

# Dental anxiety reduction and dental attendance after treatment in a dental fear clinic: a follow-up study

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Aartman IHA, de Jongh A, Makkes PC, Hoogstraten J: Dental anxiety reduction and dental attendance after treatment in a dental fear clinic: a follow-up study. Community Dent Oral Epidemiol 2000; 28: 435–42. © Munksgaard, 2000

**Abstract – Objectives:** The aim of the present study was to assess treatment outcome in terms of dental anxiety reduction at a post-treatment assessment and dental anxiety reduction and dental attendance one year later. Furthermore, it was determined to what extent psychopathological characteristics were related to treatment outcome. **Methods:** Questionnaires were sent to 280 patients treated with one of three treatment modes (i.e., behavioral management (BM), nitrous oxide sedation (NOS), and intravenous sedation (IVS)) at a dental fear clinic in The Netherlands. Dental anxiety before (T1) and after (T2) treatment was assessed using the Dental Anxiety Scale (DAS) and the Short version of the Dental Anxiety Inventory (S-DAI); the Symptom Checklist 90 (SCL-90) was used to assess general psychopathology. Dental anxiety was assessed again a year later and patients were questioned about their dental attendance pattern (T3). **Results:** ANOVA showed that the DAS and S-DAI scores at T2 and T3 were statistically significant lower than the initial scores. In addition, IVS patients showed less anxiety reduction than BM patients at both T2 and T3. Of the 145 patients whose last visit to the clinic was at least one year ago, 62% had visited a GDP at T3. A regression analysis revealed that, beside treatment mode, somatization, number of visits to clinic for dental treatment, and number of months between first and last visit to the clinic predicted dental anxiety at follow-up. **Conclusions:** It is concluded that, although a reduction in dental anxiety level was present, a relatively large proportion of patients did not improve, in terms of both dental anxiety and dental attendance.

**Key words:** behavioral science; dental anxiety; treatment; treatment outcome

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Submitted 15 October 1999; Accepted 30 March 2000

Adequate treatment of highly anxious dental patients is an important concern in many countries. Nitrous oxide sedation by inhalation, intravenous sedation, and general anaesthesia (GA) are being used in the treatment of these patients (e.g., 1) and this variety of interventions is generally considered successful (2). Especially treatment based on psychological methods has been effective in reducing dental anxiety (2–3). However, the few studies that assessed dental attendance at follow-up showed that approximately 25–35% of patients did not fol-

low through with treatment (4–8). A large proportion of patients did not visit a general dental practitioner (GDP) following treatment (4, 6) or did not visit one regularly (5, 7). These findings support the notion that it is important to assess outcome in the long run, to consider the differential effect of treatment modalities per patient type, and to seek for variables that are related to treatment outcome; that is, factors that predict success or failure. In order to plan treatment more efficiently, knowledge about how individual characteristics are related to

dental anxiety reduction and dental attendance following treatment may lead to more efficient and less frustrating treatments for both dentist and patient.

At the present time, few studies have addressed the issue of these potential prognostic factors. However, it has been found that highly anxious dental patients with low general anticipation anxiety showed a greater reduction in dental anxiety than those with relatively high general anticipation anxiety (9). The notion that patients who suffer from dental anxiety per se are easier to treat than patients with concomitant fears is postulated in several other studies (9–14). The question arises whether this also holds true for other dimensions of psychopathology beside the presence of multiple fears. Support for the presence of a relation between severity of psychopathology and degree of treatability is provided by a study of Kleinhauz et al. (15). They found that the presence of psychopathological symptoms contributed significantly to the failure of a behaviorally-oriented treatment approach.

The aim of the present study was twofold. The first aim was to determine the outcome of three different kinds of treatment modes (i.e., behavioral management [BM], nitrous oxide sedation [NOS], and intravenous sedation [IVS] in terms of both dental anxiety reduction after treatment and dental anxiety reduction and dental attendance at a follow-up one year later. Secondly, it is determined to what extent psychopathological characteristics and treatment mode are related to treatment outcome.

## Material and methods

### *Subjects*

Subjects were all 280 patients (167 women and 113 men) who applied and were treated at a dental fear clinic in Amsterdam, The Netherlands, between April 1995 and February 1997. The mean age of this group was 33.8 years (SD=10.0, range 17–74). The mean DAS and S-DAI scores were 17.8 (SD=2.2, range 11–20) and 40.5 (SD=4.8, range 20–45) respectively. Average time since last dental treatment was 6.8 years (SD=8.5, range 0–30,  $n=82$  [Duration of avoidance was assessed for a small subsample of the patients only]). On average it was 8.8 years ago (SD=9.1, range 0–34,  $n=82$ ) that patients of this clinic visited the general dental practitioner regularly. A part of this sample ( $n=144$ ) has been described before with regard to another research question (16).

### *Procedure*

Patients completed several questionnaires at home in order to assess dental anxiety and general psychopathology (T1). After a waiting period of approximately four months, patients were invited for an intake with one of the dentists of the clinic. In this screening interview, the dentist conducted an oral examination, after which the dentist decided together with the patient what treatment modality seemed most appropriate (i.e., BM, NOS, IVS, or GA). The BM approach varied from simple reassurance and “tell-show-do” to gradual exposure and relaxation exercises. Treatment with a BM approach could be supported by NOS. Hence, treatment with NOS had several aspects in common with BM, whereas IVS and treatment under general anaesthesia hardly included any components of the BM approach. Patients could be referred to the psychologist at the clinic for a limited number of sessions. In general, patients were treated until they were dentally fit.

A second set of questionnaires was sent to the patients between June 1997 and February 1998 (T2). In February 1999, a third set of questionnaires was sent to all the patients to assess dental anxiety level and dental attendance (T3). The following variables were assessed from the patient records at T3: number of months between the last and first visit to the clinic, number of visits to the clinic for restorative dental treatment, number of visits to the clinic for dental check-ups, number of appointments with psychologist, and other appointments. Moreover, patients were contacted by telephone to increase the response rate at this stage. In this way, dental attendance information was collected for as many patients as possible. For both T2 and T3 questionnaire reminders were sent out within four weeks.

### *Instruments*

Two inventories were used to assess reduction in dental anxiety. First, the Dental Anxiety Scale (DAS; 17), a four-item dental anxiety questionnaire with total scores that can range from 4 (not anxious at all) to 20 (extremely anxious). Second, the Short version of the Dental Anxiety Inventory (S-DAI), a questionnaire that contains nine items and has total scores that can range from 9 to 45 (18).

The Dutch Symptom Checklist 90 (SCL-90; 19) was used as a predictor of treatment outcome. The SCL-90 has been used to assess psychopathological complaints in highly anxious dental patients in several countries (15–16, 20–21). Total scores can

range from 90 to 450, with higher scores indicating more psychological distress. The 90 items provide an indication of psychological dysfunction on eight dimensions: agoraphobia (7 items), somatization (12 items), anger-hostility (6 items), depression (16 items), interpersonal sensitivity and paranoid ideation (18 items), anxiety (10 items), cognitive-performance difficulty (9 items), and sleep disturbance (3 items). Patients are requested to indicate on a five-point scale the amount of complaints they experienced during the previous week (1=none; 5=very many).

*Data analysis*

First, MANOVA and  $\chi^2$ -tests were conducted to compare respondents with non-respondents. All relevant dependent variables were included in a multivariate analysis to avoid an inflated Type I error rate due to multiple testing (22). For the same reason, a significance level ( $\alpha$ ) of 0.01 was used with the  $\chi^2$ -tests. ANOVA with repeated measures was used to assess dental anxiety reduction and differences in reduction among the treatment modalities. Next, percentages of patients with a DAS score after treatment of 13 or higher (i.e., the proposed cut-off score for dental anxiety [17]) are given per treatment mode. Since no such cut-off score exists for the S-DAI, clinical significance of S-DAI scores at follow-up was calculated. This method, introduced to assess outcome in psychotherapy research, defines a clinically significant score after treatment as a score that falls outside the range of the dysfunctional population; this range being two standard deviations below the pre-test mean score for that population (23, 24). After assessing dental attendance, one-way analyses of variance was used to assess the relation between treatment variables and treatment mode. Finally, predictors of treatment outcome were determined using multiple regression analysis and discriminant analysis. Residual gain scores were used as dependent variables in the regression analysis (25). This means that post-test scores (T3) were adjusted for the gain to be expected on the basis of the linear regression of the pre-test on the post-test score.

**Results**

Of the 280 patients 68.6% returned their questionnaire at T2 and 61.1% at T3. Both questionnaires were sent back by 51.4%. At T3, 19.6% patients were contacted additionally by phone. The remaining 19.3% of the patients could not be reached, ei-

ther because they moved, changed their telephone number, did not have a telephone, or because contact failed after several trials. MANOVA revealed that there was an overall difference between the respondents and non-respondents at T2 and T3 ( $F_{17,186}=1.86, P=0.024$  and  $F_{17,186}=2.00, P=0.013$  respectively). Subsequent univariate F-tests indicated that at T2 the respondents were older ( $F_{1,202}=7.56, P=0.007$ ), scored higher on the SCL-anxiety scale ( $F_{1,202}=5.31, P=0.022$ ), had a longer treatment duration ( $F_{1,202}=10.87, P=0.001$ ), had more dental treatment visits ( $F_{1,202}=5.41, P=0.021$ ), and had more regular dental check-ups ( $F_{1,202}=12.47, P=0.001$ ) than non-respondents. Similar results were found at T3. The respondents were older ( $F_{1,202}=10.39, P=0.001$ ), spent more months in the clinic ( $F_{1,202}=13.90, P<0.001$ ), had more dental treatment visits ( $F_{1,202}=4.66, P=0.032$ ), and had more regular check-ups ( $F_{1,202}=12.52, P=0.001$ ) than non-respondents. Using a significance level of  $\alpha=0.01$ , non-response was neither related to gender nor treatment mode.

Of the 192 patients who returned their questionnaire at T2, 97 (50.5%) were treated with a BM approach, 54 with NOS (28.1%), 36 with IVS (18.8%), and 5 with GA (2.6%). For the 171 respondents at T3 these percentages were 53.8%, 24.0%, 19.9% and 2.3% respectively. With regard to being reached at T3, the percentages were 52.2%, 24.3%, 20.4% and 3.1% respectively ( $n=226$ ). GA was excluded from all the analyses in which treatment modes were compared, because of the limited number of patients in this group. Men and women were equally distributed among the three treatment modalities ( $\chi^2=3.44, df=2, P=0.179$ ). Mean scores for the DAS and S-DAI are shown for T1, T2, and T3 in Table 1.

*Anxiety reduction per treatment mode*

ANOVA with repeated measures showed that reduction in dental anxiety level was statistically significant for both the DAS and S-DAI ( $F_{2,126}=76.34, P<0.001$  [ $d$ =effect size (26)]  $d=1.35$  [T1-T3];  $F_{2,128}=29.20, P<0.001, d=0.90$  [T1-T3]). Repeated

Table 1. Means and standard deviations for the DAS and S-DAI at T1, T2, and T3 (for all patients for whom scores are available)

Variable	T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD
DAS	17.8	2.2	14.6	3.6	13.6	3.8
S-DAI	40.5	4.8	36.0	7.4	34.6	7.9

contrasts indicated that the mean scores at T2 were statistically significant lower than at T1. The mean scores at T3 did not differ significantly from those at T2, although there was a trend for the DAS ( $P=0.063$ ). Reduction in dental anxiety scores is shown graphically in Figures 1 and 2. There was a statistically significant interaction between treatment mode and dental anxiety reduction for the S-DAI ( $F_{4,258}=3.11, P=0.016$ ). Post-hoc analysis revealed that the reduction in the BM group was higher than in the IVS group at both T2 and T3. No such interaction existed for the DAS ( $F_{4,254}=1.60, P=0.174$ ). There were no interaction effects between gender, treatment mode, and reduction in DAS and S-DAI.

Correlation coefficients between T1, T2, and T3 for the DAS and S-DAI are shown in Table 2.

*High versus low dental anxiety*

The following data provide information on treatment outcome at an individual level. Percentages of patients with a DAS score of 13 or higher and percentages of patients with a clinically significant S-DAI score after treatment are shown per treatment mode in Table 3. For the DAS, 31.5% of the

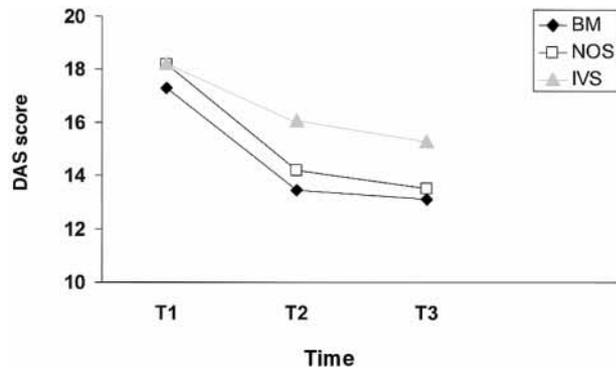


Fig. 1. Change in DAS scores per treatment mode.

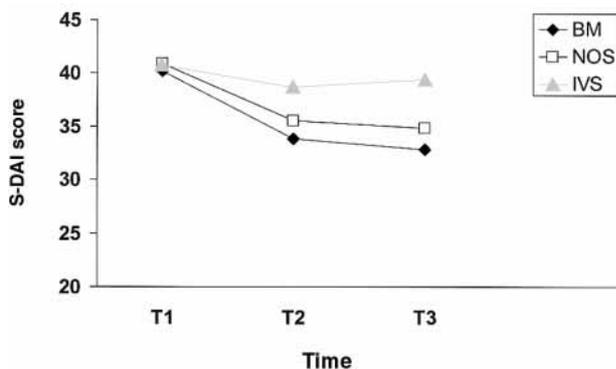


Fig. 2. Change in S-DAI scores per treatment mode.

Table 2. Correlation coefficients between dental anxiety scores at T1, T2, and T3\*

	DAS	S-DAI
T1-T2	0.44	0.40
T1-T3	0.32	0.38
T2-T3	0.57	0.68

\* all  $P$ 's < 0.001.

patients scored lower than 13 at T2 and 40.4% scored lower than 13 at T3. For the S-DAI, 27.1% of the patients had a clinically significant score at T2 and 33.5% at T3. A larger proportion of patients treated with IVS was anxious than of patients treated with a BM approach (see Table 3).

*Dental attendance*

Dental attendance was not assessed for 46.8% of the patients ( $n=131$ ). This group was composed of non-respondents ( $n=54$ ) and patients that visited the dental fear clinic less than one year before ( $n=77$ ). There was an overall difference between patients for whom dental attendance was assessed and those for whom these data were not available or used ( $F_{17,186}=2.02, P=0.012$ ). Univariate F-tests indicated that "respondents" spent less months in the clinic ( $F_{1,202}=17.96, P<0.001$ ) and visited the clinic less often for "other" visits ( $F_{1,202}=10.76, P=0.001$ ) than "non-respondents".  $\chi^2$ -tests showed no relation with gender and treatment mode. Of the 145 patients whose visit to the clinic was at least 12 months ago (GA excluded), 37.9% did not visit a GDP yet. There was no statistically significant relation between treatment mode and dental attendance (see Table 4;  $\chi^2=5.50, df=2, P=0.064$ ) or between treatment mode and having had dental treatment outside the clinic ( $\chi^2=5.43, df=2, P=0.066$ ).

*Relation between treatment mode and treatment variables*

One-way analyses of variance were carried out to assess differences among the treatment modes with regard to the treatment variables. The results showed that there was only a statistically significant difference for the number of dental treatments ( $F_{2,265}=15.71, P<0.001$ ). Post hoc analysis revealed that patients treated with NOS ( $M=5.0, SD=2.8$ ) visited the clinic more often for dental treatment than patients treated with BM ( $M=4.1, SD=2.6$ ) and IVS ( $M=2.6, SD=1.5$ ). In addition, BM

Table 3. Percentages of patients with a DAS score of 13 or higher and with a clinically significant (CS) S-DAI score at T2 and T3 per treatment mode

Group	DAS				S-DAI			
	T2		T3		T2		T3	
	<13	≥13	<13	≥13	CS	Not CS	CS	Not CS
BM	39.4*	60.6	51.6**	48.4	35.1 <sup>†</sup>	64.9	44.4 <sup>‡</sup>	55.6
NOS	28.0	72.0	39.0	61.0	24.1	75.9	30.0	70.0
IVS	14.7	85.3	11.8	88.2	9.1	90.9	8.8	91.2

\*  $\chi^2=7.43$ ,  $df=2$ ,  $P=0.024$ . \*\*  $\chi^2=16.40$ ,  $df=2$ ,  $P=0.000$ . <sup>†</sup>  $\chi^2=8.72$ ,  $df=2$ ,  $P=0.013$ . <sup>‡</sup>  $\chi^2=14.35$ ,  $df=2$ ,  $P=0.001$ .

patients had visited the clinic more often than IVS patients for restorative dental treatment.

*Predictors of treatment outcome*

Correlation coefficients between the SCL-90 scales and treatment variables on the one hand, and residual gain scores of the DAS and S-DAI on the other, are displayed in Table 5. Although these correlation coefficients are relatively low, some of them appeared to contribute significantly to the prediction of the residual gain scores of the DAS and S-DAI. This was shown in a multiple regression analysis with a stepwise entry procedure (see Table 6). Treatment mode was included in the list of possible predictors in order to calculate the relative contribution of the other variables. Somatization, treatment mode, number of visits to the psychologist, number of months spent in the clinic and number of dental treatment visits together explained 20% of the variance in the adjusted DAS T3 score. Eighteen percent of the S-DAI was explained by treatment mode, somatization, number of months spent in the clinic and number of dental treatment visits.

At T3, 27.3% of the patients had both a DAS score lower than 13 and a clinically significant S-DAI score and could be considered as patients with a relatively low dental anxiety level. This variable, "low" or "high" dental anxiety, was used as a dependent variable in a discriminant analysis. Treatment mode and number of other visits contributed significantly to the discriminant function (Wilks'  $\lambda=0.90$ ,  $\chi^2(2)=11.24$ ,  $P=0.004$ ). A discriminant analysis with "dental attendance" as the dependent variable revealed that treatment mode and somatization both contributed significantly to the prediction of dental attendance (Wilks'  $\lambda=0.88$ ,  $\chi^2(2)=16.47$ ,  $P=0.000$ ).

**Discussion**

The results showed that treatment in the dental fear clinic was successful in reducing severity of

dental anxiety as measured by the DAS and S-DAI. This reduction remained relatively stable after one year. In addition, there appeared to be a relation between treatment mode and treatment outcome. For example, IVS patients showed less anxiety re-

Table 4. Dental attendance and treatment outside the clinic (percentages of patients)

	Total (%)	BM (%)	NOS (%)	IVS (%)
Visited a dentist outside fear clinic (n=145)				
Yes	62.1	71.1	51.4	53.1
No	37.9	28.9	48.6	46.9
Treated outside clinic (for those patients that needed treatment; n=63)				
Yes	74.6	72.5	93.3	50.0
No	25.4	27.5	6.7	50.0

Table 5. Correlation coefficients between possible correlates of success and residual gain scores

Variables	DAS	S-DAI
SCL-Ago <sup>†</sup>	0.12	0.10
SCL-Anx	0.21*	0.16
SCL-Dep	0.17*	0.12
SCL-Som	0.25**	0.22**
SCL-CPD	0.21*	0.13
SCL-ISPI	0.14	0.12
SCL-AH	0.16	0.11
SCL-Sle	0.19*	0.16*
Number of months from first to last visits	0.21**	0.18*
Number of dental treatment visits	-0.09	-0.18*
Number of visits to psychologist	-0.17*	-0.08
Number of regular check-up visits	0.13	0.18*
Number of other visits	-0.04	-0.03

\*  $P<0.05$ . \*\*  $P<0.01$ . <sup>†</sup> Ago=SCL-Agoraphobia; Anx=SCL-Anxiety; Dep=SCL-Depression; Som=SCL-Somatization; CPD=SCL-Cognitive-Performance Difficulty; ISPI=SCL-Interpersonal Sensitivity and Paranoid Ideation; AH=SCL-Anger-Hostility; Sle=SCL-Sleep Disturbance.

Table 6. Final results multiple regression analysis using a stepwise entry method

Variables in the equation for the DAS	R <sup>2</sup> *	Beta	<i>t</i>	<i>P</i>
SCL-somatization	0.05	0.16	1.90	0.060
Treatment mode	0.09	0.20	2.35	0.020
Number of visits to psychologist	0.14	-0.26	-3.11	0.002
Number of months spent in the clinic	0.17	0.25	2.82	0.006
Number of dental treatment visits	0.20	-0.21	-2.43	0.017
Variables in the equation for the S-DAI				
Treatment mode	0.08	0.23	2.74	0.007
SCL-somatization	0.13	0.17	2.08	0.040
Number of dental treatment visits	0.15	-0.23	-2.66	0.009
Number of months spent in the clinic	0.18	0.19	2.14	0.034

\* R<sup>2</sup> after inclusion of this variable.

duction than BM patients when measured with the S-DAI, and proportionally more patients treated with IVS were still dentally anxious than patients treated with a BM approach. Furthermore, the results showed that about 38% of the patients that could have visited a dentist outside the clinic by that time, had not. There was a trend indicating that this percentage varied depending upon treatment mode. Finally, somatization, number of months spent in the clinic, number of dental treatment visits, and, not surprisingly, treatment mode explained about one fifth of the variance in the adjusted follow-up dental anxiety scores.

In general, pre-treatment DAS scores of patients applying for treatment at dental fear clinics are comparable throughout the world. Post-treatment means, however, vary somewhat (27). Although several studies carried out in our dental fear clinic showed similar treatment effects (4, 7, 9), post-treatment dental anxiety scores revealed that these patients should still be considered as relatively anxious compared to ordinary dental patients (27). Likewise, the proportion of patients with a DAS score lower than 13 or a clinically significant S-DAI score was not high. Only 27.3% of all patients at follow-up could not be considered as dentally anxious.

Beside information about dental anxiety reduction, the findings of the present study also provide information about dental attendance following treatment. Thirty-eight percent of the relevant patients had not visited a GDP. Thus, a substantially high number of patients did not benefit from treatment. This is in accordance with other studies (e.g., 5, 7).

Although the response rate was not very high in the present study, it is higher than the overall mean response rate of 58% of dental patients reported in

a review of response rates (28). An analysis of non-response data revealed that some persistent differences existed between respondents and non-respondents, suggesting that respondents were more committed to the dental fear clinic in terms of spending more months in the clinic and visiting the clinic more often than non-respondents. The results of the regression analysis indicated, as will be discussed in detail later, that one of these variables correlated negatively with treatment outcome, and one correlated positively. Therefore, it was not anticipated that non-response would have a serious effect on the results in the present study.

Admittedly, a study in which patients are randomly allocated to treatment modes could provide a better answer to the question which treatment mode shows most improvement in dental anxiety level. However, to date such a research method is not considered ethical in the dental fear clinics of The Netherlands. The tradition in our country is to treat patients, whenever possible, by a BM approach alone. The relation between treatment outcome and treatment mode is, however, in line with other studies. For example, in a study that compared a BM approach with GA, it was found that BM was superior to GA in terms of reduction in dental anxiety scores (both self-reported and as rated by dentist) and led to less late cancellations and broken appointments (29). Another study, comparing NOS with IVS, found that reduction of distress during treatment was less for IVS patients than for NOS patients (30). Patients treated with concentrations of nitrous oxide gas utilized in dental fear clinics experience dental treatment fully conscious and are able to influence their own depth of sedation. Thus, it is inevitable that treatment with NOS has much in common with treatment with a BM approach. With IVS on the other hand,

patients are still conscious, but the anaesthetist controls the depth of sedation. In addition, patients have partial and sometimes total amnesia for the dental treatment (31). The phenomenon of habituation, that is, the generally found decline in self-reported anxiety in response to confrontation with feared stimuli (e.g., 32), may explain the above-mentioned results. However, on the basis of the present study, we can only conclude that treatment mode is related to treatment outcome, not that IVS treatment is responsible for the less favourable results obtained using it.

What then are the psychological characteristics and treatment variables that are related to treatment outcome? In other words, which patients benefited most in the present study? The influence of the treatment variables apart from treatment mode was determined by incorporating treatment mode as a possible predictor. In addition to treatment mode, somatization appeared to contribute negatively to treatment success. This was also found in the study by Kleinhauz et al. (15). Thus, the more complaints with regard to somatic aspects of health that exist before treatment, the more difficult it seems to benefit from treatment in terms of dental anxiety reduction and dental attendance. Furthermore, the more dental treatment visits the patient paid to the dental fear clinic, the lower the anxiety scores at T3. Since this variable entered the regression equation after treatment mode, the influence of number of visits can not be explained by the fact that IVS patients had less dental treatment visits. Finally, the number of months between the first and the last visit of the patient to the clinic was related to the adjusted post-test scores. The longer this period, the higher the scores appeared to be. These results indicate that undergoing a number of dental treatment sessions in a short period of time, that is, *in vivo* exposure to dental stimuli, is effective in reducing anxiety. Patients for whom this was possible during the course of treatment, benefited most. It should be noted however that the percentages of variance in T3 scores that could be explained by these variables were not large. This means that the important issue of which treatment mode is most successful for which type of patient is still not resolved.

In conclusion, because the present study followed a large group of patients treated in a dental fear clinic for a relatively long period of time, we were able to gather information about dental attendance patterns after treatment, in addition to dental anxiety reduction. The results of both outcome

measures suggest that patients generally benefit from treatment at a dental fear clinic. However, a relatively large proportion of patients does not improve satisfactorily. Further research should keep seeking variables that contribute to the differentiation between highly anxious dental patients who succeed in treatment and those who do not.

## References

1. Milgrom P, Weinstein P, Getz T. Treating fearful dental patients. A patient management handbook. Seattle: University of Washington Continuing Dental Education; 1995.
2. Kent G. Dental Phobias. In: Davey GCL, ed. A handbook of theory, research and treatment. London: John Wiley & Sons Ltd; 1997. p. 107-27.
3. Horst G ter, Wit CA de. Review of behavioural research in dentistry 1987-1992: dental anxiety, dentist-patient relationship, compliance and dental attendance. *Int Dent J* 1993;43:265-78.
4. Zijpp AT van der, Horst G ter, Jongh A de, Makkes PC. Angst voor de tandheelkundige behandeling. Evaluatie van behandeling van patiënten met angst. *Ned Tijdschr Tandheelkd* 1996;103:213-5.
5. Liddell A, DiFazio L, Blackwood J, Ackerman C. Long-term follow-up of treated dental phobics. *Behav Res Ther* 1994;32:605-10.
6. Moore R, Brødsgaard I. Differential diagnosis of odontophobic patients using the DSM-IV. *Eur J Oral Sci* 1995; 103:121-6.
7. Schuurs AHB, Makkes PC, Duivenvoorden HJ. Attendance patterns of anxiety-treated dental patients: a pilot study. *Community Dent Oral Epidemiol* 1992;20:221-3.
8. Berggren U. Long-term effects of two different treatments for dental fear and avoidance. *J Dent Res* 1986; 65:874-6.
9. Makkes PC, Schuurs AHB, Thoden van Velzen SK, Duivenvoorden HJ, Verhage F. Effect of a special dental program upon extreme dental anxiety. *Community Dent Oral Epidemiol* 1987;15:173.
10. Moore R. Dental fear treatment: comparison of a video training procedure and clinical rehearsals. *Scand J Dent Res* 1991;99:229-35.
11. Berggren U. General and specific fears in referred and self-referred adult patients with extreme dental anxiety. *Behav Res Ther* 1992;30:395-401.
12. Berggren U, Carlsson SG. Usefulness of two psychometric scales in Swedish patients with severe dental fear. *Community Dent Oral Epidemiol* 1985;13:70-4.
13. De Jongh A. Angststoornissen in de tandartspraktijk. Deel 2. Behandeling van patiënten met angst. *Ned Tijdschr Tandheelkd* 1994;101:238-9.
14. Makkes PC. Angst en tandheelkunde. Enige aspecten van angst in de tandheelkundige situatie. *Ned Tijdschr Tandheelkd* 1983;90:119-25.
15. Kleinhauz M, Eli I, Baht R, Shamay D. Correlates of success and failure in behavior therapy for dental fear. *J Dent Res* 1992;71:1832-5.
16. Aartman IHA, De Jongh A, Makkes PC, Hoogstraten J. Treatment modalities in a dental fear clinic and the relation with general psychopathology and oral health variables. *Br Dent J* 1999;186:467-71.

17. Corah NL, Gale EN, Illig SJ. Assessment of a dental anxiety scale. *J Am Dent Assoc* 1978;97:816-9.
18. Aartman IHA. Reliability and validity of the short version of the Dental Anxiety Inventory. *Community Dent Oral Epidemiol* 1998;26:350-4.
19. Arrindell WA, Ettema JHM. SCL-90; Handleiding bij een multidimensionele psychopathologie-indicator. Lisse, The Netherlands: Swets Test Services; 1986.
20. Aartman IHA, De Jongh A, Van der Meulen MJ. Psychological characteristics of patients applying for treatment in a dental fear clinic. *Eur J Oral Sci* 1997;105:384-8.
21. Berggren U, Carlsson SG, Hakeberg M, Hägglin C, Samsonowitz V. Assessment of patients with phobic dental anxiety. *Acta Odontol Scand* 1997;55:217-22.
22. Tabachnick BG, Fidell LS. Using multivariate statistics. 3rd ed. New York: HarperCollins College Publishers; 1996.
23. Jacobson NS, Truax P. Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. *J Consul Clin Psychol* 1991;59:12-9.
24. Hageman WJJM, Arindell WA. Establishing clinically significant change: increment of precision and the distinction between individual and group level of analysis. *Behav Res Ther* 1999;37:1169-93.
25. Steketee G, Chambless DL. Methodological issues in prediction of treatment outcome. *Clin Psychol Rev* 1992; 12:387-400.
26. Cohen J. Statistical power analysis for the behavioral sciences. Revised ed. New York: Academic Press; 1977.
27. Schuurs AHB, Hoogstraten J. Appraisal of dental anxiety and fear questionnaires: a review. *Community Dent Oral Epidemiol* 1993;21:329-39.
28. Tan RT, Burke FJT. Response rates to questionnaires mailed to dentists. A review of 77 publications. *Int Dent J* 1997;47:349-54.
29. Berggren U, Linde A. Dental fear and avoidance: a comparison of two modes of treatment. *J Dent Res* 1984; 63:1223-7.
30. Goodall EM, File SE, Sanders FL, Skelly AM. Self-ratings by phobic denial patients during dental treatment: greater improvement with nitrous oxide than midazolam. *Human Psychopharmacol* 1994;9:203-9.
31. Oei-Lim VLB, Kalkman CJ, Makkes PC, Ooms WG, Hoogstraten J. Conscious sedation with propofol in dentistry. *Br Dent J* 1991;170:340-2.
32. Emmelkamp PMG, Bouman TK, Scholing A. Anxiety disorders: a practitioner's guide. Chichester: Wiley & Sons; 1992.