish universities willing to participate in this study. The following year, the same study group was asked to repeat the MDAS questionnaire, along with two additional tests: Beck's Anxiety Inventory (BAI), a test to assess the level of general clinical anxiety, and Beck's Depression Inventory (BDI), a test measuring depression. Levels of clinical anxiety and depression were compared with the subgroups related to levels of dental anxiety. The anticipatory and treatment aspects of dental anxiety were derived from the MDAS questionnaire.

**Results:** The mean age of the respondents was 25 years. Of the respondents, 99 (11.3%) were classified as dentally anxious patients. Among females, the higher dental anxiety was statistically significantly associated with higher levels of clinical anxiety ( $p<0.000$ ) and depression ( $p<0.000$ ), while in males, dental anxiety was only associated with clinical anxiety ( $p=0.016$ ). For the factors of dental anxiety, only anticipatory dental anxiety was related with clinical anxiety ( $p=0.004$ ) or depression ( $p=0.034$ ) in males. In females, anticipatory and treatment dental anxiety were associated with clinical anxiety and depression (all with  $p<0.001$ ).

**Conclusions:** In severe forms of dental fear, a dentist should recommend that patients seek help from mental health professionals, who are trained to recognize the psychiatric disorders that may be underlying in cases of dental fear.

*Key words: BAI-test, BDI-test, Clinical anxiety, Dental anxiety, Depression*

## Introduction

Earlier studies suggest that between one in six to one in eight patients suffer from a level of fear of dental treatment that may compromise treatment procedures, i.e. they are dentally anxious patients [1-5]. In addition, 1-2% have (specific) dental phobia. There is a notable gender difference in dental fear, and the majority of patients affected are women [1,4,5]. In previous literature, however, the terms dental anxiety, high dental anxiety or dental phobia are not defined in a uniform manner. A wide range of research instruments have also been used to measure dental fear, without any "standardization". This heterogeneity in the use of instruments and definitions of anxiety levels make it very difficult to compare the findings of the previous studies.

There is a strong indication dentally fearful patients are not just dentally fearful; they also demonstrate a number of other comorbid (specific) phobias, such as fear of heights, closed spaces, blood, animals or natural phenomena, along with agoraphobia, and social phobia [1,6,7,8]. Dental anxiety patients are also shown to be more prone to depression and mood disorders [1,6,7,8], alcohol dependence and substance abuse [1,7] and other psychiatric disorders [1,9]. The prevalence rate of comorbid phobias can be up to 45% [6-8], and the rate of anxiety together with mood disorders varies between 30-43% [7]. There is a detectable tendency; the higher the dental anxiety, the higher the presence of comorbid phobias and disorders [1].

In general, anxiety disorders and phobias tend to precede major depression [10,11] or alcohol and/or substance abuse disorder [11]. Some clinical symptoms of anxiety and depression can show considerable overlap [12], suggesting a common neurobiological basis for the disorders. However, there has been no research on these conditions in primary dentally fearful patients.

Studies of the association of dental fear to anxiety and depressive disorders, investigated simultaneously in general population samples are still rare. Thus, the aims of this study are to assess the spectrum of dental anxiety, general clinical anxiety and depression and their correlations to each other among young Finnish adults. Special attention was focused on gender differences and the exogenous and endogenous forms of dental anxiety.

## Material and Methods

### Study population

The study population ( $n=880$ ) was collected from new students starting university in autumn 2007 at four Finnish universities; Helsinki, Oulu, Jyväskylä and Kuopio. A questionnaire was emailed to all new students, enquiring about their willingness to participate in the study. Only those who had forbidden disclosure of their personal details outside the university were excluded from the mailing list. Those willing to participate ( $n=1551$ , 21.8%) were sent a Finnish version of the Modified Dental Anxiety Scale (MDAS) [13,14], measuring dental fear.

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After about a year, The MDAS test was sent again to 1,551 participants. We also sent them each a Finnish version of Beck's Anxiety Inventory (BAI) [15] and a Finnish version of Beck's Depression Inventory (BDI) [16], tests evaluating clinical anxiety and depression, respectively. Respondent's age, gender and marital status were also recorded. The respondents completed the MDAS, BAI and BDI tests via web-based questionnaires, programmed using Webropol survey software. After two reminders had been sent, 899 (58.0%) students completed the test package. Incorrectly completed ( $n=19$ ) questionnaires were excluded from the study, leaving a total of 880 students in the final study population.

#### Variables

**Dental anxiety:** MDAS, the Modified Dental Anxiety Scale [14,15] test has five questions, asking for respondents' emotional reaction to 1) the day before a dental visit 2) being in the waiting room 3) anticipation of drilling 4) root scaling and 5) local anesthetic injection. Each question has five options, with scores from 1 (not anxious) to 5 (extremely anxious). Participants scoring 19 or above (from a maximum of 25 points) were considered to be dentally anxious patients, while patients scoring from 5-11 points were considered not anxious at all. The mildly dentally anxious group consisted of students with a total score ranging from 12 to 19.

The MDAS test was categorized into two subscales, in order to evaluate the endogenous and exogenous components of dental anxiety, according to Yuan [16]. The concept of endogenous and exogenous components was first introduced by Weiner and Sheehan [17]. In *anticipatory dental anxiety*, the exogenous (external) component involves the way patients re-live previous frightening dental experiences when attending the dentist. This is covered in the first two questions of the MDAS test, which ask about the level of anxiety when waiting for treatment [16,17]. *Treatment dental anxiety* is a patient's tendency to respond negatively to specific treatment procedures and it is covered in the last three questions. It is considered to be an endogenous (external) form of dental anxiety. It is suggested that these subscales are useful in understanding the origins of dental fear [16,17].

**Anxiety:** The clinical anxiety of a person is considered to represent the general clinical anxiety described in DSM-IV Axis I anxiety disorders subgroup, but not (specific) dental anxiety [18]. A Finnish version of Beck's Anxiety Inventory (BAI) [19] was used to assess the level of clinical anxiety of the participants. The BAI is a 21-item self-report inventory, with high reliability for measuring clinical anxiety. The test is capable of discriminating anxious diagnostic groups (generalized anxiety disorder, panic disorder etc.) from non-anxious diagnostic groups (major depression, dysthymic disorder etc.). Each question describes a common symptom of anxiety with a 4-point scale ranging from 0 (not at all) to 3 (severely- I could barely stand it). The sum score of 21 items can vary from 0 to 63. As in the study of Jylhä and Isometsä [20], the following cut-off points are used to indicate different levels of anxiety: no anxiety (0-9), mild (10-18), moderate (17-29) and severe (30-63 pts).

**Depression:** A Finnish version of Beck's Depression Inventory (BDI) is a clinically derived self-evaluation test, with high reliability, inquiring about symptoms and behavioral manifestations associated with depression [21]. The test

includes 21 items, each consisting of a graded series of 4 to 5 statements ranked to reflect the severity of the symptom. Numerical values from 0 (neutral) to 3 (maximal severity) are assigned to each statement to indicate the level symptom severity. The sum score is classified into four categories: no depression (0-9), mild (0-16), moderate (17-29) and severe depression (30-63).

#### Statistical analyses

The statistical significance of group differences was assessed in categorical variables with  $\chi^2$  test or Fisher's Exact test. In continuous variables the significance of difference between two groups was investigated with either Student's *t*-test or the Mann-Whitney U-test. The univariate Analysis of Variance test was used for comparisons of three groups, after controlling for participants' age. The Kruskal-Wallis test was used if the distribution of continuous variables was found to be abnormal. The two-factor model, with principal component analysis as the extraction method and Varimax with Kaiser normalization as the rotation method, was used to group the dental anxiety questions for males and females separately. All tests were two-tailed, and the limit for statistical significance was set at 0.05. All analyses were performed using PASW statistical software, version 18.

#### Ethical approval

The Ethical Committee of The Northern Ostrobothnia Hospital District approved the study design.

## Results

#### The characteristics of the study population

Of all participants, 83.8% ( $n=737$ ) were women and 15.5% ( $n=136$ ) were men. Information on gender was absent for 7 respondents. Median (IQR) age was 22 (21-27) years and no age differences were observed between genders (Mann-Whitney U-test,  $p=0.796$ ). The majority of the participants were unmarried (61.0%,  $n=530$ ). The proportion of unmarried men (69.9%,  $n=94$ ) was significantly higher compared to females (59.4%,  $n=436$ ) ( $p=0.025$ ).

#### The prevalence of dental anxiety, clinical anxiety and clinical depression

99 of the respondents (11.3%) fulfilled the criteria for dental anxiety, 291 (33.3%) for mild dental anxiety and 483 (55.3%) had no dental anxiety (*Figure 1a*). Dental anxiety was statistically significantly more common in females (12.2%) compared to males (6.6%) ( $\chi^2=16.7$ ,  $df=2$ ,  $p<0.001$ ). As presented in *Figure 1b*, 27 (3.2%) of the participants suffered from moderate/severe clinical anxiety, 148 (17.5%) from a mild level and 670 (79.3%) had no clinical anxiety. Moderate/severe clinical anxiety affected 27 (3.8%) females, but no males ( $\chi^2=12.6$ ,  $df=2$ ,  $p=0.002$ ) (*Figure 1c*). In terms of the clinical depression (*Figure 1c*), 77 (8.8%) participants suffered from moderate/severe depression and 153 (17.5%) from a mild level of depression. 642 (73.6%) participants did not fulfilled the criteria for depression (*Figure 1b*). No statistically significant gender difference was found in the prevalence of clinical depression; 66 (9.0%) females and 11 (8.1%) males fulfilled the criteria of moderate/severe depression ( $\chi^2=0.18$ ,  $df=2$ ,  $p=0.914$ ).

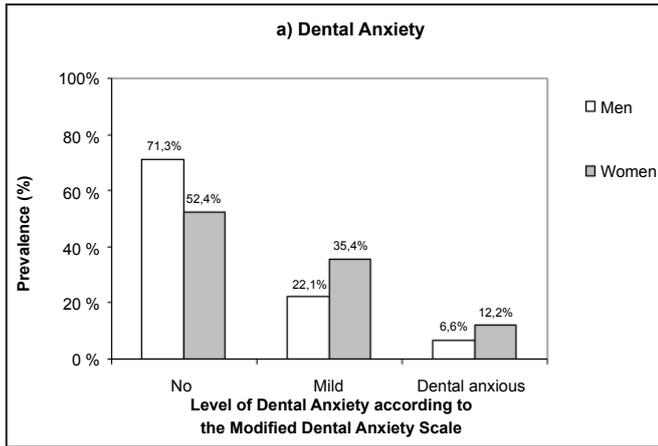


Figure 1a. Level of dental anxiety according to Modified Dental Anxiety Scale.

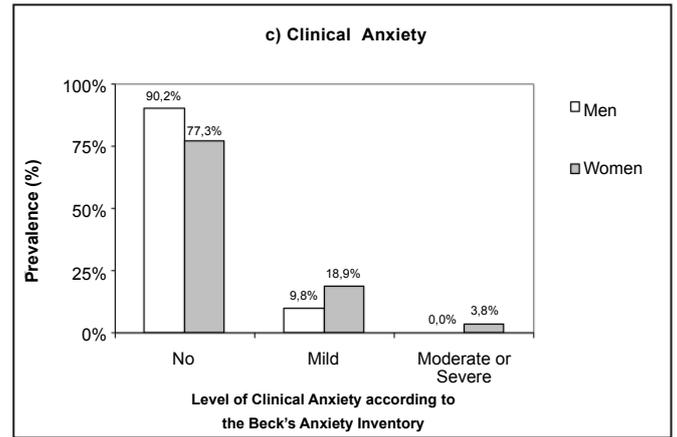


Figure 1c. Level of Clinical Anxiety according to Beck's Anxiety Inventory.

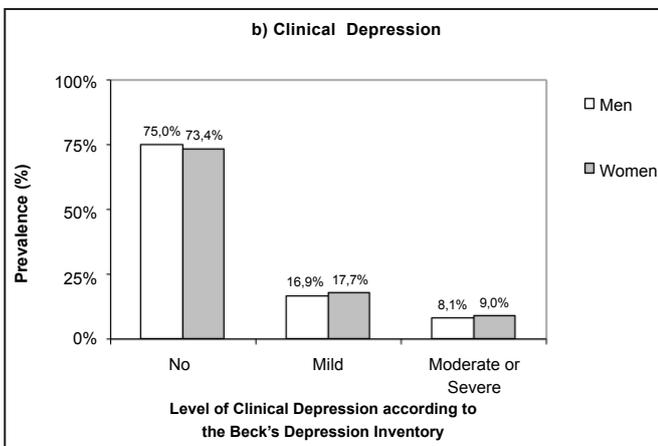


Figure 1b. Level of Clinical Depression according to the Beck's Depression inventory.

**Association of dental anxiety to clinical anxiety and depression**

For the clinical anxiety (Table 1), the mean scores determined using Beck's Anxiety Inventory (BAI), differed significantly to the levels of dental anxiety obtained using the Modified Dental Anxiety Scale (MDAS) in both males

( $p=0.016$ ) and females ( $p<0.001$ ). Pair-wise comparisons showed that participants with mild dental anxiety had statistically significantly higher BAI scores compared to those without any dental anxiety, in both males ( $p=0.016$ ) and females ( $p<0.001$ ). Women with dental anxiety had also higher BAI scores compared to those without any dental anxiety ( $p<0.001$ ). Between-gender analysis only found evidence of gender- differences in BAI scores in participants without dental anxiety ( $p=0.004$ ).

Mean scores for clinical depression, as assessed using the Beck's Depression Inventory (BDI), differed statistically significantly in females ( $p<0.001$ ) but not in males ( $p=0.426$ ) (Table 1). In females, significantly higher depression scores were observed among those with mild dental anxiety ( $p<0.001$ ) or among those who suffered from dental anxiety ( $p<0.001$ ) compared to females without dental anxiety. Females with higher levels of dental anxiety also had significantly higher depression scores compared to those with mild dental anxiety ( $p=0.017$ ). Between-gender analyses did not show any statistically significant gender- differences in BDI scores in any level of dental anxiety.

**Dentally anxious participants**

In order to characterize the dentally anxious individuals in

Table 1. Mean (sd) scores for clinical anxiety and clinical depression in relation to the level of dental anxiety among female and male participants.

	The level of Dental Anxiety (MDAS)							Pairwise differences between the levels of dental anxiety <sup>b</sup>
	No dental anxiety		Mild dental anxiety		Dental Anxious		Group difference	
	N	mean (sd)	n	mean (sd)	n	mean (sd)		
<b>Clinical anxiety (BAI)</b>								
<b>Males</b>	92	3.7 (3.8)	29	6.2 (5.4)	9	5.3 (2.7)	0.016	No vs. Mild
<b>Females</b>	375	5.4 (5.1)	252	7.7 (5.3)	86	8.6 (6.5)	<0.001	No vs. Mild No vs. Dental Anxious
<b>Gender difference<sup>b</sup></b>		0.004		0.179		0.143		
<b>Clinical depression (BDI)</b>								
<b>Males</b>	94	6.2 (6.9)	30	6.9 (5.6)	8	9.3 (6.2)	0.426	--
<b>Females</b>	375	5.5 (5.7)	247	8.1 (6.5)	88	10.2 (7.4)	<0.001	No vs. Mild No vs. Dental Anxious Mild vs. Dental Anxious
<b>Gender difference<sup>b</sup></b>		0.298		0.351		0.718		

Note: MDAS=the Modified Dental Anxiety Scale, BAI=the Beck's Anxiety Inventory, BDI=the Beck's Depression Inventory.

<sup>a</sup>Analysis of Variance (ANOVA) test, two-tailed significance.

<sup>b</sup>Only statistically significant ( $p<0.05$ ) differences between two groups are reported.

**Table 2.** Factor loadings from the two-factor model of the Modified Dental Anxiety Scale (MDAS) among Finnish university students.

	MEN		WOMEN	
	“Treatment Dental Anxiety”	“Anticipatory Dental Anxiety”	“Treatment Dental Anxiety”	“Anticipatory Dental Anxiety”
Mdas1 If you went to your dentist for treatment tomorrow, how would you feel?		0.944		0.914
Mdas2 If you were sitting in the waiting room, how would you feel?		0.853		0.865
Mdas3 If you were about to have your teeth drilled, how would you feel?	0.830		0.722	
Mdas4 If you were about to have your teeth scaled and polished, how would you feel?	0.871		0.757	
Mdas5 If you were about to have a local anesthetic injection in your gum, above an upper back tooth, how would you feel?	0.803		0.858	

Note: Extraction method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

**Table 3.** Mean score of anticipatory and treatment dental anxiety in relation to different levels of clinical anxiety.

	Clinical anxiety (BAI)			group difference	pairwise differences <sup>b</sup>
	No anxiety	Mild anxiety	Moderate/Severe anxiety		
	mean (sd)	mean (sd)	mean (sd)		
<b>MEN</b>	n=119	n=13	n=0		
<b>Anticipatory Dental Anxiety</b>	3.2 (1.6)	4.6 (2.1)	-	0.004	No vs. Mild
<b>Treatment Dental Anxiety</b>	6.9 (2.9)	8.3 (3.1)	-	0.146	--
<b>WOMEN</b>	n=551	n=135	n=27		
<b>Anticipatory Dental Anxiety</b>	3.8 (1.9)	4.5 (1.9)	5.0 (2.2)	<0.001	No vs. Mild No vs. Moderate/severe
<b>Treatment Dental Anxiety</b>	7.7 (3.0)	9.3 (3.0)	9.8 (3.4)	<0.001	No vs. Mild No vs. Moderate/severe

Note: Anticipatory Dental Anxiety=Sum score of first two items of the MDAS test. Treatment Dental Anxiety=Sum score of the three last items of the MDAS test. BAI=the Beck's Anxiety Inventory.

<sup>a</sup>One-way analysis of variance or Kruskal-Wallis test, two-tailed significance.

<sup>b</sup>Only statistically significant ( $p < 0.05$ ) differences between two groups are reported.

our study sample in more detail, the participants ( $n=99$ , 9 males, 90 females) fulfilling the criteria for dental anxiety ( $MDAS \geq 19$ ) were analyzed separately. Of these females, 58 (67.8%) had no clinical anxiety at all, while 21 (24.4%) had mild and 7 (8.1%) had moderate/severe anxiety. All dentally anxious males came from the group of participants without any clinical anxiety. Six (66.7%) of the males had no depression, while 1 (11.1%) male had mild and 2 (22.2%) males suffered from moderate depression. In the females, 48 (53.3%) had no depression and 25 (27.8%), 14 (15.6%) and 3 (3.3%) subjects suffered from mild, moderate and severe depression, respectively.

#### Association between anticipatory and treatment dental anxiety

The results of our factor analysis revealed a two-factor model for both male and female participants (Table 2). The factors termed as “Treatment dental anxiety” and “Anticipatory dental anxiety” were similar to the model suggested by Yuan and colleagues [16] and Weiner and Sheehan [17].

The results regarding the association of Anticipatory and Treatment Anxiety with clinical anxiety (BAI) are shown in Table 3. The Anticipatory Treatment Anxiety scores differed statistically significantly between the categories for clinical anxiety in both male ( $p=0.004$ ) and female ( $p < 0.001$ )

participants. In males, statistically significant pair-wise differences in scores were observed between the subgroups with mild and no clinical anxiety ( $p=0.004$ ) and, in females, between the groups with mild ( $p=0.002$ ) and moderate/severe ( $p=0.006$ ) clinical anxiety as compared to females without clinical anxiety. Treatment Dental Anxiety was only associated with clinical anxiety in females ( $p < 0.001$ ). The scores were significantly higher in females with mild ( $p < 0.001$ ) or moderate/severe ( $p=0.001$ ) clinical anxiety than in females without clinical anxiety.

Table 4 presents the results of the association between Anticipatory and Treatment Dental Anxiety and clinical depression (BDI). The mean score for Anticipatory Dental Anxiety was shown to differ statistically between the categories for clinical depression in both male ( $p=0.034$ ) and female participants ( $p < 0.001$ ). In males, the scores differed statistically significantly between the subgroups with mild and no clinical depression ( $p=0.034$ ), while in females the scores were significantly higher in subgroups with mild ( $p < 0.001$ ) and moderate/severe ( $p < 0.001$ ) clinical depression. Treatment dental anxiety was only associated with clinical depression in females ( $p < 0.001$ ). Those with mild ( $p < 0.001$ ) or moderate/severe ( $p < 0.001$ ) depression had higher scores for Treatment dental anxiety than females without depression.

**Table 4.** Mean score of anticipatory and treatment dental anxiety in relation to different levels of clinical depression according to Beck's Depression Inventory (BDI).

	Clinical depression (BDI)			group difference	pairwise differences <sup>b</sup>
	No depression	Mild depression	Moderate/Severe depression		
	mean (sd)	mean (sd)	mean (sd)		
				p-value <sup>a</sup>	
<b>MEN</b>	n=102	n=23	n=11		
<b>Anticipatory Dental Anxiety</b>	3.1 (1.5)	3.9 (1.9)	4.0 (2.6)	0.034	No vs. Mild
<b>Treatment Dental Anxiety</b>	6.9 (2.8)	7.7 (3.1)	6.6 (3.9)	0.456	--
<b>WOMEN</b>	n=540	n=130	n=66		
<b>Anticipatory Dental Anxiety</b>	3.8 (1.9)	4.6 (2.1)	4.9 (2.2)	<0.001	No vs. Mild No vs. Moderate/Severe
<b>Treatment Dental Anxiety</b>	7.7 (2.9)	9.3 (3.0)	9.4 (3.4)	<0.001	No vs. Mild No vs. Moderate/Severe

Note: Anticipatory Dental Anxiety=Sum score of first two items of the MDAS test. Treatment Dental Anxiety=Sum score of the three last items of the MDAS test. BDI=the Beck's Depression Inventory.

### Discussion

This study confirmed the presence of an association between dental anxiety – as determined by using the Modified Dental Anxiety Scale (MDAS) – and both clinical anxiety and clinical depression among young Finnish adults, as measured using Beck's Anxiety Inventory (BAI) and Beck's Depression Inventory, respectively. The results of the factor analyses suggest there may be some underlying difference in the basic nature of dental fear between genders. In females, both anticipatory and treatment dental anxiety were associated with clinical anxiety and depression, while in males the association was only seen in anticipatory dental anxiety.

Our findings showed that clinical anxiety was related to dental anxiety in both genders. However, in the case of clinical depression, an association with dental anxiety was only found in females. In general, dental anxiety (MDAS scores  $\geq 19$ ) in our study sample was more common among females compared to males. The study by Humphris and colleagues [22] reported that dental fear (MDAS scores  $\geq 19$ ) was highest among females and patients aged 18-39 year. One possible explanation for this may relate to gender; it is generally accepted that women are more prone to react to unfavorable life events with depression, while "bad" or even antisocial behavior is more typical in men [23].

In male participants, only anticipatory dental anxiety, which is considered to be an exogenous component of dental fear [16,17] was found to be associated with clinical anxiety and depression. The results suggest that "waiting for the treatment" is more fear-provoking for males than the treatment procedures themselves. This may also explain, at least in part, why men are less likely to attend for dental treatment. More research on exogenous and endogenous forms of dental anxiety is needed, because studies on these factors are still rare.

But when a fearful patient is encountered in the dental practice, a significant challenge for all clinicians, including experienced professionals, is to recognize patients with depression underlying their symptoms. For screening purposes, MDAS has been shown to be an effective tool for measuring dental anxiety [22]. Further studies are required to

determine whether it is necessary to screen for other potential underlying illnesses associated with dental fear. The results of this study indicate that, at the very least, clinical levels of depression and anxiety are significant contributing factors in dental anxiety in young people.

The strength of our study was that the participants form a representative group of young Finnish adults. The sample size was large and the research instruments used (MDAS, BAI, BDI) were standardized and are widely used in scientific research. A limitation was that the longitudinal aspect of dental anxiety could not be investigated, since dental anxiety and clinical anxiety and depression were measured cross-sectionally at one time-point. Another limitation was that the participants' medical and/or psychiatric history was not investigated. It would have been useful, for example, to have information on alcohol intake, thus enabling an evaluation of the role of dental anxiety in the circulus vitiosus of substance abuse- depression- phobia. Finally, the number of male participants (n=136) was notably lower than female participants (n=737). This may have caused some weakness in statistical analyses related to male participants.

### Conclusion

As a conclusion, dental anxiety has a multicausal etiology. In clinical work, a professional-manner and painless dental treatment are advisable ways of dealing with patients suffering from dental fear. Discussion of previous traumatic dental treatment experiences and efforts focused on avoiding their repetition may also alleviate patients' dental fear. In severe cases of dental fear, however, a dentist should encourage patients to seek help from mental care professionals. Clinical anxiety or depression may be underlying in cases of dental fear, and it is important that patients affected are seen by the appropriate health professionals.

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