The ability of Corah's Dental Anxiety Scale and Spielberger's State Anxiety Inventory to distinguish between fearful and regular Norwegian dental patients

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The purpose of this study was to test the ability of Corah's Dental Anxiety Scale (DAS) and Spielberger's State Anxiety Inventory (STAI-S) to distinguish between fearful ($n = 145$) and regularly attending ($n = 156$) Norwegian dental patients. The reliability of both instruments was high (Cronbach's alpha indices > 0.95). With DAS, 90% of the fearful patients and 85% of the reference patients were correctly assigned to their appropriate group. Thus it may be concluded that, when used on a Norwegian population, DAS is a valid instrument for distinguishing fearful patients from those regularly attending dental treatment. The corresponding figures for STAI-S were 80% for the fearful patients and 79% for the reference patients. Although not developed specifically for this purpose, this instrument may therefore still validly be used to distinguish between the groups. The correlation between the instruments was 0.76, indicating that to some extent they measure the same phenomenon. □ *Dental fear; reliability; validation*

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Extreme fear of dental treatment occurs among 5%–10% of the adult population (1, 2). A characteristic manifestation of such fear is a tendency to avoid necessary dental treatment, either partially or completely. A consequence of dental avoidance behavior may be poor oral health, and psychosocial problems and a reduced quality of life may ensue (3, 4).

The most widely used psychometric instrument to measure dental fear specifically is Corah's Dental Anxiety Scale (DAS) (5, 6). The scale consists of four questions related to various aspects of dental treatment. Spielberger's State–Trait Anxiety Inventory (STAI) is one of the most frequently used measures of anxiety in applied psychology research (7). It consists of two forms, one to measure anxiety as a personality trait (STAI-T) and one to measure fluctuating anxiety (state anxiety) across a variety of situations or contexts (STAI-S). Each form contains 20 questions. In the current investigation, only STAI-S was employed.

DAS has been validated in a Swedish sample of students, consisting of regular and emergency dental patients as well as patients referred to a fear clinic (8). Despite a small study sample, the authors concluded that the scale had acceptable psychometric properties, and that the scores obtained were comparable to US scores. However, contrary to the US results, they did not find any differences with regard to dental fear between men and women, and this was attributed to cultural differences. Normative Norwegian data on DAS are available (9), but the scale has not been validated in a Norwegian sample.

STAI-S has been validated in a Norwegian sample consisting of police recruits and college students who were tested in the context of anxiety related to impending and more distantly scheduled exams, respectively (10). To our knowledge, its ability to distinguish between fearful and regular dental patients has so far not been explored in a Scandinavian sample. Some studies have, however, employed a significantly modified version of STAI-S (11, 12). In these studies the introduction to the questionnaire explicitly referred to dental anxiety, and the questionnaire was mailed to the participants. Since STAI-S is intended to measure state anxiety (feelings in an actual situation), none of these studies can be classified as proper validations.

Because it cannot be precluded that culture, language, or other variables may have an effect on the reliability and validity of psychometric scales, they should not be used in a new context before they have been revalidated (13). Accordingly, both DAS and STAI-S, originally formulated in English and validated in North American samples (6, 7), need to be validated in a Norwegian sample in order to document their usefulness.

A measure of the applicability of a psychometric instrument may be evaluated in terms of its power to distinguish between a reference and a control group (13, 14), by its degree of correlation with another psychometric instrument designed to measure basically the same phenomenon, or by assessing the efficacy of intervention (15). In the current study the first two procedures were employed. As the use of a self-referred

sample of dentally fearful individuals tends to exclude the most fearful ones, this validation procedure may be considered conservative, and a first step in validating a given fear instrument.

The general aim of this study was to validate DAS and STAI-S in a Norwegian sample consisting of a group of dentally fearful patients and a group of regularly attending patients. Specifically, the study addressed the following topics: 1) the efficacy of DAS and STAI-S in terms of distinguishing between patients who regard themselves as dentally fearful and those who regularly seek dental treatment and 2) the extent to which the two scales correlate with each other.

Materials and methods

Subjects

The fear group. The fear group included all the patients who applied for treatment at a university clinic specializing in dental fear (Center for Odontophobia, University of Bergen, Norway) and who also attended their first regular appointment during the period October 1994 through October 1995. This group consisted of 145 patients, 56 men and 89 women (mean age, 33.4 years; $s = 10.26$). All the data were collected before any dental treatment.

The reference group. The reference group was selected from the patients of general dental practitioners. The inclusion criteria were that they 1) had regular dental treatment and 2) volunteered to participate in the study. The group consisted of 156 individuals, 62 men and 86 women (mean age, 39.9 years; $s = 11.76$).

Instruments

Norwegian translations of DAS (5, 16) and STAI-S (7, 17) were used. DAS contains 4 items with score levels from 5 (highest fear) to 1 (lowest fear). The items refer to feelings related to having an appointment the next day, sitting in the waiting room, sitting in the dental chair and hearing the drill, and sitting in the chair and having the teeth cleaned.

STAI-S contains 20 items, with scores ranging from 1 to 4 for each question. The subject indicates to what extent a given emotion is representative of his or her current state. A score of 1 means 'not at all', while 4 denotes 'very much'. To control for response set, half of the questions are formulated in terms of positive emotions, whereas the others state negative emotions. The scaling of the positively formulated questions is reversed when computing the total score.

Procedures

The patients in both groups completed DAS and STAI-S in the waiting room before meeting the dentist. The fear group knew that they were having only a diagnostic interview and that no dental treatment would take place that day. The reference group were having dental examination or treatment immediately thereafter.

The reference patients were asked to complete the questionnaire, together with information about their age, sex, and time since their last dental treatment, and return it in a stamped and addressed envelope that was provided.

Statistical methods

Possible differences between the groups with regard to age and sex were tested for by means of a two-tailed t test for independent samples.

To determine systematic differences in sex related to DAS and STAI-S, two-way ANOVAs were conducted, with group (fear and reference) and sex (male and female) as factors and DAS or STAI-S as the dependent variable.

Cronbach's alpha was used to assess the reliability of the instruments.

Point biserial correlations were calculated between group membership and total score for each of the instruments, indicating its validity. A significant age difference between the groups was included as a covariate in the correlation analyses.

For each instrument discriminant analyses were conducted in order to calculate the proportion of patients assigned to the correct group.

Stepwise multiple regression analyses were carried out for each instrument in order to identify which items on the respective scales distinguished most clearly between the fear group and the reference group. F-to enter was 3.84, and F-to remove was 2.71 (default values of the statistical program, SPSS, SPSS Inc., Chicago, Ill., USA).

The scores of the two instruments were correlated by means of Pearson's product-moment correlation.

All significance levels were set at 0.05.

Results

Dental avoidance behavior

On average the fear group had avoided dental treatment for a median of 4 years (range < 1–35 years). There was no significant correlation between avoidance and DAS score ($r_{(127)} = 0.04$) or STAI-S score ($r_{(122)} = 0.15$). For the reference group, the mean time since the last visit to the dentist was 10 months (range, 0–121 months).

Demographic variables

Information on sex was missing for eight subjects in the reference group. With regard to this variable there was no significant difference between the groups ($t_{(313)} = 0.25$). There was a highly significant age difference between the groups ($t_{(299)} = 5.11$, $P < 0.0001$).

Table 1. Mean and standard deviation, *s*, of DAS item scores for the fear group and the reference group

Items*	Fear group ($n = 145$)			Reference group ($n = 156$)		
	Mean	*s*	Rank	Mean	*s*	Rank
1. Going to the dentist tomorrow	4.2	0.7	1	2.6	1.0	1
2. Waiting in the dentist's waiting room	4.0	1.0	3	1.8	1.0	3.5
3. Sitting in the dental chair hearing the drill	4.1	0.9	2	2.0	1.0	2
4. Having teeth cleaned	3.5	1.0	4	1.8	1.0	3.5

* Abbreviated. For complete wording, see Ref. 5.

Reliability of the instruments

Cronbach's alpha was 0.95 ($n = 299$) for DFS and 0.95 ($n = 285$) for STAI-S, indicating a high degree of reliability for both instruments.

Validity of the instruments

DAS. For the fear group ($n = 144$) the mean DAS score was 15.80 ($s = 3.07$). For the reference group ($n = 155$) the corresponding score was 8.12 ($s = 3.58$). This group difference was highly significant (*r* point biserial $(rpb)_{(299)} = 0.76$, $P < 0.001$). Entering age as a covariate, the difference remained highly significant ($rpb_{(296)} = 0.73$, $P < 0.001$). Mean DAS item scores for the two groups are shown in Table 1.

According to the discriminant analyses of DAS items, 85.8% of the reference group ($n = 155$) and 90.3% of the fear group ($n = 144$) were assigned to the correct group.

STAI-S. The fear group ($n = 140$) had a mean STAI-S score of 52.5 ($s = 11.6$). The corresponding mean score for the reference group ($n = 145$) was 36.2 ($s = 12.6$). This group difference was highly significant ($rpb_{(285)} = 0.56$, $P < 0.01$), and it remained highly significant after entering age as a covariate ($rpb_{(282)} = 0.53$, $P < 0.001$). Mean item scores on STAI-S for the two groups are shown in Table 2.

According to the discriminant analyses of the STAI-S items, 78.6% of the reference group ($n = 145$) and 80.7% of the fear group ($n = 140$) were assigned to the correct group.

Single items differentiating between groups, DAS. A multiple regression analysis using 'group' as the dependent variable indicated that the total of 4 items explained 58% of the variance ($R^2_{(4298)} = 0.58$). The stepwise analysis indicated that item 2 was the best predictor ($R^2_{(1298)} = 0.57$). Entering item 3 only marginally improved the explained variance ($R^2_{(2296)} = 0.58$).

The multiple regression analyses indicated that all items reached a beta value of 0.05 or more.

Single items differentiating between groups, STAI-S. A multiple regression analyses using 'group' as the dependent variable indicated that the total of 20 items explained 39% of the variance ($R^2_{(20,284)} = 0.39$, $P < 0.001$). The stepwise regression analysis entered 3 items (items 17, 19, and 12) (Table 3).

Table 2. Mean and standard deviation, *s*, of STAI-S item scores for the fear group and the reference group

Items*	Fear group ($n = 145$)			Reference group ($n = 156$)		
	Mean	*s*	Rank	Mean	*s*	Rank
1. I feel calm	3.0	0.8	9	2.2	0.9	6.5
2. I feel secure	2.9	0.8	10	1.9	0.9	10
3. I feel tense	2.5	0.9	11.5	1.7	0.9	11
4. I feel guilty	1.8	0.9	18.5	1.3	0.6	17.5
5. I feel comfortable	3.3	0.8	3	2.3	1.0	4
6. I feel out of sorts	1.8	0.8	18.5	1.3	0.5	17.5
7. I worry that something unpleasant may happen to me	2.1	1.0	14	1.5	0.8	13
8. I feel rested	3.3	0.8	3	2.5	1.0	1
9. I feel anxious	2.0	1.0	15.5	1.3	0.6	17.5
10. I feel nice	3.3	0.0	3	2.4	1.0	2
11. I feel self-confident	3.1	0.9	7	2.2	1.0	6.5
12. I feel nervous	2.5	0.9	11.5	1.6	0.8	12
13. I am restless	2.0	0.9	15.5	1.3	0.7	17.5
14. I feel 'high-strung'	1.9	0.8	17	1.3	0.6	17.5
15. I feel relaxed	3.4	0.8	1	2.3	1.1	4
16. I feel content	3.1	0.9	7	2.3	1.0	4
17. I am worried	2.4	0.9	13	1.4	0.7	14
18. I feel stressed and confused	1.6	0.8	20	1.2	0.6	20
19. I feel happy	3.2	0.9	5	2.0	0.9	9
20. I feel pleasant	3.1	0.9	7	2.1	1.0	8

* Abbreviated. For complete wording, see Ref. 7.

Table 3. Stepwise regression analysis showing items differentiating most clearly between groups on STAI-S

Entered in step no.	Item no.	Item*	Result†
1	17	I am worried	$R^2_{(1283)} = 0.29$
2	19	I feel happy	$R^2_{(2282)} = 0.35$
3	12	I feel nervous	$R^2_{(3281)} = 0.36$

* Abbreviated. For complete wording, see Ref. 7.
† $P < 0.001$.

The multiple regression analyses indicated that items 3, 6, 4, 9, 1, and 18 (presented in beta-ranked order) did not reach beta values of 0.05 or more (for wording of items, see Table 2).

Correlations between the instruments. DAS and STAI-S were significantly positively correlated: $r_{(283)} = 0.76$, $P < 0.01$.

Differences between the sexes

The two-way ANOVA analyses showed significant differences between the sexes for both instruments (DAS: $F_{(1/309)} = 6.5$, $P < 0.01$; STAI-S: $F_{(1/292)} = 74.23$, $P < 0.001$). No significant interactions between sex and group were found in either analysis.

Discussion

These results indicate that both DAS and STAI-S reliably and validly, but to somewhat different degrees, distinguish between fearful and regularly attending Norwegian dental patients. However, despite this general conclusion, the two instruments differ in many specific respects, in terms of both the purpose for which they were designed and the detailed results. These matters are addressed below.

DAS

The highly satisfactory validity of this instrument demonstrates its usefulness in future studies of dental fear in Norwegian populations.

The mean DAS score of 15.8 for the fear patients appears to be slightly lower than comparable Swedish (18.2) (8), Danish (17.5) (12), and US (17.2) (6) findings. There are no obvious reasons for this difference. The mean score in the reference group of 8.12 was slightly higher than the mean of Swedish figures (7.3) collected from a similar sample of patients (8) and normative Norwegian scores (7.87) (9).

In the current study there was a slight, but significant, tendency for women to score higher on DAS than men. This is in accordance with results published from US (6, 19) and normative Norwegian (9) studies, but not with Swedish results, where no difference between the sexes was found (3, 20).

With regard to single items, the stepwise regression analyses showed that item 2 ('Waiting in the waiting room') explained 57% of the variance. When entering the remaining three items, the additional explained variance was only 1%. This indicates that all four items are highly intercorrelated, and thus to a large extent measure the same aspect of dental anxiety.

The results of DAS discriminant analyses indicate that nearly 15% of the subjects in the reference group were incorrectly assigned to the fear group. One factor contributing to this might be the possible heterogeneity of the reference group with regard to dental anxiety. It is to be expected that some of the patients in the reference group might be what are called 'haters, but goers' (21) or patients that only partially comply with dental treatment. This is supported by the small, but significant, correlation between total DAS score and time since last dental visit.

STAI-S

STAI-S is an instrument designed to measure state anxiety across a variety of situations. With nearly 81% of the fear group and 79% of the reference group assigned to the correct group, our results indicate that its ability to distinguish between the dentally fearful and the reference patients is fairly high, but still somewhat lower than that of DAS.

The fear group had a mean STAI-S score of 52.5. In a previous Danish study an apparently higher mean STAI-S score of 69.8 was recorded for a similar fear group (12). However, the two studies are not comparable. The current STAI-S scores were completed in the waiting room, with the standard instruction that the patients' responses should reflect how they felt at the time. In the Danish study, on the other hand, the form was mailed to the patients and completed at home, with the qualified instruction that the responses should reflect how the patients felt when they were at the dentist (personal communication, R. Moore, 1997).

It is well documented that anticipatory anxiety typically tends to exceed the reported anxiety when in the actual situation. Indeed, excessive anticipatory anxiety is one of the diagnostic criteria for specific phobias (DSM-IV, 1994) (22), and unreasonable anticipatory anxiety is one of the strongest contributors to the maintenance of avoidance behavior. When dentally fearful subjects are asked to imagine how they would feel in a real dental situation, high anxiety scores might be expected. Equally, the higher mean score for the current reference group of 36.2, as compared to a similar score of 41.7 reported in a Danish study (11), is most likely attributable to the same methodological differences.

The overall acceptable validity of STAI-S notwithstanding, nearly 20% of the patients in both the fearful and the reference group were not assigned to the appropriate group. The same suggestion put forward in regards to DAS—that in the reference group may be 'haters, but goers'—is likely to apply equally to STAI-S.

Focusing on single items, the stepwise multiple regres-

sion analyses indicated that the item with the greatest power to distinguish between the groups was item 17, 'I am worried' (Table 3), which accounted for nearly 30% of the explained variance. The two others that were included, 'I feel happy' (item 19) and 'I feel nervous' (item 12), improved this percentage by 6% and 1% respectively, indicating that, to a lesser extent than for DAS, the items are intercorrelated and therefore measure different aspects of dental anxiety.

Correlation between DAS and STAI-S

DAS and STAI-S had a significant positive correlation of nearly 0.8, indicating that the instruments to a certain extent measure the same phenomenon in a dental situation. This correlation is slightly stronger than the correlation between the Dental Fear Scale (DFS) and the Dental Belief Survey (DBS) that we found in a previous, analogous study (13), despite these instruments being developed specifically to measure dental fear. The finding is to be expected, because both DAS and STAI-S primarily measure feelings in a dental situation, whereas DBS and DFS are additionally aimed at cognitions and dental behavior, respectively.

Conclusion

The present results indicate that the two scales, DAS and STAI-S, are applicable instruments for use in Norwegian samples because they are able to distinguish highly reliably and efficaciously between subjects who regard themselves as dentally fearful and subjects who regularly seek treatment. This was to be expected for DAS, which was specifically designed for this purpose, unlike STAI-S, which was primarily developed to measure a different psychologic dimension. The applicability is further indicated by the fairly high and significant correlation found between the total scores of the two instruments.

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