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## **A Test of Berggren's Model of Dental Fear and Anxiety**

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### **Running title: A Test of Berggren's Model**

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### **Abstract**

Berggren's (1984) model of dental fear and anxiety predicts that dentally anxious individuals postpone treatment, leading to a deteriorating dental state, and subsequently to fear of negative evaluations in relation to their oral condition. The present study aimed to test one of the core assumptions of this model, namely that deterioration of dental health status would mediate the effects of avoidance of dental care on self-reported fear of negative evaluation. Participants were 73 patients (mean age = 38.5 yrs) meeting the DSM-IV-TR criteria of dental phobia. Variables in the theoretical model were operationalized with multiple measures. A series of Sobel tests indicated that mediation was present for the relation between years of avoidance and fear of negative self-evaluation in case dental health status was based on the assessment of dentists ( $P < 0.001$ ) or patients' opinion of their own dental state ( $P < 0.016$ ), but not when dental health status was operationalized as DMFS ( $P > 0.195$ ). Although the findings are supportive of Berggren's model, other causal pathways that contribute to the perpetuation of anxiety and fear still need to be tested. The results suggest that individuals with high levels of dental anxiety would particularly benefit from interventions specifically designed to break their avoidance pattern.

Keywords: fear, dental anxiety, dental phobia, specific phobia

## **Introduction**

It has been asserted that patients' dental anxiety is maintained and increased by a unique self-perpetuating pattern (1-6). According to Berggren, fears of dental objects and situations lead to avoidance, to deterioration of dental health, and accordingly to negative self-conscious evaluations (resulting in experiencing emotions such as shame, guilt and embarrassment), thereby increasing the likelihood of dental fear and anxiety (7).

Although Berggren's thesis has been cited by dozens of other authors, there have been remarkably few attempts to validate his model. Probably the most explicit test of Berggren's model so far used a health survey to examine associations among dental anxiety, delayed dental visits, self-reported oral health status and the use of dental services among a random sample of more than 6000 Australian residents (2). Although this study concluded that the results were generally supportive of a vicious cycle of dental anxiety, only less than one third of the respondents who reported a high level of dental anxiety appeared to meet the profile of the alleged vicious cycle model. These findings highlight the need for a further empirical examination of the model, and the way the various components of the model might contribute to the maintenance or exacerbation of dental trait anxiety.

One of the core assumptions of Berggren's model involves the relationship among avoidance of dental care, dental health status and apprehension about others' negative evaluations.

Although studies using population surveys generally yield support for significant relationships between avoidance, dental health status and various operationalizations of self-consciousness and fear of negative evaluation (2, 5, 8), studies using objective criteria (e.g., DMFT, dental x-rays) to determine dental health status are scarce (1, 9-12). These studies, carried out among samples with adult dentally anxious individuals, show that those who never or occasionally visit a dentist, have an overall poorer dental status with significantly more missing teeth (1)

and root remnants (10), than those receiving regular dental care. Moreover, it appears that dental health status is significantly associated with social impairment and negative social consequences of people's anxiety problems (2, 10-11). Anxious patients with poor dental health (in terms of dentist's opinion, DMFT or the presence of root remnants) not only report more problems at work and with talking to other people, but they also indicate to have fewer romantic relationships and relationships with friends than those with a healthy dentition (2, 10-11).

Although these findings suggest that factors like avoidance of dental care, dental health status and fear of negative evaluation play a role in the maintenance or exacerbation of existing levels of dental anxiety, until now, associations among these variables have only been investigated in terms of bivariate relationships within the model. The main aim of the present study was to test the hypothesis that deterioration of dental health status plays a mediational role in the association between the extent to which dentally anxious patients avoid dental treatment and fear of negative evaluation. Such an approach allows putative associations to be decomposed into components that reveal possible causal mechanisms, which is deemed to be useful for theory development and for the identification of possible targets for intervention (13).

## **Method**

### *Subjects*

Participants were patients attending the centre of specialised dental care (SBT) in Amsterdam, The Netherlands. All were referred to the centre by their dentist or family doctor in the region of Amsterdam. Patients were included if they had a minimum age of 18 years. All patients refused conventional dental treatment, fulfilled the DSM-IV criteria for specific phobia (i.e.,

dental phobia, 14), had a Dental Anxiety Scale (DAS) score of 15 or higher, a score on the short version of the Dental Anxiety Inventory (S-DAI) of 30 or higher, and no missing data with regard to the relevant variables. A sample size calculation indicated that with an estimated medium effect size of  $r=0.30$  for the relation between avoidance and fear of negative evaluation, a two-sided significance level of 5% and a desired power of 70%, a minimum of 67 patients is required (15).

### *Procedure*

All patients who applied for treatment completed the Dutch version of the Dental Anxiety Scale (DAS; 16) and the Dutch version of the short version of the Dental Anxiety Inventory (S-DAI; 17-18) to assess severity of dental trait anxiety. The study was conducted in accordance with the Declaration of Helsinki. Patients were invited to participate in the study while patients were waiting for their assessment appointment. Written informed consent was obtained from all patients who agreed to participate following explanation of procedures. Next, patients were asked to fill out the Social Attributes of Dental Anxiety Scale (SADAS; 19-20). The subscale score 'social inhibition' of the SADAS (with items like "I refuse social invitations because of the state of my teeth") was used as an index of fear of negative evaluation and negative self-evaluation (21-22) in relation to patients' dentition. During the first assessment interview with the patient, an orthopantomogram (OPG), and a standardized photograph of the front teeth were taken. The DMFS index, the most commonly used index of cumulative dental experience, was determined as an index of dental deterioration. This index was calculated by the summation of the number of decayed (primary and secondary caries), filled (all types of filling materials and crowns), and missing (irrespective of the reason) surfaces, with four surfaces being considered for anterior teeth,

and a fifth surface for posterior teeth. These numbers were based on 28 teeth (third molars were excluded). Inspection was visual using a dental mouth mirror.

Further, data were collected on gender, age, country of origin and number of years avoiding dental care. Next, patients were asked to rate the level of embarrassment when confronted with his or her own teeth (“On a scale from 0 to 100, how embarrassed are you at the sight of your own teeth?”), and to evaluate the health state of their dentition (Dental Health State, DHS; “On a scale from 0 to 100, how healthy is the state of your teeth according to you?”). For this purpose separate Visual Analogue Scales (VAS embarrassment and VAS patients’ DHS, respectively) were used, ranging from 0 (‘not at all’) to 100 (‘extremely’), and from 0 (‘very poor’) to 100 (‘very good’).

Three different experienced dentists were instructed to provide an overall judgement about the health state of patients’ dentition after having evaluated, independently from each other, patients’ OPG (“Please carefully evaluate the state of patient’s dentition and indicate your judgement, on a scale from 0 to 100”). The dentists, who were blinded to patients’ biographic data including name, gender and age, and the judgment of their colleagues, were asked to indicate their response on a VAS-scale, ranging from 0 (‘very poor’) to 100 (‘very good’). Next, they were confronted with the photograph depicting the patient’s front teeth and were requested to judge the health status of patients’ front teeth (“Please indicate the state of this patient’s front teeth, on a scale from 0 to 100”), using a VAS-scales ranging from 0 (‘very poor’) to 100 (‘very good’). The interobserver reliability was assessed by intraclass correlation coefficients (ICC’s). The ICC for the OPG score was 0.97 ( $p < 0.001$ ) and for the photograph 0.96 ( $p < 0.001$ ). Since there was a substantial agreement of ratings among the three dentists, the average of the mean of the three dentists’ scores regarding patients’ OPG and the photograph of their front teeth (i.e., dentists’ Dental Health State: VAS dentists’ DHS) was used for further analyses.

Figure 1 about here

### *Statistical methods*

Statistical analysis was performed using PASW Statistics 18. Differences between the various groups were tested using independent sample t-tests with a 5% significance level. To examine the mediational effects of dental health state, the process and criteria outlined by Baron and Kenny (23) and Shrout and Bolger (13) were used. That is, in the first step it was determined whether the predictor variable was significantly correlated with the outcome variable by calculating Pearson correlation coefficients (path c). Second, it was assessed whether the predictor variable was significantly correlated with the mediator (path a, Pearson correlation coefficient). Third, it was assessed whether the mediator affected the outcome variable, while the influence of the predictor variable is controlled for by calculating partial correlation coefficients (path b). Furthermore, it was assumed that mediation was present if the relationship (partial correlation coefficient) between predictor and outcome variable (path c') was significantly reduced, while controlling for the effect of the mediator (in case of partial mediation), or was zero (in case of total mediation). The statistical significance of the presence of mediation was assessed by the Sobel test (24).

## **Results**

### *Descriptive data and relationships among variables*

Seventy-three patients fulfilled the inclusion criteria (26 men and 47 women) and agreed to participate. Their mean age was 38.5 years (range: 19-63 years, SD = 11.0). They had avoided a visit to a dentist for an average of 7.5 years (SD=9.7) with a range from 0 to 40 years. The descriptive data are displayed in Table 1. *T*-tests demonstrated that VAS dentists' and



patients' DHS were significantly higher for women than for men, while scores on avoidance and negative self-evaluation (VAS embarrassment) were significantly higher for men than for women (see Table 1).

Table 1 about here

The three indices of patients' dental health state were found to be significantly associated. The VAS dentists' DHS correlated with both DMFS ( $r = -0.69$ ,  $P < 0.001$ ) and VAS patients' DHS ( $r = 0.63$ ,  $P < 0.001$ ), and DMFS was significantly correlated with VAS patients' DHS ( $r = -0.48$ ,  $p < 0.001$ ). Similarly, the two scores measuring fear of negative evaluation, the SADAS and VAS embarrassment, were highly correlated ( $r = 0.75$ ,  $P < 0.01$ ).

*Deterioration of dental health state as a mediator between avoidance of dental care and fear of negative evaluation*

As shown in Figure 1, step 1 yielded a significant relationship between years of avoidance of dental care and both SADAS social inhibition ( $r = 0.35$ ;  $P = 0.003$ ) and VAS embarrassment ( $r = 0.38$ ;  $P = 0.001$ ), suggesting that years of avoidance is a predictor of fear of negative evaluation (path c).

With regard to the second step, whether the predictor variable (years of avoidance) was significantly correlated with the mediator (dental health state; path a), it was found that the correlations between avoidance and the VAS dentists' DHS and VAS patients' DHS were both statistically significant ( $r = -0.50$ ,  $P < 0.001$  and  $r = -0.32$ ,  $P = 0.006$  respectively).

However, years of avoidance was not predictive of dental health state as indexed by DMFS ( $r = 0.18$ ,  $P = 0.133$ ).

Regarding the third step, whether the mediator (dental health state) was related to the outcome variable (fear of negative evaluation), while the influence of the predictor variable (years of avoidance) is controlled for (path b), it was found that all correlations between the various operationalizations of both variables reached significance (all Ps at least  $<0.009$ ; see Table 2).

Table 2 about here

Step 4 (path c' in Fig. 1) gave mixed results. Mediation was shown to be present in case dental state was indexed by VAS dentists' DHS and VAS patient's DHS. That is the relationship between years of avoidance and the outcome variables tapping fear of negative evaluation was no longer significant when controlling for VAS dentists' DHS and VAS patient's DHS. Conversely, the significant relation between years of avoidance and fear of negative evaluation persisted, while controlling for the effect of dental state when operationalized by DMFS. The results of the Sobel test confirmed that mediation was present for the relation between years of avoidance and negative self-evaluation in case dental health status was assessed by VAS dentists' DHS and VAS patient's DHS, but not with DMFS as a mediator (see Table 3). The analyses for men and women separately yielded similar results.

Table 3 about here

## **Discussion**

According to Berggren (7) dentally anxious individuals postpone treatment due to anticipatory fear of one or more aspects of the dental treatment situation, leading to a deteriorating dental status, and subsequently to fear of negative self evaluations as a consequence of how they perceive (others to perceive) their oral condition. The present study

investigated one of the core assumptions of this influential model on dental fear, namely that dental health status would mediate the effects of avoidance of dental care on self-reported fear of negative evaluation. Our results support this main hypothesis. Consistent with previous reports (1, 10), years of avoidance was found to be significantly associated with a poorer dental status. Furthermore, a less healthy dental status appeared to be significantly associated with more negative social consequences, and greater embarrassment related to the dentition (1, 10, 11). Moreover, when the effect of dental health was controlled for, the significant effects of years of avoidance on fear of negative evaluation disappeared. This was true for dental health status as indexed by both the judgments of the dentists and patients' own opinion of their dental state, but not when dental health status was operationalized as DMFS. One explanation is that DMFS is less appropriate as a measure of dental deterioration for use in samples of highly anxious patients than for use in community samples. Since many dentally anxious people prefer to have their teeth extracted instead of restored when dental treatment is needed, the consequence of avoidance may not always be 'filled' surfaces, but untreated tooth decay or missing teeth (25-26). Accordingly, it could be that in patients with high levels of dental anxiety tooth extractions result in greater loss of surfaces compared to when caries would have been left untreated, while in their low anxious counterparts filling leads to greater loss of healthy surfaces. This may explain not only the observation that DMFS or DMFT do not automatically differ between groups of high and low dental fear (25), but also why DMFS did not moderate the association between avoidance and fear of negative evaluation in the current study.

The present study has a number of strengths, including the use of a wide variety of operationalizations for the variables in the model. Further, the inclusion of both objective and subjective measures may have optimized the validity of the measurement method and the external validity. To this end, it is important to note that, until now, fear of negative

evaluation had only been examined in relation to individuals' fears or avoidance behavior, or their inability to do something about it (5; 27), or was operationalized as satisfaction, or even as self-reported condition of the teeth (28-29). Unfortunately, these constructs seem to bear little resemblance to fear of negative evaluation, negative self-evaluation or the experience of embarrassment.

A number of limitations also give rise to comment. First, causality cannot be determined with a cross-sectional design. Longitudinal studies are needed to test causal pathways among avoidance patterns, dental health state and apprehension about possible negative evaluations by others. Second, the sample in this study consisted of dental phobic patients seeking treatment in a specialized dental fear clinic. Thus, the results may not apply to individuals with lower levels of dental fear. Therefore, it would be enlightening to replicate the present study using a sample of individuals showing a wide range of levels of dental anxiety, from those with no anxiety at all to patients fulfilling diagnostic criteria of specific (i.e., dental) phobia. Third, another core assumption of Berggren's model, that fear of negative evaluation is a mediator between dental health condition and dental trait anxiety, has not been tested. A reason for this is that a sample of patients with only phobic levels of dental anxiety would restrict the range of scores due to ceiling effects, which attenuates correlations among variables. On the other hand, other pathways are still possible and may even be more likely. For example, an alternative explanation of how dental trait anxiety is maintained is that, rather than by negative self-evaluation, severe levels of dental trait anxiety are reinforced by patients' exaggerated appraisal of their oral state as being poor (1, 3, 30-32). The prospect of relatively deep fillings, root canal treatments, and extractions is likely to aggravate patients' worries: with more potentially invasive treatments, the higher the chance this goes wrong. This may induce anticipatory anxiety and avoidance behavior and, consequently, a further deterioration of the oral state. In other words, negative self-evaluation may simply be an

epiphenomenon and an emotional response to the visible deterioration of the teeth, whereas individuals' catastrophizing thought patterns play a central role in enhancing patients' level of trait anxiety.

Taken together, the present findings provide support for the notion that avoidance of dental care is associated with deteriorated dental health condition, and consequently, with the likelihood of experiencing fear of negative evaluation. Given the importance of avoidance of dental care as a risk factor for a deteriorating dental health condition it is pivotal to develop accessible solutions and directed innovative interventions for people with dental phobias. This would break their avoidance pattern and facilitate them finding their way to either dental or mental health care in order to achieve increased wellbeing and significant health benefits at relatively low costs.

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**Table 1. Demographic and clinical characteristics of all patients, and of women and men separately (n=73)**

	Total		Gender				p
			Men (n=26)		Women (n=47)		
	Mean	(SD)	Mean	(SD)	Mean	(SD)	
Age in years	38.5	(11.0)	37.9	(10.4)	38.9	(11.3)	0.732
DAS	18.1	(1.7)	17.8	(1.8)	18.3	(1.7)	0.207
S-DAI	41.0	(4.2)	40.0	(4.5)	41.5	(3.9)	0.128
Years of avoidance	7.5	(9.7)	13.1	(12.8)	4.5	(5.5)	0.003
VAS dentists' DHS	54.2	(22.4)	46.4	(24.3)	58.6	(20.3)	0.025
VAS patients' DHS	27.7	(25.0)	17.7	(16.3)	33.3	(27.3)	0.003
SADAS social inhibition	9.4	(5.5)	10.7	(5.5)	8.6	(5.4)	0.126
VAS embarrassment	59.9	(38.5)	73.3	(27.4)	52.5	(41.8)	0.013
DMFS index	48.1	(24.5)	51.6	(26.2)	46.2	(23.6)	0.368

**Table 2. Relationship between the mediator dental health state and the dependent variable (n=73; path b of Baron & Kenny, 1986).**

<i>Mediator</i>	<b>SADAS social inhibition</b>		<b>VAS embarrassment</b>	
	<b>r</b>	<b>P</b>	<b>r</b>	<b>p</b>
<b>DMFS</b>	0.34	0.004	0.31	0.009
<b>VAS dentists' DHS</b>	-0.51	<0.001	-0.51	<0.001
<b>VAS patient's DHS</b>	-0.51	<0.001	-0.62	<0.001

**Table 3. Relationship between years of avoidance and fear of negative evaluation while controlling for dental health state (n=73; path c' of Baron and Kenny (22) and the results of the Sobel test (z-value)**

	SADAS social inhibition		Sobel test		VAS embarrassment		Sobel test	
	<b>r</b>	<b>P</b>	<b>z</b>	<b>p</b>	<b>r</b>	<b>p</b>	<b>z</b>	<b>p</b>
<i>Mediator</i>								
<b>DMFS</b>	0.31	0.008	1.30	0.195	0.35	0.003	1.26	0.208
<b>VAS dentists' DHS</b>	0.08	0.522	3.44	<0.001	0.12	0.332	3.44	<0.001
<b>VAS patient's DHS</b>	0.22	0.066	2.40	0.016	0.24	0.043	2.57	0.010

**Figure 1. Berggren's vicious cycle model of dental fear and anxiety, operationalizations and correlations among the variables (n=73)**

a, b, c and c' refer to Baron and Kenny's (22) steps to test mediation.

\* Years of avoidance was not predictive of dental health state as indexed by DMFS.

† Sobel test indicated that mediation was present for the relation between years of avoidance and fear of negative self-evaluation in case dental health status was assessed by VAS dentists' DHS and VAS patient's DHS, but not with DMFS as a mediator.

Dental Anxiety Scale (DAS); Dental Anxiety Inventory (S-DAI); Social Attributes of Dental Anxiety Scale (SADAS); Decayed Missing Filled Surfaces (DMFS)-index; Visual Analogue Scales (VAS); Dental Health State (DHS).