A comparison of cognitive therapy, applied relaxation, and nitrous oxide sedation in the treatment of dental fear

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The aim of this study was to investigate the short-term efficacy of cognitive therapy and applied relaxation in dental fear treatment and to compare these methods with conventional pharmacological sedation (nitrous oxide sedation). Patients ($n = 65$) with severe dental fear were randomly assigned to the different treatment methods and received 10 weekly sessions of individual therapy. Dropout rates were low, and all patients who completed the therapy sessions were able to receive dental treatment. Scores on dental fear tests were significantly reduced compared with pretreatment level for all treatment groups. There were no major differences between treatment methods in this short-term perspective. □ *Applied relaxation, cognitive therapy, dental anxiety/therapy, nitrous oxide sedation*

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About 5% of the population in Western countries report extremely high dental fear (1, 2), and another 20%–30% report moderate fear levels (3). Fairly large proportions of dental fear patients see the dentist on a regular basis but with a high incidence of missed or cancelled appointments (2, 4). Other patients with dental fear use dental services only in cases of emergency. Consequently, these patients often have poor oral health (5). Moreover, patients with extremely high dental fear generally score high on psychological distress scales (6), and treatment of dental fear has been shown to be associated with significant decrease in distress (7).

Well-designed studies using different types of sedative medication, such as benzodiazepines or nitrous oxide sedation, have documented significant reductions in dental fear scores (8–14). Various behavioural treatment techniques and, in particular, systematic densensitization have been found effective compared with general anesthesia and control groups (15–18). In addition, there is growing realization that non-specific factors may be powerful components of successful psychotherapy (19) and in dental fear treatment (20). However, there is a paucity of studies comparing and contrasting different treatment principles.

Recently, cognitive therapy has shown promising outcomes compared with pharmacological therapy in the treatment of anxiety and phobic conditions (21). Variants of cognitive therapy have also found their way into the field of dental fear treatment, and controlled studies have been conducted (see, for example, 22–25). Furthermore, various methods of relaxation have been explored in the treatment of anxiety. Applied relaxation has been found particularly useful in several conditions and is now considered an established psychological treatment method for phobias and other anxiety disorders (21, 26).

The main aims of this study were to examine applicability and short-term effects of applied relaxation and a variant of cognitive therapy in the treatment of severe dental fear and to compare these methods with a conventional pharmacological treatment method—that is, nitrous oxide sedation. Moreover, the dropout rate and dental fear level after treatment were compared with results obtained in earlier well-controlled behavioral treatment studies (14, 17, 27) and with general population norms (2, 28). To increase generalizability to dental general practice, it was an explicit aim to develop treatment methods that made it practicable to conduct psychological interventions and dental treatment in the same session.

Materials and methods

Patients and procedure

All dental fear patients who contacted the Dental Faculty, University of Oslo, in the period January 1995 to March 1996 were offered participation in the study.

The following inclusion criteria were applied: 1) Adult persons with severe dental fear; clinical evidence shows that a score on the Corah Dental Anxiety Scale of 15 or above indicates this condition (29). 2) Willingness to accept the practical arrangements of the study.

Table 1 summarizes patient characteristics in the three treatment groups. No significant group differences with regard to sex ratio, age, duration of dental avoidance, decayed tooth surfaces, or family income were found.

After being on a waiting list for at least 1 month, the patients were randomly assigned to the three treatment

Table 1. Patient characteristics on several measures for the three treatment methods

	Nitrous oxide sedation, $n = 21$ (35% men)		Cognitive therapy, $n = 21$ (43% men)		Applied relaxation, $n = 20$ (30% men)		
	Mean	*s*	Mean	*s*	Mean	*s*	*F*
Age	32.1	10.2	32.5	9.8	36.4	10.2	2.00
Duration of dental avoidance (years)	10.7	6.8	11.7	8.4	12.7	8.8	0.31
Decayed tooth surfaces	10.5	8.9	10.5	10.9	8.9	5.5	0.24
Family income (NOK)	296,752	237,305	323,588	143,204	307,611	151,834	0.94

methods and scheduled for 10 treatment sessions over a period of 10 weeks. After the 10th session all patients were referred to general practitioners.

Treatments and therapist

Treatment manuals and therapist training. Detailed treatment manuals are now routinely used in modern treatment of phobias (30, 31). Treatment manuals describing both specific treatment principles and non-specific factors were developed and adhered to during the present study. A dentist (the first author) performed all parts of the treatment.

On the basis of the treatment manuals for cognitive therapy (32) and applied relaxation (26) and established procedures for nitrous oxide sedation (33), manuals for the three dental fear treatment methods were developed.

In the treatment manuals specific and non-specific treatment principles were described in detail, and instructions for interventions in critical situations were given. In addition, the treatment manuals also functioned in education and therapist training. Before the trial a pilot study was conducted, to ensure integrity of treatment—that is, competence and adherence to the treatment manuals. Five patients in each treatment group were treated, and video recordings of treatment sessions were used for evaluation. This training involved supervision by psychologists (second and third authors) and specialists in pharmacological sedation. Regular supervision continued throughout the trial.

General non-specific treatment principles. As non-specific factors may be powerful components of treatment, the same procedures and the same set of generalized treatment principles were adhered to in all treatment conditions to reduce unwanted between-group differences. Several general principles were followed throughout the trial:

1) Education about fear was emphasized in all treatment conditions. In the second session theoretical models of anxiety and avoidance were introduced, using the patients' former experiences in dental settings as a basis. Equipment used for dental treatment was demonstrated.

2) It was considered important that the patient had adequate understanding of specific treatment principles before treatment started. Thus, the rationales of the treatment methods and practical procedures were explained. Each patient was given a written description (one to two pages) of the treatment method they were to be exposed to.

3) The patient's emotional state and experience of control in the treatment situation were emphasized (34). All patients were aware of what to expect during treatment. At the end of each session the dental treatment to be given next was discussed and decided on in a collaborative manner. Use of behavioral control procedures (for example, using a stop signal) was encouraged.

4) Emphasis was placed on effective pain control. All patients were encouraged to accept local anesthesia for those parts of the treatment which were expected to be painful. It was considered important to train the patients to give feedback when the anesthetic was effective.

5) General self-efficacy was improved through positive feedback. Examples of positive feedback are small comments by the dentist like 'When you are as relaxed as you are now, it is easy for me to give you an injection with minimal discomfort' and more elaborated comments and evaluations during and after treatment sessions.

6) Relaxing music was used if the patient wanted it.

7) To avoid postponing treatment sessions, 10 weekly appointments, preferably at the same time every week were scheduled at the start of the treatment. The patients paid in advance. The fee was not refunded if he/she was unable to attend a session. The importance of attending all 10 treatment sessions was emphasized.

Nitrous oxide sedation (NO). The specific treatment manual was developed in accordance with standard use of NO sedation (33). A mixture of NO and oxygen was given to the patient through a nose mask during treatment. The dose of NO was decided individually on the basis of the patient's feeling of comfort and calmness. The maximum dosage allowed was 60% NO. Dosages from 20% to 55% NO were given. During treatment the patient was encouraged to learn to control the dose by asking for a higher/lower dose to achieve optimal effect. The patient was allowed to receive the sedation as long as he/she wanted.

Cognitive therapy (CT). This treatment method was based on standard CT principles (35) and on the CT of panic in particular (21). Several cognitive and behavioral techniques were used to help patients identify and change fear-related thoughts. The cognitive procedures included identifying misinterpretations, challenging the patient's evidence for them, and substituting them with more

realistic interpretations. The behavioral procedures included exposure of feared situations in dental treatment, to test negative thoughts (for example, 'the dentist won't stop treatment even if I ask'). Homework assignments included keeping a record of anxiety-provoking thoughts about dental treatment. Fearful thoughts coming up before treatment sessions and fearful thoughts about dental treatment outside our clinic were explored.

Each treatment session started with a preexposure interview. Questions like 'What could happen if the injection causes pain?' were asked by the therapist, and the chain of catastrophic thoughts was explored.

Belief ratings for the various dangers that could occur were collected. Alternative non-harmful 'hypotheses' were elicited, using questions like: 'If you feel that intense unpleasantness you described, is there anything else you can do rather than flee the office?' The patient's evidence for and against the catastrophic expectation was examined.

The exposure was conducted in accordance with standard dental procedures. In the postexposure interview the experiences gained during exposure was investigated. The most frightful moment of treatment and the catastrophic thoughts at that moment were examined. Belief ratings for these events were conducted as well. The fearful thoughts before, during, and after exposure to dental treatment were compared and explored through questions like 'What makes you think differently about having an injection now?'

Applied relaxation (AR). The manual for this treatment method was developed from manuals for AR (26) and reports from clinical studies (17). Applied relaxation had two primary aims: to learn to recognize early signs of anxiety, and, second, to cope with this anxiety by initiating relaxation. The patients were to practice progressive relaxation by using a specially designed tape at home. It was emphasized that the treatment outcome depended on regular practice. On a specially designed form patients recorded experiences from their relaxation training and early signs of anxiety in everyday life situations.

During treatment sessions the patients were first seated in the dental chair and then instructed in progressive relaxation for about 7 min by the therapist. Dental treatment was then conducted in accordance with the general treatment principles outlined above. If anxiety-related thoughts or bodily symptoms emerged, the patient was instructed to interrupt the treatment and initiate relaxation.

Measures

Dental fear was assessed at enrollment in the program (time 1), at the start of treatment (time 2), and at the end of treatment (time 3). There was at least 1 month between the assessments made at time 1 and time 2. These assessments served as a waiting-list control condition. To assess treatment outcome, changes in scores from time 2 to time 3 were used.

The measure most often used to assess dental fear is Corah's Dental Anxiety Scale, (CDAS) (36, 37). This four-item test, which measures anticipatory dental fear on a scale of 4 (no fear) to 20 (extreme fear), is considered to be a coarse but valid and reliable instrument.

Kleinknecht's Dental Fear Scale (DFS), a test comprising 20 items with scores ranging from 1 (no fear) to 5 (extreme fear), is considered to have advantages over the CDAS because of its comprehensiveness (38, 39) and the possibility of generating subscales. The three subscales proposed by Kleinknecht et al. (36) were used: 1) past avoidance of dentistry (avoidance), 2) bodily arousal during treatment (arousal), and 3) fear of specific situations and stimuli (situations). In the present study only measures likely to change during treatment (the arousal and situation dimensions) were considered of interest.

To assess the patient's attitudes towards dentists we used the Dental Belief Scale (DBS), a 15-item test with scores varying from 1 (no fear) to 5 (extreme fear) (40).

Treatment progression was measured by registering the number of sessions before the first local anesthetic injection and the first use of the dental drill. To evaluate the subjective benefit from different components of the treatment, the patients were asked to rate the importance of specific treatment principles (NO sedation, cognitive interventions, and relaxation training) and the importance of non-specific principles (for example, predictability and pain control). The scores varied from 1 (no importance for the treatment process) to 5 (large impact on the treatment process).

Statistical analyses

Most of the variables used in this study were measured in ordinal scales. In addition, the observations were shown to have skewed distributions. Thus, both non-parametric and parametric tests were used in the initial analyses. Intra- and inter-group differences were tested by means of the Wilcoxon signed rank test and the Kruskal–Wallis one-way analysis of variance, respectively. Repeated measures analysis of variance (ANOVA) was then performed for each measure, to examine i) time effects, ii) differences between treatment groups, and iii) time × group interaction effects. On the whole, the parametric and non-parametric tests yielded similar results; that is, no changes in the main conclusions would ensue when choosing one or the other set of methods. As parametric tests such as ANOVA and *t* tests are generally used in the published dental fear studies, parametric statistics were chosen in the final analysis and data presentation in this report too.

In analyses showing significant time × group interaction effects, the groups were compared at each assessment by means of modified *t* tests with Bonferroni corrections to adjust the *P* value and control the type-I error rate. Effect sizes were calculated in accordance with the formula M1–M2/pooled standard deviation (*s*), where M1 was the

Table 2. Indicators of clinical progression in the three treatment groups and patients' assessments of different elements of the treatment at the end of the trial

	Nitrous oxide sedation		Cognitive therapy		Applied relaxation		
	Mean	*s*	Mean	*s*	Mean	*s*	*F*
No. of sessions before first injection	3.8	0.7	3.3	0.5	3.5	0.5	0.20
No. of sessions before first use of dental drill	4.4	1.2	4.1	0.8	4.1	1.2	2.04
Filled tooth surfaces during treatment	9.9	6.7	8.6	4.2	8.9	4.7	0.42
Patient's assessments of							
Specific treatment method	4.1	1.1	4.3	0.9	4.1	0.6	0.17
Non-specific factors							
Predictability	4.1	0.9	4.2	0.8	4.1	0.6	0.32
Control	4.4	0.8	4.3	0.7	4.2	0.6	0.28
Pain control	4.6	0.7	4.4	0.9	4.8	0.4	1.15
Increased self-efficacy	4.2	0.9	4.5	0.9	4.1	0.8	1.56

mean of the treatment group and M2 was the mean of the control group (41).

To test group differences when only one measurement was obtained, one-way ANOVA or the chi-square test was used. Finally, Pearson's correlation coefficient was used to study zero-order correlations between variables.

Results

The dropout rate was 4.6% (two patients in the AR group and one in the NO group), with 62 patients completing the trial (20 in the NO group, 21 in the CT group, and 21 in the AR group). Data from the dropout patients were not available. A total of 60 patients (96.7%) rated the treatment very successful or successful, and 2 patients (3.3%) rated it as partly successful and partly a failure. Fifty-four (88.5%) of the participants would recommend the treatment to all other patients with dental fear, and seven (11.5%) patients would recommend it with certain reservations.

There were no between-group differences with regard to treatment progression, measured by time spent before the first injection and the first use of the dental drill (Table 2).

All forms of dental treatment were performed during the trial (for example, fillings, crowns, prosthetics, and extraction of teeth) in accordance with the patients' needs. The most frequent treatment was dental fillings. There were no significant between-group differences in the number of filled surfaces (Table 2).

The patients' assessment of the specific and non-specific factors showed that the patients judged their benefit from the non-specific factors to be equally important as the specific treatment method in all treatment conditions (Table 2). One-way ANOVA showed no significant between-group differences.

Results from the dental fear assessments are summarized in Table 3. A series of repeated-measures ANOVA showed highly significant changes over time for all tests. However, the most substantial reductions occurred during therapy. All tests of time effects had strong power.

A time × group interaction effect with regard to the CDAS was found. Multiple comparisons showed significant differences between CT and AR before treatment ($t = 2.26$, $P < 0.05$) and between NO and AR after treatment ($t = 2.36$, $P < 0.05$). When Bonferroni adjustments were used, the differences were no longer significant (CT versus AT at time 1, $P = 0.07$; NO versus AR at time 3, $P = 0.09$).

Co-variance analyses with CDAS score at enrollment used as co-variate showed a significant between-group difference in CDAS scores after treatment ($F = 6.76$, $P < 0.05$).

With regard to the DFS Situation subscale, a between-group difference approaching significance ($P = 0.06$) was found. Multiple comparisons using Bonferroni adjustment showed that the CT group scored significantly lower than the NO group ($t = 2.65$, $P < 0.05$) at time 3.

The between-group tests had weak power, except the time × group interaction for CDAS.

The effect sizes were substantial for all dental fear measurements (Table 4). Particularly favorable were effect sizes for anticipatory fear (CDAS) and fear of specific dental situations (DFS Situation).

CDAS scores after treatment for each of the present treatment groups were compared with CDAS scores obtained in Berggren & Linde's study of systematic desensitization (14), Moore's study of video training and clinical rehearsals (17), and results from a study of intravenous sedation and NO sedation in Dutch dental fear clinics (27). Results from z tests (data not shown) showed significantly lower CDAS scores ($P < 0.05$) in all groups compared with the Dutch dental fear patients (27). Significantly ($P < 0.05$) higher CDAS scores were found in the NO group compared with systematic desensitization, video training, and clinical rehearsals. However, no significant differences between the AR and CT groups, on the one hand, and systematic desensitization, video training, and clinical rehearsals were found. Furthermore, the dropout rates in the Berggren & Linde (14) and Moore (17) studies were 8% and 12%, respectively, which are higher than in the present study (4.6%). Importantly, after treatment the dental fear level in the three intervention

Table 3. Dental fear assessments at enrollment in program (time 1), by start of treatment (time 2), and after the treatment program (time 3) across treatment conditions

Measure	Nitrous oxide sedation, mean (*s*), *n* = 21	Cognitive therapy, mean (*s*), *n* = 21	Applied relaxation, mean (*s*) *n* = 20	ANOVA repeated measures		
				F, group *(power)*	*F*, time *(power)*	*F*, group × time *(power)*
CDAS						
Time 1	18.3 (1.5)	17.6 (1.9)	18.7 (1.3)			
Time 2	17.0 (3.1)	17.0 (3.0)	17.8 (2.4)	0.4	420.2**	3.3*
Time 3	10.0 (3.1)	9.3 (2.9)	8.1 (1.9)	*(0.1)*	*(1.0)*	*(0.8)*
DBS						
Time 1	3.2 (0.8)	3.0 (0.8)	3.1 (0.8)			
Time 2	2.8 (1.0)	2.9 (1.0)	2.8 (1.0)	0.2	74.4**	0.3
Time 3	1.8 (0.9)	1.8 (0.8)	2.0 (1.1)	*(0.6)*	*(1.0)*	*(0.1)*
DFS Arousal						
Time 1	3.7 (0.7)	3.7 (0.8)	4.0 (0.6)			
Time 2	3.7 (0.8)	3.6 (0.9)	3.7 (0.7)	0.1	68.5**	1.8
Time 3	2.9 (0.9)	2.6 (1.0)	2.5 (1.1)	*(0.1)*	*(1.0)*	*(0.4)*
DFS Situations						
Time 1	4.2 (0.5)	4.1 (0.5)	4.2 (0.6)			
Time 2	4.2 (0.5)	4.0 (0.6)	4.0 (0.6)	3.0	163.7**	1.2
Time 3	2.7 (0.9)	2.1 (0.7)	2.4 (1.0)	(0.6)	*(1.0)*	*(0.2)*

* Significant difference, $P < 0.05$; ** significant difference, $P < 0.01$.

groups was comparable to the general Norwegian population norm, which is 7.5 ($s = 3.1$) for CDAS (2) and 2.2 ($s = 1.0$) for DFS (29).

Discussion

A major aim of the present study was to test the efficacy of two psychological treatment methods, cognitive therapy and applied relaxation, and compare outcomes with results obtained with conventional pharmacological sedation. All three treatment methods were associated with significant improvements with regard to dental fear and dental treatment progression. Moreover, dental fear levels after treatments were comparable to general population norms (2, 28) and in agreement with results reported in earlier treatment studies (14, 17). Importantly, the dropout rate was low.

The differences in scores that appeared during the waiting list control can most probably be explained as unspecific effects of being in a treatment program. Several factors might account for these improvements—for example, regression effects and the assurance that the actual problem will be taken care of in the forthcoming treatment (42).

Table 4. Effect sizes of dental fear assessments in each treatment method

	Nitrous oxide sedation	Cognitive therapy	Applied relaxation
CDAS	2.3	2.6	4.6
DBS	1.0	1.3	0.9
DFS arousal	1.0	1.1	1.3
DFS situation	2.2	2.9	2.0

In addition to the highly significant time effects, a between-group effect with regard to the DFS Situation subscale and a group × time interaction effect for CDAS scores were found. However, these effects are rather isolated findings, which emerged in a fairly large number of statistical tests. Thus, the findings are of uncertain validity. The power of the between-group analyses was generally weak and may indicate that the sample size was too small to detect real, albeit small, differences. The lack of between-group differences may also be explained as a 'ceiling and floor' effect. As one of the inclusion criteria was extreme dental fear (ceiling effect) and all treatment groups scored within the range of the normative mean score after treatment (floor effect), the absence of differences between the groups may result from limits in the range of scores obtained (43).

However, the lack of between-group differences may also indicate the importance of the non-specific factors. Elements like exposure to dental situations, practical procedures (such as fixed appointments), and hearing a logical procedure that describes the genesis of one's problem may exert influence on patient performance and generate therapeutic effects. On the basis of ethical and psychological arguments, these common and non-specific factors were considered essential ingredients of the treatment methods. Moreover, in contrast to most other treatment studies of dental fear, in the present study the non-specific factors were made explicit and included in the treatment manuals. The finding that patients assessed the non-specific treatment principles to be as useful as the specific treatment principles supports the importance of these factors. Ideally, a control group including the same

procedure and set of non-specific treatment principles should have been included in this study. However, it should be stressed that we were primarily interested in investigating which of the two psychological interventions was better for dental fear treatment. Hence, the present design without a non-specific treatment control group is adequate. On the other hand, the question of whether either treatment exerts therapeutic effects beyond those that can be accounted for by non-specific treatment effects is certainly an important one and should be addressed in future studies.

Summing up, the following conclusions seem warranted: First, the treatment methods may be considered effective and interchangeable, at least in a short-term perspective. Second, it is obviously within the reach of an ordinary dentist, through special training and supervision, to deliver high-quality treatment for dental fear, even to the extent of giving therapeutic interventions based on a different underlying rationale. Third, the contribution of the non-specific factors is not known but is probably substantial. Thus, future research should compare the specific treatment principles with a non-specific treatment condition (including essential elements such as regular contact with a therapist, exposure to dental treatment, and predictability/control). Finally, the long-time effects of the different treatment methods should be explored.

References

1. Hakeberg M, Berggren U, Carlsson SG. Prevalence of dental anxiety in an adult population in a major urban area in Sweden. Community Dent Oral Epidemiol 1992;20:97–101.
2. Vassend O. Anxiety, pain and discomfort associated with dental treatment. Behav Res Ther 1993;31:659–66.
3. Stouthard ME, Hoogstraten J. Prevalence of dental anxiety in The Netherlands. Community Dent Oral Epidemiol 1990;18: 139–42.
4. Kleinknecht RA, Bernstein DA. The assessment of dental fear. Behav Res Ther 1978;9:6626–34.
5. Hakeberg M, Berggren U, Gröndahl HG. A radiographic study of dental health in adult patients with dental anxiety. Community Dent Oral Epidemiol 1993;21:27–30.
6. Aartman I, de Jong A, van der Meulen MR. Psychological characteristics of patients applying for treatment in a dental fear clinic. Eur J Oral Sci 1997;105:384–8.
7. Vassend O, Willumsen T, Hoffart A. Effect of dental fear treatment on general distress: The role of personality variables and treatment method. Behav Modif 2000;24:580–99.
8. Makkes PC, Schuurs A, van Velzen SK, Duivenvoorden HJ, Verhage F. Effect of a special dental program upon extreme dental anxiety. Community Dent Oral Epidemiol 1987;15:173.
9. Veerkamp JS, van Amerongen WE, Hoogstraten J, Groen HJ. Dental treatment of fearful children. Using nitrous oxide. I: Treatment times. J Dent Child 1991;58:453–57.
10. Weinstein P, Milgrom P, Ramsay DS. Treating dental fears using nitrous oxide oxygen inhalation and systematic desensitization. Gen Dent 1988;36:322–6.
11. Hallonsten AL. Sedation by the use of inhalation agents in dental care. Acta Anaesthesiol Scand Suppl 1988;88:31–5.
12. Ter Horst G, De Wit CA. Review of behavioural research in dentistry 1987–1992: dental anxiety, dentist-patient relationship, compliance and dental attendance. Int Dent J 1993;43:265–78.
13. Van der Bijl P. The benzodiazepines in dentistry: a review. Compendium 1992;13:46–50.
14. Berggren U, Linde A. Dental fear and avoidance: a comparison of two modes of treatment. J Dent Res 1984;63:1223–7.
15. Carpenter DJ, Gatchel RJ, Hasegawa T. Effectiveness of a videotaped behavioural intervention for dental anxiety: the role of gender and the need for information. Behav Med 1994;20: 123–132.
16. Horowitz LG. Audiotaped relaxation, implosion and rehearsal for the treatment of patients with dental phobia. Gen Dent 1992; 40:242–7.
17. Moore R. Dental fear treatment: comparison of a video training procedure and clinical rehearsals. Scand J Dent Res 1991;99: 229–35.
18. Friedman N, Wood GJ. An evaluation of the iatrosedative process for treating dental fear. Compend Contin Educ Dent 1998;19:434–42.
19. Safran JD, Muran JC. Resolving therapeutic alliance ruptures: diversity and integration. J Clin Psychol 2000;56:233–43.
20. Freeman R. Assessing and managing dental phobia in general practice: some practical suggestions. Br Dent J 1998;184:214–6.
21. Clark DM, Salkovskis PM, Hackmann A, Middleton H, Anastasiades P, Gelder MA. Comparison of cognitive therapy, applied relaxation and Imipramine in the treatment of panic disorder. Br J Psychol 1994;164:759–69.
22. Kent G. Cognitive processes in dental anxiety. Br J Clin Psychol 1985;24:259–64.
23. Getka EJ, Glass CR. Behavioral and cognitive-behavioral approaches to the reduction of dental anxiety. Behav Res Ther 1992;23:433–48.
24. de Jongh A, Muris P, ter Horst G, van Zuuren F, Schoenmakers N, Makkes P. One-session cognitive treatment of dental phobia: preparing dental phobics for treatment by restructuring negative cognitions. Behav Res Ther 1995;33:947–54.
25. Berggren U, Hakeberg M, Carlson SG. Relaxation vs. cognitively oriented therapies for dental fear. J Dent Res 2000; 79:1645–51.
26. Öst LG. Applied relaxation: description of a coping technique and review of controlled studies. Behav Res Ther 1986;25:397–409.
27. Aartman IH, 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.
28. Kvale G, Berg E, Nilsen CM, Raadal M, Nielsen GH, Johnsen TB, et al. Validation of the Dental Fear Scale and the Dental Belief Survey in a Norwegian sample. Community Dent Oral Epidemiol 1997;25:160–64.
29. Berggren U, Carlsson SG. Psychometric measures of dental fear. Community Dent Oral Epidemiol 1984;12:319–24.
30. Dobson KS, Shaw BF. The use of treatment manuals in cognitive therapy: experience and issues. J Consult Clin Psychol 1988;56: 673–80.
31. Hoffart A. Use of treatment manuals in comparative outcome research: a schema-based model. J Cogn Psychother 1994;8:41–54.
32. Hoffart A. A comparison of cognitive and guided mastery therapy of agoraphobia. Behav Res Ther 1995;33:423–34.
33. Hallonsten AL, Koch G, Schroder U. Nitrous oxide-oxygen sedation in dental care. Community Dent Oral Epidemiol 1983; 11:347–55.
34. Logan HL, Baron RS, Keeley K, Law A, Stein S. Desired control and felt control as mediators of stress in a dental setting. Health Psychol 1991;10:352–9.
35. Beck AT. Cognitive therapy: past, present, and future. J Consult Clin Psychol 1993;61:194–8.
36. Corah NL. Development of a dental anxiety scale. J Dent Res 1969;48:596.
37. Corah NL, Gale EN, Illig SJ. Assessment of a dental anxiety scale. J Am Dent Assoc 1978;97:816–9.

38. Kleinknecht RA, Thorndike RM, McGlynn FD, Harkavy J. Factor analysis of the dental fear survey with cross-validation. J Am Dent Assoc 1984;108:59–61.
39. Moore R, Berggren U, Carlsson SG. Reliability and clinical usefulness of psychometric measures in a self-referred population of odontophobics. Community Dent Oral Epidemiol 1991;19: 347–51.
40. Smith T, Milgrom P, Weinstein P. Evaluation of treatment at a dental fears research clinic. Spec Care Dent 1987;7:130–4.
41. Kazdin AE. Research design in clinical psychology. 3rd ed. Boston: Allyn and Bacon; 1998. p. 50–3.
42. Frank JD, Nash EH, Imber SD. Immediate and long-term symptomatic course of psychiatric outpatients. Am J Psychiatry 1963;120:429–39.
43. Kazdin AE. Research design in clinical psychology. 3rd ed. Boston: Allyn and Bacon; 1998. p. 118–20.

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