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A preliminary investigation of the relationship of dental fear to other specific fears, general fearfulness, disgust sensitivity and harm sensitivity

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Abstract – *Objectives:* People with dental fear often suffer from other psychological disorders, as well as from a number of other specific fears. Fear of going to the dentist may be associated not only with general fearfulness, but also with underlying personality dispositions. This exploratory study, therefore, investigated the associations between dental fear and 67 other specific fears, general fearfulness, disgust sensitivity and harm sensitivity. *Methods:* Participants were 88 Australian adults who were administered the Fear Survey Schedule III (FSS-III), the Harm Sensitivity Index and the Disgust Sensitivity Index. Principle axis factor analysis with Promax rotation was used to examine how dental fear related to other specific fears as measured with the FSS-III. *Results:* Dental fear was significantly correlated with most of the other specific fears, with factor analysis indicating that it tended to load more with fears related to lack of control rather than with what have often been classed as 'medical' fears. Significant associations were found between dental fear and the personality dispositions of general fearfulness, harm sensitivity and disgust sensitivity, although these associations were not linear. *Conclusions:* Findings reveal extensive co-occurrence of other specific fears with dental fear, while the associations of dental fear with personality traits suggest enduring aspects to dental fear which may translate into difficulties in fear alleviation. Dental fear was more related to a diverse range of fears relating to a loss of control than to medical-specific fears.

Key words: dental fear; disgust; fearfulness; pain sensitivity; personality traits

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Recent epidemiological studies have reported the prevalence of high dental fear in Western countries to be about 10–15% (1–3). People with high dental fear have poorer oral health (2, 4) and often suffer significant social and psychological impacts associated with their oral state (1, 5). In addition, people with high dental fear often delay dental visiting and, as a result, may experience a further deterioration in oral health and more traumatic and invasive treatment when they are eventually forced to see a dentist, leading to a maintenance or increase in their level of dental anxiety.

People with high dental fear, or dental phobias, may also suffer from a variety of anxiety disorders, mood disorders, personality disorders and behavioural disorders, as well as from multiple other specific fears (6, 7). These co-occurring fears can be determined by instruments such as the Fear Survey Schedule III (FSS-III) (8) that ask people to report their fear of a large number of items and situations.

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Factor analysis of the FSS-III and its variants has generally found that fear of going to the dentist groups with what are often called 'medical fears' (9–12). However, the relationship between dental fear and other specific fears has yet to be firmly established. For instance, the combination of fears loading on to the 'medical fear' factor appears to vary across studies (10, 13, 14) and the relationship of dental fears to these other medical fears has not been made explicit in the reported results.

It has been proposed that dental fears can be classified as either exogenous or endogenous (15). Exogenous fear is believed to be based on conditioned responses to aversive experiences, whereas endogenous dental fear reflects a constitutional vulnerability to anxiety disorders and multiple fears (7). In support of the concept of endogenous fear, studies have found a high prevalence of other specific fears among dentally fearful individuals (6, 16). For example, among patients with extreme dental fear, Berggren found high percentages with fears of suffocation (53%), pain (49%), death of a loved one (43%), hypodermic needles (37%), untimely or early death (35%), sharp objects (33%), death (32%), heights (32%) and other stimuli (16).

A predisposition for general fearfulness can be seen as an aspect of a person's general temperament or personality. Although there has been relatively little research into the relationship between personality traits and dental fear, there is at least theoretical support for this association. There is, for example, evidence that pain sensitivity is related to dental fear (17). Certainly, the experience of dental pain is considered to be highly aversive (18) and even patients undergoing routine restorative procedures frequently report pain (19, 20). Gross believes that pain sensitivity interacts with pain expectancies in dental situations resulting in fear and subsequent dental avoidance (17). Given that highly fearful dental patients have an overestimated fear of dental pain (21), it is quite plausible that pain sensitivity is an important component of expectations of and reactions to dental procedures.

An interesting possibility is that disgust sensitivity is also related to dental fear. Recent research indicates that disgust plays an important role in some anxiety disorders (22). Of particular relevance to dentistry is the relationship between disgust and anxiety in blood-injury-injection (BII) fears (23). BII fears form one of the four primary subtypes of specific phobias as classified by the Diagnostic and Statistical Manual of Mental Disorders IV (24) and relate to fear cued by seeing blood or an injury or by receiving an injection or by other invasive medical procedures. There is considerable evidence attesting to the fear of needles experienced by many dentally phobic individuals (25, 26). It might be expected, therefore, that individuals with dental fear may also demonstrate disgust sensitivity. Indeed, Merckelbach and colleagues found that both dentally anxious and dental phobic individuals had higher disgust sensitivity than a sample of undergraduate students with less dental fear (27). Yet, they concluded that their data indicated that disgust sensitivity plays only a minor role in BII-related fears such as dental anxiety. A major limitation of this study; however, was that disgust sensitivity was measured using a scale that focussed purely on concerns about food contamination and this may not represent a good index of general disgust sensitivity. It is important, therefore, that the specific association between fear of going to the dentist and disgust sensitivity be investigated further.

A theoretical model relating personality traits to dental fear is presented in Fig. 1. Personality traits, such as disgust and pain sensitivity among others, are seen as impacting upon dental fear via perceptions of the dental situation. These proposed associations are based on a model of the aetiology of fear presented by Armfield (28). This model proposes that anxiety and fear in relation to any given object or situation is a direct function of the perception of the object or situation as uncontrollable, unpredictable, dangerous and disgusting. These perceptions contribute to an overriding sense of vulnerability in regards to the stimulus and are the result of an accumulation of experiences modified by personality traits related to the specific cognitive vulnerability variables. According to this model of the aetiology of fear, personality traits such as pain sensitivity and disgust sensitivity can

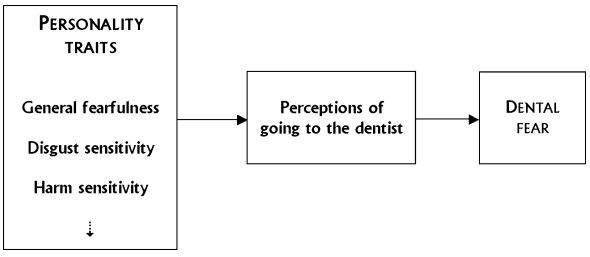

Fig. 1. Proposed model of relationships between personality traits and dental fear.

form a part of the causal chain of the origin of dental fear.

This study represents a preliminary attempt to determine the relationship between dental fear and the personality predispositions of general fearfulness, pain sensitivity and disgust sensitivity. In addition, it sought to examine dental fear as it relates to a broad range of other specific fears.

Materials and methods

Participants

The study involved 88 adult undergraduate psychology students in Adelaide, South Australia. There were 68 females (77.3%) and 19 males (21.6%) with one person not indicating his or her sex. The age of participants ranged from 18 to 53 years (mean = 23.3 years; SD = 8.54). Ethical approval for the study was obtained and participation in the study was voluntary.

Dental fear and other specific fears

Fear of dentists was assessed using the single item from the FSS-III, which asked how much fear people have of dentists. A more comprehensive multi-item measure of dental fear was not used as this would have restricted the comparability of the factorial analysis of the FSS-III with that of other studies. Although the FSS-III originally comprised 72 items measuring 6 domains of fear-relevant stimuli (8), social anxiety-evoking stimuli were excluded from the scale in the current study because they belong more correctly to social phobias and additional items from a subsequent Australian revision (10) were added, creating a total of 68 items. Participants were asked to indicate, for each item or situation, '…how much actual fear (not dislike or disgust) you have of it nowadays.' Answers were scored from 1 (None at all) to 5 (Very much). A general fearfulness score was obtained by calculating the mean fear score across all items (excluding the dental fear item), whereas a measure of high fearfulness was obtained by summing the number of items (again, excluding the dental fear item) with a fear response of 3 or greater ('A moderate amount', 'Much' or 'Very much').

Harm sensitivity

The Harm Sensitivity Index (HSI) was created by combining items from the Pain Sensitivity Index (17) and the Pain Anxiety Symptoms Scale (29), in addition to some newly developed items. The scale comprised 16 items measuring feelings about and reactions to pain and danger. Example items were: 'It is important for me to avoid any pain' and 'I worry about getting hurt'. Responses range from 1 (Not at all) to 7 (Very much).

Disgust sensitivity

The Disgust Sensitivity Scale (DSS) (30) is a modified 28-item scale measuring 6 domains of disgust elicitors (food, animals, body products, body envelope violations, death and hygiene). One of the original disgust domains (Sex; four items) was excluded because of its potentially offensive nature. The scale is presented in two sections: Section 1 contains 14 statements with True/False responses (scored 0 or 3); Section 2 presents 14 situations and requires people to rate how disgusting they would find the situation to be on a 4-point scale, with responses ranging from 0 (not disgusting at all) to 3 (very disgusting).

Statistical analysis

Exploratory factor analysis was conducted on the 68-item FSS-III using Principal Axis Factor extraction with Promax ($\kappa = 4$) rotation and Keiser Normalization. The goal was to identify underlying latent constructs that explain the relationships between the observed variables. Factor analysis is considered to be the appropriate statistical technique for this task (31, 32). An oblique rotation method was employed as there has been no empirical support for the assumption that fears are uncorrelated (10). Because there is no completely accurate method to determine the number of factors to retain, the use of multiple decision rules is desirable. Interpretation of the Scree plot, considerations from previous research, the need to balance simplicity with good representation of the data, as well as factor interpretability were used to guide decisions on the number of factors to be extracted. Based on previous research, factor solutions with between 3 and 7 factors were examined and interpreted. In accordance with recommendations (32), factor loadings of 0.32 or greater were considered to indicate salient factors.

Dental fear was categorized to create three fear groups corresponding to 'None at all', 'A little' and 'A moderate amount, Much or Very much'. One-way ANOVAS, with *post hoc* comparisons using Scheffe's corrections, were used to test for differences in general fearfulness, disgust sensitivity and harm sensitivity across the three groups. Pearson's

correlation coefficients were computed to examine the linear associations between dental fear and other specific fear items.

Results

Dental fear and other specific fears

Before examining the factor structure of the FSS-III, the data were analysed to assess appropriateness for factor analysis. Communalities for extracted variables were all well below one, indicating the absence of singularity and multicollinearity. In addition, Bartlett's Test of Sphericity was significant ($\chi^2 = 5\,387.63$, $P < 0.001$). However, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was only 0.43, which does not exceed the suggested cutoff of 0.60 (32).

Examination of the Scree plot indicated that a 5- or 6-factor solution might best fit the data. However, because previous research has indicated differing numbers of factors for the FSS-III and for the FSS for Children, a range of factor solutions were examined. Table 1 presents summaries of the adequacy of 3- through 7-factor solutions. While solutions with fewer factors contained higher numbers of nonsalient items, solutions with higher numbers of extracted factors contained increasing numbers of complex items, making interpretability more difficult. Both examination of the factor solutions in Table 1 and interpretation of the meaningfulness of the structure matrix of the principle axis factor analyses indicated that the best fitting outcome involved a 5-factor solution. These factors accounted for 49.3% of the variance in loadings with all but 6 of the 68 items having rotated loadings greater than 0.32. Cronbach's alpha was used to test the internal consistency of the extracted factors, with all factors showing good internal reliability (alphas = 0.92, 0.92, 0.86, 0.87 and 0.84, respectively). A number of factor correlations exceeded 0.32, indicating in excess of 10% overlap in variance among factors and confirming the appropriateness of employing an oblique rather than an orthogonal rotation procedure. To examine the stability of the 5-factor solution, principle components analysis (PCA) with both Varimax and Promax rotation was also computed. Overall, the same 5 conceptual factors emerged.

Table 1. Characteristics of factor solutions using principal components extraction and promax rotation[a]

Number of factors extracted	Total percentage of variance explained	Number of complex items[b]	Number of non-salient items[c]
Three	39.93	7	13
Four	45.13	13	8
Five	49.28	13	6
Six	52.68	18	7
Seven	55.98	22	4

[a]$\kappa = 4$.
[b]Complex items have pattern loadings ≥0.32 on two or more factors.
[c]Nonsalient items have pattern loadings ≤0.32 on all extracted factors.

Examination of the factor loadings from the 5-factor solution revealed significant differences from previous investigations. The pattern loadings for the 5-factor solution are shown in Table 2. Fear of dentists loaded highest on Factor I with a diverse group of items that were interpreted as relating to situations or objects involving lack of control rather than on Factor II that comprised items often classified as medical-related fears. Indeed, Factor II appeared to have more to do with blood-injury-illness and disgust-related fears than with medical/injury fears *per se*, which might explain why fear of doctors loaded highest on Factor III rather than on Factor II.

While 43.2% of people expressed no fear of the dentist, 34.1% indicated a little fear, 12.5% a moderate amount of fear, 8.0% much fear and 2.3% indicated extreme fear. There were significant correlations between dental fear and a wide range of other FSS-III items (Table 2). Although dental fear correlated moderately with items such as fear of receiving an injection ($r = 0.42$) and fear of the prospect of a surgical operation ($r = 0.45$), it also had moderate correlations with numerous items unrelated to dental procedures, such as fear of cockroaches ($r = 0.61$), failure ($r = 0.52$), wasps or bees ($r = 0.50$), lightning ($r = 0.47$), doctors ($r = 0.47$), darkness ($r = 0.45$) and weapons ($r = 0.44$).

Dental fear and personality traits

As people's dental fear increased so did their general fearfulness as measured by their mean FSS-III score, F (23.20), $P < 0.001$ (Table 3). In addition, increased dental fear was associated with people having a greater number of high fears, F (26.53), $P < 0.001$. However, the difference between people with a little fear and those with moderate to high fear did not reach statistical significance, using Scheffe's *post hoc* comparisons. Similarly, although people with no dental fear had significantly fewer

Table 2. Structure loadings for the five-factor solution with promax rotation and correlations of dental fear with each item

Factors and items	Pattern matrix factor loadings					Corr. With dental fear
	Factor I	Factor II	Factor III	Factor IV	Factor V	
Factor I. ''Fears involving loss of control''						*0.57**
Failure	**0.69**	−0.04	0.07	0.29	−0.04	0.52*
Seeing a fight	**0.63**	0.03	−0.29	0.20	0.03	0.42*
Making mistakes	**0.61**	−0.09	0.25	0.16	−0.06	0.37*
Losing control of yourself	**0.60**	−0.28	−0.01	0.10	0.22	0.23*
Being in a strange place	**0.60**	0.03	0.12	−0.11	0.07	0.32*
Darkness	**0.60**	−0.04	0.16	0.20	−0.13	0.45*
Fire	**0.59**	0.19	−0.03	−0.00	−0.09	0.43*
Falling	**0.57**	0.30	−0.14	0.01	0.05	0.42*
Loud voices	**0.53**	−0.06	0.23	−0.10	0.09	0.35*
Sudden noises	**0.52**	0.09	0.01	0.07	0.08	0.41*
One person bullying another	**0.51**	−0.11	−0.06	0.03	0.21	0.37*
Weapons	**0.51**	−0.03	0.06	0.15	**0.45**	0.44*
Sight of deep water	**0.50**	−0.19	**0.35**	0.12	−0.24	0.21
Dentists	**0.43**	0.13	0.07	0.27	−0.13	1.00
Being alone	**0.43**	0.17	−0.10	0.03	0.09	0.20
Thunder	**0.41**	0.03	0.29	−0.03	0.03	0.40*
Enclosed places	**0.39**	0.15	0.13	0.16	−0.28	0.28*
Sick people	**0.39**	**0.36**	0.12	−0.24	0.21	0.29*
Heights	**0.33**	0.17	0.25	0.19	−0.23	0.40*
Factor II: ''Blood-injection-injury and disgust-related fears''						*0.48**
Blood (human or animals)	−0.13	**0.82**	0.17	−0.03	0.05	0.27*
Open wounds	0.12	**0.75**	0.09	−0.06	−0.13	0.39*
Seeing other people injected	0.01	**0.75**	−0.21	0.20	−0.20	0.36*
Witnessing surgical operations	−0.09	**0.71**	0.18	−0.05	−0.03	0.25*
Receiving injections	0.13	**0.70**	−0.18	0.15	−0.36	0.42*
Medical odours	−0.23	**0.66**	**0.40**	−0.00	0.14	0.31*
Dead people	0.29	**0.61**	−0.26	−0.16	0.30	0.35*
Hospitals	−0.02	**0.59**	**0.33**	−0.15	−0.01	0.31*
The prospect of a surgical operation	0.15	**0.58**	0.17	−0.06	0.10	0.45*
Cats	−0.36	**0.46**	0.24	0.28	−0.05	0.25*
Cemeteries	0.10	**0.43**	0.19	−0.08	0.29	0.40*
Dead animals	0.20	**0.43**	−0.01	−0.16	**0.42**	0.36*
People with deformities	−0.10	**0.38**	0.11	0.03	0.14	0.17
Sharks	0.26	**0.34**	−0.09	0.22	0.31	0.37*
Journeys by aeroplane	0.16	**0.33**	−0.02	0.14	−0.17	0.29*
People who seem insane	0.22	0.31	0.01	−0.04	0.16	0.31*
Sirens	0.23	0.29	0.01	−0.07	0.20	0.29*
Factor III: ''Fears related to possible precursors of harm or illness''						*0.41**
Journeys by bus	−0.13	−0.00	**0.69**	0.27	0.20	0.25*
Journeys by car	−0.12	0.10	**0.63**	0.29	−0.01	0.41*
Fish	−0.07	0.13	**0.62**	0.24	−0.08	0.23*
Crossing streets	0.00	0.28	**0.57**	−0.13	0.08	0.19
Dull weather	0.11	−0.11	**0.52**	−0.07	0.23	0.22*
Being in an elevator	−0.14	0.16	**0.50**	0.14	−0.07	0.28*
Dogs	0.07	−0.06	**0.45**	0.23	−0.05	0.40*
Journeys by train	−0.26	0.26	**0.42**	**0.47**	−0.06	0.25*
Germs	**0.35**	0.05	**0.41**	−0.07	−0.06	0.35*
Lightning	0.31	0.02	**0.38**	0.21	0.07	0.47*
Automobiles	0.21	0.12	**0.38**	−0.14	0.00	0.35*
Noise of vacuum cleaners	0.31	0.11	**0.38**	−0.35	−0.18	0.06
Doctors	0.17	**0.33**	**0.37**	0.05	−0.13	0.47*
Dirt	0.12	−0.10	0.20	−0.05	−0.03	0.20
Factor IV: ''Animal fears''						*0.46**
Cockroaches	0.29	0.03	−0.03	**0.69**	0.02	0.61*
Worms	0.00	−0.27	0.15	**0.69**	0.26	0.29*
Frogs	−0.21	−0.18	0.12	**0.57**	**0.41**	0.17
Moths	0.16	−0.15	0.14	**0.57**	0.19	0.27*

Table 2. (*Continued*)

Factors and items	Pattern matrix factor loadings					Corr. With dental fear
	Factor I	Factor II	Factor III	Factor IV	Factor V	
Harmless spiders	0.11	0.19	−0.05	**0.53**	−0.09	0.36*
Bats	0.00	**0.36**	−0.20	**0.48**	0.24	0.23*
Mice or rats	0.09	0.13	0.06	**0.46**	0.24	0.36*
Jellyfish	0.17	0.27	−0.13	**0.39**	0.16	0.44*
Wasps or bees	0.14	**0.37**	−0.05	**0.35**	0.02	0.50*
Harmless snakes	0.00	**0.34**	−0.13	**0.33**	0.32	0.29*
Birds	0.13	0.10	0.03	0.30	−0.17	0.23*
Imaginary creatures	0.20	−0.16	0.15	0.28	−0.12	0.25*
Factor V: ''Improbable fears''						*0.52**
Terrorist attack	0.11	−0.15	−0.01	0.19	**0.80**	0.26*
Nuclear war	0.21	−0.07	−0.08	0.19	**0.70**	0.34*
Feeling angry	0.20	−0.09	0.15	0.04	**0.58**	0.29*
Wolves	0.24	0.07	0.07	0.12	**0.44**	0.24*
Strange shapes	0.26	−0.13	**0.33**	−0.17	**0.41**	0.25*
Fear of large open spaces	−0.18	0.08	−0.07	0.00	0.29	0.10

Bold indicates a salient (≥0.32) loading; *$P < 0.05$.

Table 3. Relationship between dental fear and general fearfulness

Dental fear	*N*	FSS total			FSS high scores[c]		
		Mean	SD	95% CI	Mean	SD	95% CI
None	38	1.45 [a,b]	0.32	1.34–1.55	7.42 [a,b]	7.03	5.11–9.73
A little	30	1.96 [a]	0.39	1.82–2.11	19.97 [a]	8.62	14.74–21.19
Moderate–Very much	20	2.23 [b]	0.58	1.97–2.50	23.75 [b]	13.16	17.59–29.91
		$F = 23.20$, $P < 0.001$			$F = 26.53$, $P < 0.001$		

Same superscripts for means indicate significant pairwise differences ($P < 0.05$) using Scheffe's *post hoc* corrections for multiple comparisons. Means that do not show superscripts are not significantly different.
[c]Mean number of FSS items with a score ≥3 (Moderate, High, Very high).

Table 4. Relationship between dental fear, harm sensitivity and disgust sensitivity

Dental fear	*n*	Harm Sensitivity Index			Disgust Sensitivity		
		Mean	SD	95% CI	Mean	SD	95% CI
None	38	3.15[a,b]	1.01	2.82–3.49	1.14[a,b]	0.63	0.94–1.35
A little	30	4.34[a]	0.85	4.02–4.66	1.57[a]	0.50	1.38–1.76
Moderate–Very much	20	3.98[b]	0.98	3.52–4.44	1.55[b]	0.52	1.31–1.80
		$F = 13.61$, $P < 0.001$			$F = 5.95$, $P = 0.004$		

Same superscripts for means indicate significant pairwise differences ($P < 0.05$) using Scheffe's *post hoc* corrections for multiple comparisons. Means that do not show superscripts are not significantly different.

higher fears (mean = 7.03) than people who were either a little afraid (mean = 19.97) or a moderate to very afraid (mean = 23.75), there was no significant difference in the mean number of high fears of people with a little dental fear compared with those who were moderate to very much afraid.

Both the HSI and DSS showed high internal consistencies as measured by Cronbach's alpha (0.91 and 0.88, respectively). Table 4 shows that dental fear was significantly associated with both harm sensitivity, F (13.61), $P < 0.001$ and with disgust sensitivity, F (5.95), $P = 0.004$. However, this relationship was not linear, with no statistically significant difference in either harm or disgust sensitivity between people with a little dental fear or those with higher levels of dental fear.

Discussion

It is often assumed that dental fear is related to other medical fears and that its aetiology is

contingent upon an aversive experience with an emphasis on fear-relevant stimuli such as injections and drills. However, in this study, dental fear was found to be grouped with fears such as fear of failure, fear of losing control and fear of heights rather than with fear of doctors or fear of receiving injections as has been previously found (11, 12). Although perceived or desired control was not measured in this study, it appears that items loading on to Factor I with fear of dentists all relate to situations or stimuli where a person's perceived control might be compromised. Given research indicating that lack of control is one of the most salient fear-relevant features associated with going to the dentist (33, 34), this is, in hindsight, not surprising. Indeed, it has been argued that perceptions of uncontrollability associated with an event may be more aversive than the event *per se* (33).

The labelling of factors in this study was influenced by the Cognitive Vulnerability Model of the aetiology of fear, which proposes that it is perceptions of a stimulus's uncontrollability, unpredictability, dangerousness and disgustingness which are causal in the determination of anxiety and fear (28). There is emerging evidence that these vulnerability perceptions are related to fear so it makes intuitive sense that a number of the factors should relate to these stimulus characteristics. Nonetheless, there is a strong subjective element to the naming of factors, and the sample size in this study was relatively small, so it will be important to replicate these results with a larger sample.

Given the low Keiser-Meyer-Olkin test score, the factorizability of the data may be seen as poor and the results should therefore be properly viewed as preliminary and in need of corroboration with a larger sample. Such a replication should be seen as a necessary precondition before accepting the interpretation of the factor structure provided here. Indeed, it might also be worthwhile to extend the study to a selected population of highly dentally anxious individuals or even to those people with dental phobias. Nonetheless, and despite the small sample size in this study, the pattern of results was robust and the position of dental fear in the factor structure was consistent and independent of the number of factors extracted, the extraction technique and the method of rotation adopted. This provides some preliminary support for the derived factor structure and the relatedness of dental fear, not with BII and disgust-related fears, but with fears relating to a perceived lack of control.

Dental fear was significantly correlated with a large number of other specific fears. This has implications for studies using measures such as the Dental Fear Scale (35), which incorporate fear of dentally related stimuli such as needles, and also for research that assumes a causative pathway for an association between dental and needle fears (36). Clearly, people with dental phobias are more likely to express other fears, and this is borne out by the strong relationship between dental fear and general fearfulness, as measured using the FSS-III. While fear of injections or undergoing a surgical operation might contribute to the aversiveness of a dental visit it has also been argued that these fears relate more to other painful treatment generally than to dental fear specifically (37). In support of this contention, research in New Zealand found that although fear of the dentist and fear of needles commonly co-occurred they were not synonymous, and it was recommended that cognitive-behavioural treatment strategies should therefore be aimed at both these fears (25).

A final implication of the finding that dental fear is often related to many other specific fears is the need of clinicians to be aware of the strong likelihood that individuals with dental fear also harbour other relevant fears, and that these may present various complications for treatment. There is a need to screen and then introduce appropriate strategies for patients with other dentally relevant fears such as confined spaces, sudden noises, being in a strange place, blood, germs or medical odours. This underlines the importance of teaching cognitive-behavioural techniques for dealing with fearful patients to dental undergraduates. Clinicians should also be aware of some patients' fear of dentist behaviours and other anxious preoccupations. For instance, while people with dental fears commonly report fear of both pain and specific procedures, fear of dental personnel behaviour (rough, incompetent or unsympathetic dentists) and patient's fear of their own emotional responses are also common (38). Other research has found embarrassment to be a common complaint among people with extreme dental anxiety or phobia (39). It should be recognized that perceived vulnerability in dental anxiety has a strong social component and this is especially the case in dental phobias.

The relationships between dental fear and the personality variables of harm sensitivity and disgust sensitivity were statistically significant, albeit small in magnitude. This is to be expected given that personality traits probably only set the overall limits

of situational-specific dental stress factors (20). In addition, according to the Cognitive Vulnerability Model, the relationship between personality traits and a specific fear is mediated by perceptions of the stimulus relevant to the personality traits (as shown in Fig. 1). However, no information on perceptions of dental visits as being uncontrollable, unpredictable, dangerous or disgusting was obtained in this study. Future research might usefully gauge these perceptions so that the hypothesized pathway to fear expression could be better examined.

It should be noted that the current study used a single-item measure of dental fear from the FSS-III to enable comparisons with previous factorial studies. It might be argued that using a more comprehensive measure would more accurately assess dental anxiety. For example, Corah's Dental Anxiety Scale (DAS) (40), the most widely used measure of trait dental anxiety in epidemiological research, has been found to have good psychometric properties (41). Although the DAS has been criticized for lacking a clearly defined conceptual underpinning (41), the existence of extensive normative data makes its use advantageous. Single-item measures of dental anxiety similar to that used in the current study have been found to have only fair to moderate agreement with the DAS (42). Efforts to compare the level of dental fear demonstrated by participants in this study to those in other epidemiological studies are therefore problematic. The Dental Fear Scale has also been widely used to measure aspects of dental fear and relates to self-assessed behavioural, physiological and cognitive reactions to typical dentally related events and stimuli (43). Although these various aspects of dental anxiety are highly correlated (44) they each contribute to an individual's overall fear experience and this should be recognized when dealing with people with dental anxiety.

Dental fear is a multiply determined reaction, often complicated by co-morbidity with other anxiety and mood disorders and co-occurring with numerous other specific fears. The relationship between personality traits, such as disgust and harm sensitivity, and dental fear suggests an enduring element to dental fear that would hinder the possibility of ready fear extinction. Both co-existing fears and personality traits help to determine an individual's dental fear experience. Awareness of this more extensive psychological 'environment' provides an opportunity for dental professionals to better address an individual's fear of going to the dentist, leading to improvements in client oral health and future service utilization.

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