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Development of a questionnaire measuring treatment concerns in regular dental patients

U. Klages, Z. Sadjadi, L. D. Lojek, G. Rust and H. Wehrbein

Department of Orthodontics, Johannes Gutenberg-University, Mainz, Germany

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Abstract – *Objectives:* The aim of this study was to develop an instrument measuring core concerns about dental treatment guided by Reiss' expectancy theory of fear. This would include the content domains of injury, somatic reaction and interpersonal concerns, to study the underlying factorial structure, and to determine the test quality of the resulting subscales. *Methods:* A total of 555 regular dental patients answered the item pool. Subsamples filled in the Dental Anxiety Scale (DAS) (n = 346) and the Anxiety-Present Scale of the state-form of the State-Trait Anxiety Inventory (STAI-S) (n = 187). A second sample (n = 89) was used to determine test-retest reliability and bias for social desirability [Self Disclosure Scale of the Freiburg Personality Inventory (FPI)]. *Results:* Exploratory and confirmatory factor analyses identified a stable three-dimensional structure underlying the items convergent to the content domains of interpersonal, injury and somatic reaction concerns. Internal consistencies of the resulting subscales were between α = 0.84 and α = 0.87, test-retest reliabilities were from r_{tt} = 0.72–0.78. No evidence for a social desirability response bias was found. All subscales discriminated between patients with low and high dental trait anxiety at a level of $P < 0.00001$. Dental treatment concerns predicted 36% of variations in actual anxiety during treatment. *Conclusions:* The results suggest that the proposed instrument, namely the Dental Treatment Concerns Inventory, shows good test qualities according to construct, discriminant and predictive validity, and may be a promising tool for research and clinical applications.

Key words: dental fear; dental treatment; test development; treatment concerns

Dr U. Klages, Ulrich Augustusplatz 2, Mainz, D-55101, Germany
e-mail: klages@kieferortho.klinik.uni-mainz.de

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Despite technological progress in instrumentation and anesthesia alleviating pain and discomfort in patients undergoing dental treatment, the proportion of people in the general adult population with fear of dentistry has not declined during the last five decades (1). This finding may suggest that not only characteristics of dental procedures but also patient characteristics contribute to experienced pain and distress.

Previously established instruments measuring dental anxiety assess fear-evoking stimuli and physiological or emotional aspects of patient reactions (2, 3), whereas the measurement of cognitive responses has been of less concern. Three instruments assessing various cognitive aspects of dental anxiety have been suggested. A preliminary dental cognition questionnaire has been proposed by De Jongh et al. (4). An instrument specifically related to negative cognitions about dental injections has been presented by Milgrom et al. (5). On the level of generalized beliefs, Milgrom et al. (6) introduced a questionnaire assessing negative attitudes toward dentistry, primarily relating to dentist behavior.

Instruments addressing dental stimuli and physiological or emotional responses assess to what extent patients are anxious and in which situations, but they do not answer the question why they react anxiously. Litt (7) assumes that events related to dental procedures may be associated with anxiety though they are not inherently aversive. He

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suggests that expectancies patients bring into the treatment situation may be more important in determining the aversiveness of experience than objective characteristics of the procedure. According to Lazarus and Folkman (8), threat appraisal is a cognitive factor which determines the extent of anxious tension a patient experiences while encountering dental treatment.

In his expectancy theory of fear, Reiss (9) provides a conceptual framework, which may help to understand fear of dental procedures, which are nowadays not inherently painful or discomforting. He postulates that a small set of fundamental fears contributes to fears of specific stimuli or situations, including fear of injury, fear of anxiety symptoms, and fear of social evaluation. They provide reasons why stimuli or events, although not inherently aversive, may be perceived as threatening (10). Liddell and Gosse (11) referred to this approach in studying characteristics of unpleasant dental experiences. They found that these events could be classified into those relating to injury, emotional responses, and dental personnel behavior.

A similar categorization of basic fears underlying fear of dentistry has been proposed by Milgrom et al. (6). The so-called Seattle system explains dental fear as (a) conditioned fear of dental procedures; (b) fear of somatic reactions (e.g. fainting, panic); and (c) distrust of dental staff behavior. A fourth category of generalized anxiety subsumes all these fears. According to Davey (12), conditioned fears are to be explained by expectancies of aversive outcomes. Following this argument, conditioned fear of dental procedures is to be conceived as fear of injury. Several investigations applying the Seattle system proved its usefulness in classifying high dentally anxious (13) or phobic (14, 15) persons according to their core concerns and confirmed its validity using conceptually oriented questionnaires.

Furthermore, several studies suggest that fundamental fears may contribute to anxiety about dental treatment. McNeil and Berryman (16) found that generalized fear of injury was related to dental fear. General concerns about physical reactions predicted pain during dental treatment (17). Negative beliefs about dental staff behavior were strongly correlated with dental trait anxiety (18). The cited studies lend support to the assumption that concerns about injury, somatic reactions, and dental staff interaction may be basic in explaining fear of dental treatment.

The aim of this study was to develop a questionnaire assessing core concerns about dental treatment, including negative expectancies for injury, somatic reactions, and staff interaction. Observing criteria for test quality, the following analyses were undertaken:

1 The factorial structure underlying an item pool representing the described core concerns about dental treatment was assessed in one half of the patient sample. The stability of the solution applying a confirmatory factor analysis was determined in the second sample half (factorial validity) (19).
2 Internal consistency and test-retest reliability of the subscales derived from factor analyses were investigated.
3 The influence of response bias (20) was studied by analyzing correlations between treatment concerns and social desirability.
4 The ability of the treatment concerns subscales to discriminate between high and low dentally anxious patients was assessed (discriminant validity).
5 Predictive validity was evaluated by relating patients' dental treatment concerns to actual anxiety experienced during subsequent dental procedures.

Materials and methods

Sample and study procedure

A total of 555 regular patients awaiting their treatment at 10 dental practices participated in the study. After receiving information about the research purpose and assurance of anonymity, 21 patients declined to participate, and 12 questionnaires were excluded because of incomplete answers. Mean sample age was 39.1 years (SD = 13.7). Two hundred and seventeen participants were male and 338 female. Thirty-four percent had received a primary 9-year school education, 36% a 10-year intermediate education, and 30% had completed 13 years of primary and secondary school. Dental procedures the patients subsequently underwent were: filling (33.6%), crown preparation (15.8%), tooth extraction (15.8%), calculus removal (10.6%), root canal treatment (7.7%), periodontal surgery (6.4%), and others (10.1%). The patients answered the 28-item dental treatment concerns list before the procedures took place. A subsample of $n = 346$ indicated their trait anxiety on the Dental Anxiety Scale (21) and 187 patients evaluated their actual anxiety during the following treatment using the Anxiety-Present Scale from the state form of the STAI-S (22).

An adjunctive sample of 89 participants (mean age: 31.2 years, SD = 10.9; 27 males, 57 females) answered the dental treatment concerns item pool twice at an interval of 14 days. In addition, the Self-Disclosure Scale of the Freiburg Personality Inventory (FPI) (23) was filled in to study a possible response set for social desirability (n = 84). The subjects were investigated at a neutral location.

Measures

Dental treatment concerns item development

An expert team of four dentists and one clinical psychologist collected statements referring to treatment concerns about dental treatment from the literature and from their clinical experience, resulting in 40 items. They were reformulated uniformly to assess expectancies of negative events. In the third step the items were judged according to whether they represented fundamental concerns about injury, somatic reactions, or staff interaction. Twelve ambiguous items were excluded. The instructions requested that respondents indicate their agreement with presented concerns or thoughts about the impending treatment. The answering format was a five-point Likert scale ranging from 1 = not at all to 5 = very strong. In the course of preliminary exploratory factor analyses on one half of the sample, 11 statements constituting unique factors or showing split loading across factors were removed (24). Seventeen items were retained for further analyses.

Self-Disclosure Scale - This test was designed to evaluate the validity of respondents' answers in the FPI, a well-established instrument in German-speaking countries (23). Fourteen questions ask about slight weaknesses which probably everyone could admit (e.g. Sometimes I tell a little lie). High scores indicate low social desirability.

Dental Anxiety Scale - The instrument, developed by Corah (21) includes four questions about the level of anxiety when anticipating or undergoing dental treatment procedures. This well-established test has been used in many community studies and is designed to measure dental trait anxiety (3).

State Anxiety - The Anxiety-Present subscale of the state form in Spielberger's State-Trait Anxiety Inventory (STAI-S) has been used (22) including 10 symptom-positive items. The remaining 10 items measuring positive affect were not considered, as they have been shown to constitute an independent factor (25, 26) and to indicate depressive mood rather than anxious arousal (27, 28). The factorial independence of symptom-positive and -negative items of the STAI-S has been confirmed in patients undergoing dental treatment (29).

Treatment Invasiveness Rating - After treatment completion, the dentist evaluated the invasiveness of the procedure a patient would experience from the medical point of view using a 11-point rating scale ranging from 0% = no distress at all to 100% = worst distress imaginable (17). Treatment duration in minutes was recorded as a second indicator of treatment distress.

Statistical analyses

SPSS 12.0 statistical software (SPSS Inc., Chicago, IL, USA) was used in all calculations, except the confirmatory factor analyses. Exploratory principal component analyses with orthogonal varimax rotation were performed on half of the sample (odd–even split: n = 278). To test the stability of the solution, a confirmatory factor analysis was conducted on the second sample half (n = 277) using AMOS 5.0 (SPSS Inc.), applying the unweighted least squares method. Criteria for the acceptance of the hypothesized model were fit indices >0.90 [adjusted goodness of fit index (AGFI); relative fit index (RFI); normed fit index (NFI)] and a root mean-squared residual (RMR) <0.10 (19).

Reliability analyses determined internal consistencies of the subscales derived from factor analyses according to Cronbach's α. Pearson's correlations calculated test-retest temporal stability in the adjunctive sample (n = 89) and associations with FPI-Self Disclosure as a measure of social desirability response set (n = 84).

To determine discriminant validity, patients scoring ≥12 on the DAS were defined as highly anxious (13), representing the upper tercile of a subsample of n = 346. They were compared with patients within the lower tercile (DAS ≤ 7). Additionally, the medium tercile was compared with DAS-low scorers. One-way analyses of variance were conducted to estimate the overall effect (F-tests). Simple contrasts were calculated to analyze specific effects.

Pearson's correlations tested the predictive performance of treatment concerns with respect to state anxiety during the following treatment in a subsample of n = 187. Partial correlations studied the contribution of the treatment concern subscales in the prediction of state anxiety, controlling (a) for

treatment invasiveness; (b) for dental trait anxiety measured by the DAS; and (c) for each other treatment concerns subscale. The common variance between two variables is estimated by squared correlation coefficients (r^2). A multiple regression analysis was calculated to determine the predictive power of the treatment concerns variables set as a whole in explaining variations in state anxiety.

Results

Construct validity

The investigation of construct validity encompasses exploratory and confirmatory analyses of the factorial structure underlying the items in question, assessments of internal consistency and test-retest reliability in the factorially derived subscales, and a test for response sets possibly biasing respondents' answers (20). The results of these analyses are presented in Table 1.

Exploratory factor analysis

An exploratory principal components analysis with varimax rotation was calculated for the 17-item list in one half of the sample. Applying the Kaiser-Guttman criterion (eigenvalue >1), a three-dimensional structure was suggested. Taken together, the three factors accounted for 58.3% of the variance, indicating a satisfactory solution (30). After varimax rotation, the three factors contributed to the explanation of the variance in nearly equal amounts between 18.3% and 20.5% (first row after last item in Table 1). The factor weights of the principal components analysis after varimax rotation are presented in data columns 1 to 3 of Table 1. To improve readability, the items are arranged according to the factors they constitute. The first factor comprised six concerns relating to staff interaction behavior, with factor loadings between 0.56 (complaints) and 0.86 (questions), and no salient loadings (>0.40) on the remaining dimensions. The second factor included six expectancies for injury and pain, their factor weights ranging from 0.56 (causing drill to slip) and 0.82 (drill touching a nerve). No split loading across the other factors was found. A third dimension was constituted by concerns about somatic reactions with highest loading on 'suffocating' (0.82) and lowest in 'short of breath' (0.64). Factor weights across the respective remaining dimensions were all below 0.25, indicating the distinctiveness of this factor. Overall the factor solution converged with the content domains previously assumed.

Table 1. Factor loadings of the items of the DTCI scales after exploratory principal component analysis and orthogonal rotation, amount, and percentage of variance explained by each factor (rotated solution) in the first half of the sample, standardized regression estimates of the items on the hypothesized latent constructs after confirmatory factor analysis (CFA) in the other half of the sample, part–whole corrected item total correlations (r_{it}) and consistencies (Cronbach's α) in the sample total, test-retest reliabilities and correlations with FPI-Self Disclosure in the adjunctive sample

Item	Interpersonal	Injury	Somatic reaction	CFA estimates	r_{it}
My complaints might not be taken seriously	0.56	0.18	0.22	0.76	0.62
The treatment might be performed under time pressure	0.69	0.32	0.17	0.70	0.61
The procedures might not be explained to me	0.75	0.21	0.09	0.72	0.63
Maybe nobody will listen to me	0.82	0.02	0.09	0.70	0.72
I might not be understood	0.67	0.00	0.36	0.57	0.65
I might not get the right answers to my questions	0.86	0.17	0.12	0.70	0.78
I might move and cause the drill to slip	0.06	0.56	0.37	0.75	0.55
The drill might touch a nerve	0.09	0.82	0.00	0.68	0.69
The anesthesia might not work	0.24	0.75	0.11	0.75	0.66
The treatment might be painful	0.09	0.70	0.20	0.78	0.58
The anesthetic needle might hit a nerve	0.23	0.73	0.17	0.73	0.61
The needle might slip and injure me	0.16	0.62	0.34	0.79	0.61
I might faint	0.19	0.11	0.68	0.75	0.69
I might suffocate	0.14	0.19	0.82	0.80	0.78
I might become sick	0.15	0.23	0.71	0.74	0.66
I might panic	0.14	0.20	0.70	0.76	0.61
I might be short of breath	0.17	0.09	0.64	0.71	0.50
Percentage of variance (n = 278)	20.51	19.56	18.29		
Cronbach's α (n = 555)	0.87	0.85	0.84		
Test-retest reliability (n = 89)	0.72	0.78	0.74		
Pearson-correlation with FPI-Self Disclosure (n = 84)	−0.20	0.10	−0.05		

Confirmatory analysis

To test the stability of the factor model, a confirmatory factor analysis was performed using the second sample half and applying the unweighted least squares method. Fit indices, all approaching the ideal score of 1, suggested that the hypothesized factor model was stable across samples (AGFI = 0.98, NFI = 0.97, and RFI = 0.97). The residual variance was low at RMR = 0.06. Regression weight estimates for each item are presented in the fourth data column of Table 1. The loadings are sufficiently high (all >0.60) to confirm the hypothesized regression paths leading from latent factors to questionnaire items.

Reliability analyses

Following the factor model, three subscales, namely 'interpersonal concerns', 'injury concerns', and 'somatic reaction concerns', were constituted. The title suggested for the multidimensional questionnaire is 'Dental Treatment Concerns Inventory (DTCI)'. Pearson's correlations between the subtests were at a moderate level and strongly below their internal consistencies, indicating their relative independence (interpersonal versus injury concerns: $r = 0.55$; interpersonal versus somatic reaction concerns: $r = 0.46$; and injury versus somatic concerns: $r = 0.52$). The DTCI subscales show high internal consistencies, with Cronbach's $\alpha = 0.87$, 0.85, and 0.84, respectively (Table 1, second row below item list). The corrected item total correlations are presented in the fifth data column of Table 1. They were all between 0.50 and 0.78, indicating that the particular items and the respective scales measure the same trait.

The temporal stability of the questionnaire scores over a fortnight has been investigated in an independent sample. The test-retest reliability (Table 1, third row below item list) proved to be satisfactory in the Injury Scale ($r_{tt} = 0.78$), the Somatic Reaction Scale ($r_{tt} = 0.74$), and the Interpersonal Concerns Scale ($r_{tt} = 0.72$).

Response bias

The association between questionnaire responses and social desirability response set was studied in a sample of 88 respondents. As shown in the last row of Table 1, all correlation coefficients between treatment concerns and FPI-Self Disclosure proved to be nonsignificant ($P > 0.05$).

Relations to demographic and treatment characteristics

A series of exploratory analyses were undertaken to study the relationship between dental treatment concerns and demographic and treatment characteristics. With regard to the sample size the significance criterion was set at a level of $P < 0.01$. Pearson's correlations between DTCI scores and age were all above $P > 0.01$ (interpersonal: $r = -0.09$, injury: $r = -0.11$, somatic concerns: $r = -0.08$). *t*-Tests showed no mean differences between men and women in interpersonal and injury concerns ($t = 0.47$ and 0.11, respectively), but women scored higher in somatic reaction concerns (men: M = 6.42, SD=2.71; women: M = 7.15, SD = 3.40; $t = 2.60$, $P = 0.006$). A comparison, using ANOVAS, of the treatment concerns of patients with varying education levels proved the differences between the DTCI-mean scores to be nonsignificant [the *F*-values were between 1.36 and 3.18 (all $P > 0.01$)]. Another ANOVA was performed to compare treatment concerns in patients undergoing subsequently different treatment procedures. The *F*-statistics (between 0.33 and 0.76) all proved to be $P \geq 0.49$.

Discriminant validity

To investigate discriminant validity, we tested whether patients with high dental trait anxiety differed from low anxious patients in their DTCI scores. One-third of a subsample of 346 patients fell into the group of highly anxious subjects with DAS scores ≥ 12. Their low fearful counterparts made up the lower tercile (DAS ≤ 7). A medium tercile with DAS scores between 8 and 11 was left. We thought it would be of exploratory interest to study whether subjects in these groups differed from low anxious patients. Table 2 demonstrates the results of one-way ANOVAS with simple contrasts. On the general level, *F*-values were highly significant in all DTCI scales at a level of $P < 0.001$. The strongest effect was found in injury concerns with $F = 45.18$, followed by somatic ($F = 26.91$) and interpersonal concerns ($F = 13.66$). Comparing patients with high and low dental fear by simple contrasts, all differences were significant with *t*-values below $P = 0.00001$. Investigation of *t*-values showed that the specific effects in the subscales demonstrated the same ranking as omnibus *F*-tests. In addition, moderately fearful patients reported more injury concerns than those low with dental fear ($P < 0.0001$), more interpersonal concerns

Table 2. Results of one-way analyses of variance comparing DTCI scale scores in patients with high, moderate and low trait anxiety (n = 346): means, standard deviations, F-statistics and simple contrasts, comparing highly (group 3) and moderately fearful (group 2) with low fearful patients (group 1)

	DAS scores, mean (SD)				Simple contrasts	
	≤7, n = 109	8–11 (n = 133)	≥12 (n = 104)	F (P)	2 versus 1, t (P)	3 versus 1, t (P)
Interpersonal concerns	7.49 (2.51)	8.77 (4.12)	10.15 (4.17)	13.66 (0.000)	2.66 (0.008)	5.22 (0.00000)
Injury concerns	8.44 (2.57)	10.86 (4.47)	14.06 (5.45)	45.08 (0.000)	4.33 (0.00002)	9.47 (0.00000)
Somatic reaction concerns	5.69 (1.83)	6.36 (2.09)	8.04 (3.19)	26.91 (0.000)	2.15 (0.03)	7.11 (0.00000)

($P < 0.01$), and more somatic reaction concerns ($P < 0.05$).

Predictive validity

After treatment, a subsample of 187 patients retrospectively indicated their anxious tension just experienced using the Anxiety-Present subscale of the STAI-S. The correlations between pretreatment DTCI scores and state anxiety and their specific predictive contributions considering treatment duration and invasiveness, dental trait anxiety and each other DTCI scale, are presented in Table 3. Treatment concerns subscales did not differ in their single correlations with state anxiety, presenting coefficients between r = 0.50 and 0.54.

Controlling for treatment duration had no effect on the associations between treatment concerns and state anxiety (data not presented). When dentist-rated treatment invasiveness was partialled out, the remaining associations were slightly lower (between r_p = 0.45 and r_p = 0.47). Considering the common variance with dental trait anxiety, the additional predictive power of the DTCI scales was still very high (all $P < 0.001$). Interpersonal concerns explained 18% (r^2) of the variation in actual treatment anxiety additional to trait anxiety. Injury and somatic concerns accounted for about 13% and 11%, respectively, of state anxiety after removing the common variance with dental fear.

When interpersonal concerns were controlled for injury or for somatic concerns, the partial correlations remained still significant at a level of $P < 0.01$ or <0.001. The specific contributions of injury concerns in predicting state anxiety were even higher, both $P < 0.001$. Finally, somatic reaction concerns specifically predicted actual treatment anxiety at a level of $P < 0.001$ and of $P < 0.01$. The results suggest that each subscale of the DTCI is a specific predictor of anxious tension during treatment. A multiple regression analysis showed that the treatment concern variable set on the whole accounted for 36% of the variation in actually experienced anxious tension during treatment.

Discussion

Construct validity

Progress in technology causing less discomfort in patients undergoing dental procedures is not reflected by a decline in fear of dentistry in the community (1). This might suggest that inherent aversiveness of treatment stimuli may only partly explain dental anxiety. Major factors might be expectancies and concerns patients bring into the treatment situation which determine the appraisal of dental procedures as aversive (7, 8). According to Reiss' expectancy theory of fear (9, 10) and the Seattle diagnostic system of dental fears (6) basic concerns about injury, somatic reactions and dental staff behavior might be reasons contributing to the experience of exaggerated anxious tension.

Table 3. Results of correlation analysis between DTCI subscale scores and state anxiety (STAI-S Anxiety-Present) during dental treatment in 187 patients: single correlations (r_s), partial correlations (r_p) of each DTCI subscale controlling for the treatment invasiveness rating (TIR), dental trait anxiety (DAS), and for each of the other two DTCI subscales

		Controlling for:				
	r_s	TIR, r_p	DAS, r_p	Interpersonal, r_p	Injury, r_p	Somatic, r_p
Interpersonal concerns	0.50**	0.45**	0.44**	–	0.23*	0.32**
Injury concerns	0.54**	0.47**	0.34**	0.34**	–	0.35**
Somatic reaction concerns	0.50**	0.45**	0.33**	0.31**	0.25*	–

*$P < 0.01$, **$P < 0.001$.

Guided by these considerations we thought it would be worthwhile to develop an instrument measuring these core concerns, which might contribute to a better understanding of fear of dental procedures. An item sample was generated representing the three fundamental dental treatment expectancies. After eliminating items representing unique factors and those with split loadings, an exploratory principal component analysis in one sample half identified a three-dimensional solution which converged with the previously assumed content domains. The factors could be characterized as 'interpersonal concerns', 'injury concerns', and 'somatic reaction concerns'. A confirmatory factor analysis using the second sample half found an excellent fit of the hypothesized model with observed questionnaire data.

Reliability analyses of the subscales derived from factor analyses resulted in high consistencies and satisfactory temporal stability. Investigating associations between treatment concerns and FPI-Self Disclosure found no evidence of a response set for social desirability. In sum, it may be concluded that the investigated questionnaire, namely the 'Dental Treatment Concerns Inventory', shows good construct validity with respect to content and factorial validity, reliability and independence from response bias (20).

Discriminant validity

With regard to discriminant validity the DTCI subscale scores should differ between high and low dentally anxious subjects. The present study found that dentally fearful patients (as indicated by a DAS score ≥ 12) experienced more concerns about the impending dental procedure than those with no evidence of dental fear.

Dentally fearful patients expressed strong expectancies of possible incidents involving injury or pain. Patients reporting fear of dental procedures constituted the largest group in studies applying the Seattle system (13–15). In a population-based sample, fear of injury was elevated in dentally anxious respondents (13). Fears concerning mutilation and injury have been shown to be associated with dental anxiety (16) and avoidance of dental treatment (5). Thus present results are in line with previous investigations studying relationships between fear of injury and dental trait anxiety.

Concerns about somatic reactions, such as fainting or suffocating, also varied typically between high and low dentally anxious patients in our study. A subgroup of the Seattle system is characterized by these fears and has been repeatedly identified in community and patient samples (13–15). The disposition for anxiety sensitivity has been shown to be elevated in dentally anxious respondents of a population-based sample (13). Fears of being closed in, characterized by high somatic concerns, were related to dental anxiety in university students (16). The results of these studies, suggesting a relationship between concerns about somatic reactions and dental trait anxiety, were corroborated by the present research.

The interpersonal concerns scale of the DTCI additionally discriminated between high and low dentally fearful patients. According to the Seattle system (6), a considerable part of dentally fearful or phobic persons indicates distrust of dental personnel (13–15). In a large patient sample, dental trait anxiety was strongly associated with distrust of the dental staff (18). The assumption that interpersonal sensitivities might contribute to dental fear has been supported by our finding. Overall, the present results suggest a strong discriminant validity of core concerns about dental treatment, clearly distinguishing between patients with high and low dental trait anxiety.

Predictive validity

To fulfill the requirements of predictive validity, the DTCI scales are expected to explain variations in patients' state anxiety experienced during subsequent dental procedures (20). In our study treatment concerns shared 36% of variance with later-experienced actual anxious tension. Partial correlations suggested that each subscale specifically accounted for variations in later-experienced anxiety. Furthermore, the DTCI scales strongly added to the predictive power of dental trait anxiety.

Only few studies have been found predicting patient distress during dental procedures by relevant expectancies or cognitions. Investigating the role of pain catastrophizing, Sullivan and Neish (31) reported pain rumination to predict later-experienced pain during dental hygiene treatment. Anxiety sensitivity measuring general concerns about physical symptoms, predicted the affective component of pain experience in routine dental procedures (17). According to Corah et al. (32) patients' perceptions of dentist behavior explained reductions in anxiety during treatment. A retrospective study found patient-perceived dentist communication and behavior to be associated with

state anxiety during treatment (29). Using a single-item approach, De Jongh et al. (4) identified different combinations of negative cognitions about treatment incidents, dentist behavior, or physical reactions to share common variance with state anxiety in the waiting room and in the dental chair as evaluated by patients and dentists.

The present results suggest high predictive validity of treatment concerns in explaining anxious tension in patients undergoing dental procedures. This finding is in line with previous studies investigating the predictive ability of construct-related measures.

For further research, it would be of interest to study whether dental treatment concerns not only predict anxious tension, but also pain perceived by patients with regard to intensity, and sensory and affective qualities. Additionally, it should be investigated whether treatment concerns are specific to dental fear or whether they might be facets of generalized sensitivity to injury, somatic reactions, or interpersonal behavior. Another issue to be addressed in subsequent studies would be to investigate whether treatment concerns are acquired in the course of different learning histories relating to unpleasant dental experiences, familial models, or information learning (33).

With regard to clinical applications, the DTCI may guide the general dental practitioner in the management of patients with moderate dental fear. It has been shown that a dentist who provides patients with information about their fear often contribute to reducing their anxiety (34). Considering guidelines by De Jongh et al. (35), the following suggestions may be made. In patients with high injury concerns the dentist should be especially careful to provide a secure and safe treatment situation they can rely on. He may assure the patient that nothing will be done against his will and that he has some control and can interrupt treatment. When a patient indicates strong interpersonal concerns, the dentist may encourage him to ask questions and may take special effort to be patient in listening and answering. Encountering patients with concerns about somatic reactions, the dental practitioner may focus on acknowledging signs of anxiety and preparing patients for negative sensations. In patients with dental phobia, stress inoculation training may be advised (36). The DTCI may assist in identifying dysfunctional cognitions to develop a more adaptive internal dialogue to alleviate anxious tension.

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