Pathological forms of dental anxiety : aetiology, prevalence and fear evoking aspects

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CHAPTER 6

NEGATIVE EVENTS AND THEIR POTENTIAL RISK OF PRECIPITATING PATHOLOGICAL FORMS OF DENTAL ANXIETY[1]

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Introduction

In Pavlovian fear conditioning, a conditioned stimulus (CS, e.g. the sound of a dental drill) is paired with an unconditioned stimulus (US, e.g. pain: 1). Typically, when confronted with a similar sound the person shows a conditioned response, such as anxiety. More specifically, conditioning theories predict that objects and situations, which are irrationally feared, resemble experiences in which adversity previously occurred (2). In this respect, there is a compelling convergence of research suggesting that distressing or aversive experiences make people vulnerable and increase the risk of developing a broad range of anxiety disorders, such as general anxiety disorder (3), social phobia (4-6), panic disorder (7, 8), posttraumatic stress disorder (PTSD) (9) and specific phobia (5, 10). Research on specific phobias suggests a strong relationship between distressing events and the acquisition of several subtypes of specific phobias (heights, thunderstorms, blood-injury, driving and dentistry: 11-16).

A clear example of a phobia, of which the onset is attributed by the majority of patients to painful, aversive or otherwise fear-inducing experiences, is dental phobia (1, 17-21) For example, DE JONGH, *et al.* (20) found that highly anxious dental patients were about five times more likely to have ever experienced a horrific dental treatment in their life, and almost six times more likely to have ever experienced a violent crime than their low dentally anxious counterparts.

With regard to the acquisition of pathological forms of dental anxiety, two categories of experiences have been distinguished: dental treatment-related-distressing experiences, and distressing experiences which fulfil the Diagnostic Statistical Manual 4th edition Revised (DSM-IV-TR) stressor criterion and are not related to the dental setting *per se* (22). Some examples of the first category involve (a) invasive dental treatments, for instance, root canal treatments or injections (for example, 1, 17, 18, 23-26), (b) pain (for example, 1, 17, 18, 21, 27-29), (c) distress caused by dentists' behaviour (see, for example, 15, 17, 25), (d) distressing emotional responses to dental

treatment (for example, feelings of helplessness or loss of control: see 19, 27, 30), and (e) distressing stories told by important others (15, 31). Examples of traumatic stressors reported by subjects with pathological forms of dental anxiety are (a) sexual abuse (see, for example, 32-34), (b) war trauma (35), (c) severe traffic accidents (36); (d) a tragic death of a loved one (37), (d) a distressing medical experience (38) and (e) physical assault (20, 33).

These data suggest that certain types of experiences may be implicated in the subsequent development of dental anxiety, but we are not aware of any study that has examined the whole spectrum of these experiences, and their relationship with present levels of anxiety. More specifically, it is not clear whether some experiences are more critical than others in terms of precipitating dental phobia onset.

Although there is considerable evidence showing a meaningful relationship between distressing experiences and the development of anxiety (e.g. 10), the role of gender in this association is less clear. For example, a consistent finding across studies on traumatic experiences is a gender difference indicating a higher conditional probability of trauma-related psychopathology in women in response to stressful experiences than men (e.g. 9, 39). Yet, not for all types of anxiety disorders could such a gender-related pattern be determined. For example, in a study on general anxiety disorder (3), no gender differences in relation to life experiences were reported. In a study on specific phobias, only one distressing experience, i.e. violence in the childhood household was found to contribute to the development of specific phobia in women, and not in men (5). Conversely, a study among blood-injection-injury phobic adults failed to show support for the contention of different etiological pathways for women and men (11). However, the focus of this study was on determining differences in etiological background in terms of recall of the initial conditioning event, rather than on differences in probable risk of having a phobic fear in relation to a variety of previous life events.

The present study extends previous research on the association between distressing experiences and pathological forms of anxiety. Counter to previous studies, in which phobics were asked to recall a specific conditioning event that preceded the onset of their phobia (e.g. 14), in the present study, healthy subjects were asked to indicate any traumatic exposure or aversive encounter with a dental object or situation they ever had experienced in their lives. The study has four aims. Firstly, to examine the relationship between retrospective accounts of a broad range of distressing dental experiences and general traumatic experiences. Secondly, to determine which of these experiences are most closely associated with excessive levels of current dental anxiety. One way to define whether anxiety is excessive, disruptive or 'pathological', is to apply the diagnostic criteria of a classification system of distinct diagnostic syndromes such as DSM-IV-TR (*Diagnostic and Statistical Manual of Mental Disorders*, *DSM–IV–TR)* (22). One disadvantage of such a categorical operationalisation is that it defines a 'type' rather than a 'degree' (40, 41). Another way to assess whether anxiety is excessive or pathological, is the use of a validated questionnaire using an empirically defined cut-off score. To maximize validity in the present study, both operationalisations of pathological anxiety are applied. The third aim of the present study was to assess gender-specific differences with regard to association between distressing events and a pathological level of current dental anxiety. Final aim was to determine which combination of distressing experiences was most strongly related to a pathological level of current dental anxiety.

Method

Participants For the present study, 1,942 healthy dental patients were approached. Patients were included if they had reached the age of 18 and had sufficient command of the written Dutch language. Of all patients who were approached, 1,464 patients

(75.3%) agreed to participate and completed the questionnaire. Reported reasons for refusal were: do not feel like (N=257), insufficient command of the Dutch language (N=99), being busy with something else (N=72), forgot my reading glasses (N=5) and other (N=45).

Assessment A questionnaire booklet containing a number of self-report measures was used. In the first part, demographic variables (for example, age, gender, marital status and country of birth) were assessed.

In the second part of this booklet, pathological forms of dental anxiety were assessed by means of two operationalisations. The first was the Short version of the Dental Anxiety Inventory (S-DAI) (42), which was used to assess level of dental anxiety. This questionnaire contains nine items, which are rated on a 5-point Likert-type scale. The total scores on this questionnaire can range from 9 to 45. For clinical purposes, a patient with an S-DAI score of 36 or higher is considered clinically dentally anxious (i.e. HDA). This instrument has good psychometric properties (42). The second questionnaire, the Phobia Checklist, was based on the DSM-IV-TR criteria for specific phobia (22). More specifically, a positive screen for specific dental phobia was assumed to be present only if the patient answered all of the following questions in the affirmative: (i) I have a fear of dental treatment or withstand the dental treatment with intense fear, (ii) I avoid or give up things because of this fear, (iii) This fear is excessive or greater than justified and (iv) The anxiety or avoidance interferes significantly with daily functioning. The first three criteria were adopted to assess prevalence rates of different phobia subtypes in the general population (43); the fourth was added into this study in order to achieve a better coverage of the set of DSM-IV-TR criteria. The Phobia Checklist was validated against the Structured Clinical Interview for DSM-IV (SCID) (44) as gold standard in a sample of 22 patients with dental phobia and 133 patients without dental phobia. In the validation process, all patients completed the Phobia Checklist and were assessed using the anxiety

disorder module of the SCID. The results revealed excellent sensitivity (0.95) and specificity (0.99) and an overall hit rate of 97%. Accordingly, the Phobia Checklist was considered a valid screening tool for dental phobia.

The third part of the booklet consisted of the Level of Exposure Dental Experiences Questionnaire (LOE-DEQ) (45). The 23 items of the LOE-DEQ pertain to the presence or absence of different types of experiences both inside and outside the dental setting, and were based on a comprehensive literature review taking into account almost every experience that has ever been reported to be associated with dental anxiety onset (42). The LOE-DEQ has two main sections: 16 items pertaining to typical dental experiences (i.e. root canal treatments, injections, extractions, drilled in teeth, treatment causing pain, after treatment, during treatment: suffocation, nausea, embarrassment, helplessness, treatment by an impolite/rude dentist, criticised by dentist, lack of sufficient information provided by the dentist, lack of understanding of the dentist, frightening stories told by others, frightening stories told in the media and witnessing a treatment of an extremely dentally anxious patient), and 7 items pertaining to general DSM-IV-TR traumatic life events (i.e. serious accident, tragically death, natural disaster or war, horrific medical treatment, violent crime and sexual assault). When completing the questionnaire, the individual is confronted with each of the items and is asked to tick whether he or she 'never' (score 0) or 'ever' (score 1) had the distressing experience. The LOE-DEQ has proven to have good psychometric properties with adequate discriminant, concurrent and predictive validity (42).

Procedure The patients were approached by one of six advanced graduate students while visiting their dentist in one of sixteen selected dental practices located across the Netherlands. After a brief introduction, participants were invited to complete a questionnaire booklet while waiting for their dental appointment. Of all participants who agreed to participate written informed consent was obtained. The decision to use face-to-face administration, rather than telephone, mail or internet administration, was

based on considerations related to coverage properties, accuracy of the screening, response rate and length of the survey/respondent burden (see 46). The study was approved by the Ethical Committee of the VU University Medical Center.

Statistical analyses Prevalence rates of different distressing experiences, dental anxiety and dental phobia were assessed by means of descriptives. Gender differences in level of dental anxiety and total number of distressing experiences were assessed using independent t-tests. The difference in the overall prevalence rate of dental phobias in men and women was tested by means of a Chi-square test. The association between being highly dentally anxious (i.e. a S-DAI total score $\geq$36, HDA), or a positive screen for dental phobia (i.e. fulfilling all criteria of the Phobia Checklist, DP), and previous distressing experiences, was estimated by the adjusted odds ratio (OR) and 95% confidence intervals (95%CI). Gender differences were assessed by calculation of the interaction effects between type of experience and gender. Whenever the interaction effect was significant, Odds Ratios (ORs) and confidence intervals for women and men were reported separately. Finally, to determine the combination of experiences with the strongest association with pathological levels of current dental anxiety, all distressing experiences were included in separate stepwise logistic regression analyses, using the forward conditional method with either HDA or DP as outcome variable. The Hosmer-Lemeshow goodness of fit chi-square was used to calculate how well the data fitted the models. For all statistical analyses, a P-value < 0.05 was considered statistically significant.

Results

Participants Of the 1,466 completed questionnaires, two could not be used, because of missing data (less than 80% completed) and were excluded from subsequent data

analyses. Of the 1,464 remaining participants, 865 were female (59.1%) and 597 were male (40.8%), the gender of two participants (0.1%) remained unknown. The age of the respondents varied between 18 and 85 yr (Mean=44.6, SD=15.3).

The marital status of the participants revealed that 13.9% were singles, whereas 69.4% were married or cohabiting, 8.3% were dating, and 8.2% were divorced or widowed. Of four participants (0.2%), the marital status remained unknown. The distribution of ethnicity showed that 90.5% of the participants were Dutch, 2.3% were Surinamese, 1.0% Moroccan, 0.8% Turkish, 0.5% Antillean, while 4.5% reported another ethnic background. Five participants (0.3%) failed to disclose their ethnicity. The prevalence rates are clearly not sufficient to support subgroup analyses.

The mean S-DAI score for the total sample was 18.2 (SD=9.3). Of the participants, 114 (7.8%) scored 36 or higher on the S-DAI. Women scored significantly higher on the S-DAI than men [$t(1452)=8.61$; $P<0.001$]. Twenty-five participants (1.7%) fulfilled the screening criteria of a dental phobia, with women significantly more frequently meeting these criteria than men [21 versus 4; $\chi^2(1)= 6.52$; $P=0.01$].

Prevalence of distressing experiences The vast majority of the participants (95.7%) reported at least one distressing experience during their lives: 80.4% reported at least one distressing experience outside the dental setting, and 86.5% inside the dental setting. The last percentage includes the participants who indicated a modelling experience (i.e. witnessing a treatment of an extremely anxious patient, 14.4%), and those remembered a situation in which they were exposed to negative information about dental treatment (i.e. stories, 42.4%: information from the media, 24.4%).

In Table 1, the prevalence rates of the 23 different types of distressing experiences are presented. Most prevalent distressing experiences were a tragic death or illness of a loved one (56.4%), a horrific medical treatment (48.1%), and extreme pain

after a dental treatment (46.9%). Least prevalent experiences were having been victim of a violent crime (12.3%), natural disaster or war (11.1%) or sexual assault (4.6%).

Distressing experiences and the association with high levels of dental anxiety Table 1 also displays the percentages of those participants with the distressing experience present with HDA. Of those ever felt extremely embarrassed, 24.2% scored ≥ 36 on the S-DAI, and of those ever felt extremely nauseous, 22.9% were highly dentally anxious. The lowest percentages were found for victim of a natural disaster or war (3.7%), witnessing someone getting seriously injured or killed (7.6%) and a tragic death or illness of a loved one (8.2%).

Table 2 presents the adjusted associations (ORs) between distressing dental experiences present with HDA and corresponding 95%CI intervals. The probability of HDA was highest in persons who reported experiences involving distressing emotional or physical responses. For example, when an individual had reported an experience involving extreme helplessness, that person was 8.2 times more likely to suffer from HDA than a subject who had not reported an incident in which he or she felt helpless. Similarly, when a person had reported to have ever felt extremely embarrassed, or an experience regarding being extremely nauseous, or had reported a lack of understanding by their dentist, were respectively 5.5, 5.3 and 4.4 times more likely to suffer from HDA, when compared with someone who had not reported such an experience.

Distressing experiences and association with dental phobia Table 1 also shows the percentages of those participants with the distressing experience present fulfilling criteria of dental phobia (DP). Of those ever felt extremely embarrassed, 7.1% were phobic, and of those ever felt extremely nauseous or almost suffocating during treatment 6.8% were fulfilling the dental phobia criteria. The lowest percentages were

found for natural disaster or war (0.6%), root canal treatment (1.5%), and death or illness of a loved one (1.6%).

Table 2 presents the probability of DP by event type. The probability of current DP was highest in persons who reported ever having experienced disruptive emotional reactions, such as extreme helplessness (OR=16.2), almost suffocation (OR=8.1) or extreme embarrassment (OR=8.0).

Gender differences No significant gender differences were found in the total number of distressing experiences reported [P=0.18]. With regard to the associations between the exposure to each of the different experiences, and having a high level of dental anxiety, only with regard to the experience of having had a root canal treatment, a significant interaction effect for gender was found [Wald=7.03, P=0.008]. For women, no significant association between this item and HDA presence could be detected [OR=0.54, P=0.06], while for men, the association reached significance OR=2.65, P<0.001.With regard to the probability of DP by event type, for none of the distressing experiences, a significant interaction effect for gender was found. That is, no type of distressing experience appeared to have a higher probability for developing DP in women than in men.

Determining the combination of experiences most predictive of developing pathological levels of dental anxiety To determine which combination of experiences maximized the prediction of current HDA and DP, all 23 distressing experiences were entered in two separate stepwise logistic regression analyses with either HDA or DP as dependent variables. As shown in Table 3, four types of experiences maximized the prediction of HDA: lack of understanding by the dentist, extreme helplessness, extreme nausea, and extreme embarrassment during treatment [goodness of fit chi-square=2.34, d.f.=3, P=0.51]. This combination accounted for 23.9% of the variance of current HDA.

Table 1 *Prevalence of distressing experiences and prevalence of high dental anxiety (HDA) and dental phobia (DP) in relation to these experiences*

	Prevalence of experience			Rate HDA in relation to experience		Rate of DP in response to experience	
Type of distressing experience	%	N	SE	%	N	%	N
a tragic death or illness of a loved one	56.4	819	0.02	8.2	67	1.6	13
an horrific medical treatment	48.1	698	0.02	8.6	60	2.0	14
extreme pain after a dental treatment	46.9	684	0.02	11.0	75	2.8	19
information in the media regarding dentistry	42.4	618	0.02	11.7	72	2.4	15
a tooth drilled	39.5	576	0.02	13.2	76	3.1	18
witnessing someone being seriously injured or killed	35.4	514	0.02	7.6	39	1.8	9
a tooth extracted	35.3	513	0.02	12.5	64	3.3	17
extreme helplessness during dental treatment	32.1	468	0.02	18.6	87	6.8	14
an injection	31.2	455	0.02	14.1	64	3.1	14
a root canal treatment	27.9	406	0.02	11.8	48	1.5	6
an impolite or rude dentist	27.1	394	0.02	15.0	59	2.8	11
a dentist not providing sufficient information about invasive treatments	26.7	388	0.02	14.4	56	3.4	13
frightening or horrific stories about dental experiences	24.4	355	0.02	9.6	34	2.5	9
seriously getting injured in an accident	21.9	318	0.02	9.1	29	2.5	8
lack of understanding of the dentist	17.4	253	0.02	19.8	50	4.7	12
a criticizing dentist	16.7	242	0.02	14.9	36	4.1	10
a treatment of an extremely anxious patient	14.4	210	0.02	11.0	23	1.9	4
almost suffocation during dental treatment	14.2	207	0.02	16.4	34	6.8	14
extreme nausea during dental treatment	14.1	205	0.02	22.9	47	7.1	13
extreme embarrassment during dental treatment	12.5	182	0.02	24.2	44	2.4	15
a violent crime	12.3	179	0.02	11.2	20	3.4	6
a natural disaster or war	11.1	162	0.02	3.7	6	0.6	1
sexual assault	4.6	67	0.03	11.9	8	4.5	3

Table 2 *Distressing experiences and the likelihood (OR) of high dental anxiety (HDA) and dental phobia (DP)*

	HDA			DP		
	OR	95 CI	P value	OR	95 CI	P value
Type of distressing experience						
a tragic death or illness of a loved one	1.13	0.77 -1.67	**0.540**	0.91	0.41 - 2.05	**0.825**
an horrific medical treatment	1.24	0.84 -1.82	**0.270**	1.52	0.67 - 3.43	**0.320**
extreme pain after a dental treatment	2.39	1.59 -3.58	<0.001	3.67	1.46 - 9.24	0.006
information in the media regarding dentistry	2.50	1.68 -3.71	<0.001	2.58	1.09 - 6.12	0.032
a tooth drilled	3.37	2.45 -5.05	<0.001	4.03	1.67 - 9.71	0.002
witnessing someone being seriously injured or killed	0.96	0.64 -1.43	**0.820**	1.09	0.48 - 2.52	**0.833**
a tooth extracted	2.54	1.73 -3.74	<0.001	4.00	1.71 - 9.34	0.001
extreme helplessness during dental treatment	8.17	5.22-12.78	<0.001	16.24	4.83-54.53	<0.001
an injection	3.13	2.12- 4.61	<0.001	2.87	1.29 - 6.38	0.009
a root canal treatment	1.99	1.35- 2.95	0.001	0.81	0.32 -2.05	**0.658**
an impolite or rude dentist	3.22	2.19- 4.75	<0.001	2.15	0.97 -4.78	**0.060**
a dentist not providing sufficient information about invasive	2.92	1.98- 4.30	<0.001	3.03	1.37 -6.69	0.006
frightening or horrific stories about dental experiences	1.34	0.88- 2.05	**0.170**	2.01	0.61 -4.68	**0.107**
seriously getting injured in an accident	1.25	0.80- 195	**0.320**	1.80	0.76 -4.23	**0.180**
lack of understanding of the dentist	4.35	2.92- 6.48	<0.001	4.52	2.04-10.02	<0.001
a criticizing dentist	2.57	1.68- 3.91	<0.001	3.42	1.52 - 7.71	0.003
a treatment of an extremely anxious patient	1.56	0.96- 2.53	**0.070**	1.19	0.40 - 3.52	**0.752**
almost suffocation during dental treatment	2.91	1.89- 4.48	<0.001	8.12	3.63-18.14	<0.001
extreme nausea during dental treatment	5.25	3.49- 7.90	<0.001	8.22	3.68-18.38	<0.001
extreme embarrassment during dental treatment	5.46	3.60- 8.27	<0.001	8.02	3.60-17.86	<0.001
a violent crime	1.61	0.97- 2.69	**0.070**	2.57	1.00 - 6.61	**0.050**
a natural disaster or war	0.43	0.19- 0.99	**0.050**	0.35	0.05 - 2.58	**0.300**
sexual assault	1.68	0.78- 3.61	**0.180**	3.03	0.88-10.42	**0.079**

bold indicates that the OR is not significant OR= adjusted odds Ratios

Also shown in Table 3, is that a combination of five types of experiences maximized the prediction of current DP. That is, the combination of having experienced a distressing tooth extraction, a root canal treatment, and the experiences of almost suffocation, extreme helplessness, and extreme nausea [goodness of fit chi-square=5.16, d.f.=6, P=0.52] accounted for 31.2% of the variance of current DP.

Discussion

The current findings are consistent with results from other studies showing that having witnessed a tragic death or illness, having experienced a horrific medical treatment and having experienced extreme pain after a dental treatment are among the most prevalent distressing life experiences (20). However, prevalence rates of pathological dental anxiety varied widely across stressor type. Pathological forms of current dental anxiety appeared to be most closely associated with retrospective accounts of aversive experiences within the dental setting.

This finding synthesises results from several previous studies (e.g. 17-19, 30), albeit these studies often covered only a very limited range of potential distressing dental episodes. The finding that the presence of pathological dental anxiety was significantly associated with retrospective accounts of exposure to invasive dental procedures (e.g. injections and extractions), emotional responses (e.g. helplessness, embarrassment) as well as dentist characteristics (e.g. rude or impolite dentist), and exposure to negative stories supports the notion that a Pavlovian conditioning model is helpful in understanding the onset of dental phobias. The fact that both methods of assessing pathological dental anxiety used in the present study were found to be associated with similar types of dentistry-related experiences supports the stability of the current findings.

A noteworthy finding of the present study was that pathological dental anxiety was not significantly associated with reports of traumatic experiences outside the dental setting. This is in contrast with results of earlier studies showing significant associations between several such traumatic experiences and dental anxiety (33, 35, 36). A plausible explanation for this difference may be that the current study used a regular sample of relatively 'healthy' subjects, while the aforementioned studies used samples taken from subpopulations consisting of individuals with an abuse history (33), displaying high levels of dental anxiety (36, 47), or suffering from psychopathological conditions of which the level of co-morbidity is likely to be high (35). Thus, the fact that in the current study no association between dental anxiety and any DSM-IV-TR traumatic experience was found, seems plausible because of the low degree of co-morbidity in the present sample.

The most important research question of the present study was to determine which types of experiences are associated with pathological forms of current dental anxiety as this relates to the question which types of experiences may be most critical in terms of precipitating excessive levels of dental anxiety onset. A large array of studies on dental anxiety suggests that the experience of pain is one of the most powerful conditioning experience in terms of the development of dental phobia (see for example, 1, 23, 24, 26, 28). Among the wide variety of dental experiences potentially predisposing to pathological forms of dental anxiety investigated in the present study, including pain, the retrospective report of helplessness during treatment was found to be most strongly associated with pathological levels of current dental anxiety. More specifically, a positive screen of dental phobia appeared to be 16 times more likely if one had experienced helplessness during one or more past dental treatments. To this end, our findings are in accordance with earlier studies on dental anxiety showing perceived lack of control to be a significant correlate of dental anxiety and long-term avoidance (see for example, 48, 49).

Table 3 *Final results of the stepwise logistic regression analysis in the analysis of 'high dental anxiety' (1= yes, 0=no) and 'fulfilling criteria for dental phobia'(1= yes, 0=no)*

High Dental Anxiety						
Type of distressing experience	B[1]	SE B	Wald	OR[2]	95.0% C.I. [3]	p-value
Lack of understanding by the dentist	0.52	0.24	4.76	1.68	1.05-2.67	0.030
Extreme helplessness during dental	1.62	0.27	46.62	5.01	3.01-8.52	<0.001
Extreme nausea during dental treatment	0.95	0.24	16.53	2.60	1.63-4.11	<0.001
Extreme embarrassment during treatment	0.84	0.24	11.80	2.31	1.43-3.72	0.001
Constant	-3.90	0.22	327.81	0.00		0.020
Positive screen for Dental Phobia						
Type of distressing experience						
A tooth extracted	1.12	0.52	4.60	3.04	1.10-8.40	0.030
A root canal treatment	-1.55	0.56	7.80	0.21	0.07-0.63	0.005
Almost suffocation during treatment	1.16	0.48	5.83	3.19	1.24-8.18	0.016
Extreme helplessness during dental	3.26	1.05	9.63	26.13	3.33-205.17	0.002
Extreme nausea during dental treatment	1.25	0.48	6.80	3.47	1.36-8.85	0.009
Constant	-7.44	1.05	50.351	0.01		<0.001

[1] estimated regression coefficient [2] adjusted odds ratio (OR=exp B) [3] 95% CI confidence limits for the odds ratio

The importance of helplessness has particularly been recognized in the field of traumatic stress, as research data indicate that a sense of helplessness and a disrupted emotional reaction occurring at the time of an experience are most predictive of PTSD symptomatology (50, 51). The response to a distressing experience with helplessness is even a key characteristic (i.e. A2 criterion), which defines a potentially traumatizing event and its experience is a diagnostic requirement for the diagnosis PTSD in DSM-IV-TR (22). Apparently, subjective estimates of the intensity of emotions, particularly lack of control at the time of an event, are not only related to the development of PTSD, but also play a role in the acquisition of certain types of specific phobias.

The logistic regression analyses suggest that not only the subjective experience of helplessness, but helplessness combined with other forms of emotional (i.e. embarrassment) and physical (i.e. nausea) disruptive reactions are strongly associated with dental anxiety and phobia. This is of importance for several reasons. First, this supports the notion of interoceptive UCSs (e.g. aversive visceral sensations or gut feelings) as powerful conditioning experiences, a phenomenon which is considered as 'poorly understood, and generally not recognized, by contemporary clinical researchers' (52). Moreover, it suggests that the acquisition of pathological levels of dental anxiety might be the result of several, cumulative exposures to distressing events over a longer period of time, rather than of a one-trial learning experience. Taking into account the level of explained variance found in the present study, it seems that negative dental episodes, including their peritraumatic emotionally disruptive states, are not the only risk factors for dental anxiety onset, and indicate that other factors, such as co-morbid pathology and genetic susceptibility, may be important mediators of this relationship.

Finally, similar distressing experiences in women and men were predictive in pathological levels of dental anxiety development. Only one significant gender difference (having received a distressing root canal treatment) could be detected, but

as this was the only significant interaction-effect that emerged, it is plausible that it could be attributed to a type-I error. The current findings are in line with previous studies on gender effects in anxiety disorders showing very few gender differences in the pathways to anxiety (3, 5, 11) with PTSD being a notable exception (e.g. 9, 39). The most plausible explanation for the latter finding is that exposure to certain potential stressors responsible for the acquisition of PTSD is unevenly distributed among women (i.e. rape) and men (i.e. combat). This is in contrast with, for example, individuals suffering from dental anxiety for whom it is unlikely that exposure to certain types of potentially conditioning experiences within the dental setting would be gender specific.

At least one important limitation of the study needs to be mentioned. Because of the retrospective design of the current study, questions can be raised about the validity of the information obtained on distressing life experiences in the present study. Individuals with dental anxiety or with an anxious personality experience potentially aversive situations as more traumatic than non-fearful individuals. However, the finding that dental anxiety is associated with negative dental experiences and not with other (even more) negative or aversive experiences in general may argue against this explanation. Clearly, in the ideal situation, longitudinal studies collecting prospective data should be used in order to prevent recall issues, albeit this is often difficult, because of financial and practical reasons (53). With regard to the reliability of the retrospective accounts of the respondents, it should be noted that in the present study, subjects were not asked to indicate their mode of onset or initial aversive encounter with the phobic stimulus, which may be far more difficult to recall, than indicating whether or not a specific situation occurred, as was requested in the present study. Furthermore, a study on the influence of psychopathology on memory has shown that there is little reason to link psychiatric pathology with less reliable or less valid recall of earlier life experiences (54). To this end, it has been argued that direct conditioning events are even extremely well remembered as autobiographical

memories, and are likely to be stronger when they are unique, unexpected, provoke emotions, and have important consequences (55, 56).

Despite this limitation, several strengths are noteworthy. Firstly, the large sample comprising healthy subjects used in the current study may have reduced the bias of self-selected respondents, as may not have been the case in previous studies with clinical samples. The large sample, and the use of different operationalisations of a pathological level of dental anxiety, may have also increased both internal and external validity of the results. Secondly, to our knowledge, this is the first study that investigated the subjective impact of both dentistry related, and non-dental experiences fulfilling the DSM-stressor criterion definition, in relation to a wide variety of other types of subjective estimates of the intensity of events on the subsequent development of dental anxiety. Another strength may be its clinical significance. Increased understanding of the nature of emotional responses during treatment associated with the emergence of dental anxiety is likely to facilitate the application of interventions for those likely to be at risk. To this end, the results strongly suggest that avoidance behavior and anxiety in dental phobia could be reduced by optimizing anxious dental patients' control over the dental treatment. Indeed, it has been found that an intervention that leads to an increased level of control, reduces various patient insecurities during treatment to a minimum, and increases the level of trust in the treating dentist (57). Thus, the more sense of control patients experience, or the more they perceive they can influence the treatment to a certain degree, the less likely it is that anxiety and avoidance behaviour emerge.

In conclusion, the present data seem to indicate that the development of dental anxiety is uniquely associated with exposure to a variety of previous distressing dental experiences, with the experience of helplessness being the most salient example. With regard to the association between pathological forms of dental anxiety and distressing experiences, gender does not seem to play a meaningful role. It will be of considerable theoretical interest to explore the relative importance of helplessness

and similar forms of emotional or interoceptive (e.g. gastro-intestinal) responses in the development of other subtypes of phobias as well as in other anxiety disorders in a prospective design.

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