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A Randomized Controlled Trial of the Effect of a Brief Intervention on Dental Fear

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Abstract

Objectives: To examine the effect of a brief intervention for patients with dental fear in a private dental clinic.

Methods: Patients presenting with subjectively reported dental fear were randomly assigned to either an immediate intervention (n=53) or a waiting list (n=51) group. Both groups received an identical intervention, but delayed by 4-6 weeks in the waiting list group. Participants were asked to fill out two self-report questionnaires of dental fear at pre- and post-intervention, and again at a two-year follow-up assessment.

Results: Analysis of variance showed that dental fear was significantly reduced in the immediate intervention group (d = 1.5-2.2), compared to the waiting list group (d = 0.3-0.4). Additionally, all participants showed a significant reduction of dental fear following the brief intervention, and, in the subgroup available for follow-up, this effect was maintained after two years.

Conclusions: This indicates that a brief intervention may be efficacious in helping a significant number of dental fear patients return to regular dental treatment. Future research should investigate the applicability of a brief intervention in the dental clinic.

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Introduction

Dental fear affects many people's lives, with European prevalence rates ranging from 5.4% to 24.3% (1-6), and international studies indicating that 40-50% of the adult Western population experience some fear of dental treatment and that 5-7% suffer from high levels of dental anxiety (6-8).

The consequences of dental fear increase with severity, as individuals with mild anxiety may attend dental treatment regularly, while those with odontophobia may avoid dental treatment entirely (9). Avoiding dental treatment affects the person's oral health by increasing the risk of missing teeth, decaying surfaces, periradicular bone lesions, and pronounced marginal bone loss (10). In addition, dental fear may also cause psychological distress, as a poor dental state may lead to intense embarrassment and a poor self-image (11). Hence, interventions that reduce dental fear may improve oral health, as well as psychological well-being in fearful patients.

Interventions such as cognitive therapy and behaviour-oriented approaches have generally been shown to reduce dental fear, although the number of sessions used in each study may vary (7). Comparing a one-session psychological intervention to acute administration of a benzodiazepine, Thom et al. (12) found that both forms of intervention led to decreased anxiety during dental surgery. However, only 20 % of patients receiving the benzodiazepine had continued regular dental treatment at a 2-month follow-up assessment, compared to 70 % of patients receiving psychological intervention. In addition, patients

receiving psychological intervention showed further improvement at the 2-month follow-up. De Jongh et al. (13) compared a single session of cognitive restructuring to the provision of information about oral health and dental treatment in dental phobic patients. They found a comparable decrease in the frequency and believability of negative cognitions and dental anxiety after one year for both interventions. Jöhren et al. (4) found a 70 % rate of adherence to dental treatment following three sessions of cognitive behavioural therapy with dental phobic patients. Haukebø et al. (15) found a greater decrease in dental anxiety for patients receiving five sessions, compared to patients receiving only one session of dental fear intervention. However, after one year, both groups reported the same level of dental anxiety, and the number of patients having returned to ordinary dental treatment was also comparable. Finally, Wannemueller et al. (16) found two sessions of cognitive-behavioural therapy to be superior to both hypnosis and general anaesthesia.

Taken together, these studies suggest that very brief interventions (i.e., 1-3 sessions) may be effective in reducing dental fear, even long-term. Furthermore, the studies suggest that brief interventions based on cognitive-behavioural techniques may be equal or superior to other forms of intervention, and that their benefits persist over time.

While cognitive-behavioural methods have proven to be effective interventions, dentists report that their training in the use of psychological methods to reduce dental fear is less than adequate (17). However, Friedman et al. (18-19) showed that dental practitioners may successfully perform brief intervention techniques given adequate training. The iatrosedative process suggested by Friedman et al. (19) is based on "*an interpersonal cognitive intervention focusing on calming the patient through the behaviour, attitude and communicative stance of the dentist".* Establishing trust between the dentist and the patient and enhancing the patient's feeling of control are considered vital in reducing avoidance

behaviour and dental fear (20-21). However, the iatrosedative process assumes a traumatic background to dental fear, and hence this form of intervention may not be flexible enough to accommodate anxious patients without a traumatic background.

In sum, the literature shows that 1) dental fear is a considerable problem with wide-ranging implications for the patient; 2) a brief dental fear intervention is effective in the treatment of dental fear; 3) cognitive-behavioural techniques appear to be the most effective treatment for dental fear, both in terms of reducing fear and ensuring treatment adherence; and 4) and brief interventions may be performed by dentists without specialist training.

In the current study, we aimed to examine the effect of a brief dental fear intervention based on cognitive-behavioural principles specifically designed to be applicable in the dental practice. Specifically, we hypothesized that 1) the treatment would be effective in reducing dental fear to a greater extent than being on a waiting-list and 2) the effect of the treatment would be sustained over a 2-year period.

Materials and Methods

Design

The initial part of this study was a single centre parallel-group study with balanced randomization (1:1) between a waiting list control group (WL) and an immediate intervention group (IMI). Participants in the WL condition were placed on a waiting list for 4-6 weeks, in order to control for any effects of remission which were unrelated to the intervention. Once this period was completed, the WL group received the same intervention as the IMI group, and filled out the same self-report measures at pre-intervention, post-interview, and post-exposure. Thus both groups eventually received the same intervention, only staggered in time. In addition, two years after treatment completion, we followed up with as many patients

as possible. The study was carried out in a private Danish dental clinic specialising in treating fearful patients, hence our sample reflects patients as seen in the clinic, in contrast to patients included in clinical trials, for which inclusion criteria are usually more stringent. Apart from offering dental anxiety treatment, the clinic is comparable to other general practising dental clinics in Denmark. In Denmark, all dental treatment for adults is carried out through private dental clinics. A small public subsidy (17%) is given to all regular check-ups, prevention, treatment of periodontal disease, and dental fillings, whereas major treatments are not supported.

Participants

An a priori power analysis using two independent groups with $\alpha = .05$, a power of .80, and an effect size of $d = 0.5$ showed that 128 patients should be recruited. Recruitment was carried out through the clinic as well as through advertisements in a local paper. All new patients presenting at the clinic from March 2007 to May 2009 were invited to participate, whether they came of their own accord or due to the increased advertisement (see flowchart). The inclusion criteria were: Patients presenting with subjectively experienced dental fear and age > 24 years (this age frame was chosen so that an adult pattern of dental attendance could be established before inclusion). Exclusion criteria were: a) Receiving other forms of psychotherapeutic treatment, b) dental problems requiring acute treatment outside of the study (e.g., due to acute pain), and c) inability to understand Danish.

Out of 330 new patients contacting the clinic with subjectively experienced fear during the study period, a total of 240 patients were eligible and of these 126 responded favourably. Twenty-two participants dropped out after randomization: Two participants had acute treatment needs (one from the WL group, and one from the IMI group), while 20

withdrew from the study for various other reasons (12 = WL, 8 = IMI, see Figure 1). Of the remaining 104 participants, who completed at least one assessment, two were excluded from the data set due to large number of missing data, leaving a final sample of 102 participants (73.3% women, mean age = 40.82 years). The study was approved by the local ethics committee and conducted in accordance with the Helsinki Declaration. All patients provided informed consent.

Procedure

Details of allocation were contained in opaque numbered envelopes in an office at the dental clinic. Envelopes were prepared in blocks of 20 with a 1:1 allocation ratio. When a participant agreed to enter the study, the first envelope in the pile was opened and the participant was given a time for their first appointment, with the appointment taking place either immediately (within 1-10 days) or after 4-6 weeks. The dental assistant at the clinic administered the randomization of participants and distribution of appointments, and was assisted by the dentists in collecting the questionnaires. For practical and ethical reasons relating to the fact that participants were paying for the treatment themselves, we could not blind them to the outcome of the randomization. However, all participants eventually received the same treatment.

After randomization, each participant received the first round of questionnaires and was instructed to fill them out at home. The week before the WL group came to their first appointment, they received their second round of questionnaires by mail. While undergoing the intervention, participants received the questionnaires following their session at each assessment point. Two years after completing the study, participants were contacted again,

via a written invitation, and were asked to fill out another round of questionnaires. If a participant did not reply, we also contacted him or her by phone.

Intervention

The intervention consisted of two components: 1) a semi-structured interview designed to address cognitive, interpersonal, and behavioural aspects of the patient's fears, as well as establish trust between dentist and patient and instil a sense of control in the patient; and 2) exposure to the actual dental situation and the dental equipment (e.g., sitting in the chair, having instruments introduced into one's mouth, etc.). The exposure was based on the patient's individual hierarchy of feared situations. The intervention was conducted by one of two dentists, who are also certified psychotherapists.

The interview: The principles for the interview were based on *The Structured Fear Assessment Interview* (20), and did not deviate significantly from procedures already used at the dental clinic. The interview centred round the following two principles: *Acknowledgement of the patient's fear* and *establishing contact with the patient*. However, the goals of the interview also included openly addressing the patient's avoidance of dental treatment, having the patient self-monitor their fear, and establishing trust through recognition of the patient's emotions and experiences.

As part of the interview, a preliminary treatment plan was established. The patients were informed that the interview would not involve any dental treatment besides potential x-ray images. The duration of the interview was one (n=33) or two sessions (n=26), with each session lasting about 45 minutes (mean: 46 minutes; range: 25-60 minutes/session). If a patient required more than two sessions, he/she was excluded and offered continued treatment outside of the current study.

Exposure to dental treatment: The exposure session targeted aspects of the dental treatment that were particularly difficult for the patient (e.g., sitting in the chair, having instruments introduced into one's mouth, etc.), by using a hierarchy of feared situations created for each individual in collaboration with the dentist, as the basis for in vivo exposure in the clinic. The purpose of this method was to desensitize the patient to the dental situation, according to their individually identified fears (22). Allowing the patients to habituate to the situation at their own pace was also considered to aid in re-installing a sense of control of the dental situation. The intervention was based on exposure, as desensitization of fear through exposure is a common cognitive-behavioural method, in which exposure is considered the active ingredient (22). Similar to the interview, one (n=39) or two (n=20) exposure sessions were given (mean: 39 minutes; range: 20-60 minutes/session). Summing up both the interview and exposure sessions, 26 patients had two sessions, 20 patients had three sessions, and 13 patients had four sessions.

Materials

Sociodemographic characteristics: Sociodemographic characteristics were based on self-report, and included age, gender, living status, educational level, and occupational status. We also asked participants to estimate the importance of monetary cost of dental treatment in deciding their motivation for adherence. The two groups did not differ in their estimation ($t(100) = .88$, $p = .381$).

Clinical characteristics: Clinical characteristics included use of anti-depressant medication, time since last dental visit, and number of dental appointments since the

intervention (secondary outcome). Time since last dental visit was measured in years (0.5 - 25 or more). In Denmark, it is recommended that dental examination is conducted every six months. Therefore, patients who were not examined for two years or more were considered non-adherent. In addition, we asked participants to estimate if they visited the dentist regularly. 81.4 % reported that they did not visit the dentist regularly.

Dental fear related measures (primary outcomes)

Dental Anxiety Scale: The Dental Anxiety Scale (23) is a four item self-report scale that is widely used for measuring the severity of dental anxiety (20), and is used as an estimation of dental phobia (e.g., 15). Responses are indicated on a 5-point Likert scale and summed into a total dental anxiety score (range: 4-20), with higher scores indicating greater anxiety (24). In de Jongh et al.'s (24) study, the DAS had a Cronbach's $\alpha = 0.95$, whereas Corah's original study showed a Cronbach's $\alpha = 0.86$ (23). In our study, the Cronbach's α for the DAS was 0.78.

Dental Fear Survey: The Dental Fear Survey (DFS) (25) is a self-report questionnaire consisting of 20 items (26). The DFS may be divided into four parts, each tapping into a different aspect of dental fear: a) avoidance (2 items); b) noticeable physical discomfort while undergoing dental treatment (5 items); c) fear of specific dental procedures (12 items); and d) overall fear of general dental treatment (1 item) (20, 27). In our study, Cronbach's α for the DFS was 0.90, which is comparable to previous findings (28).

Statistical Analyses

Cases with systematically missing data were deleted (2 cases), while randomly missing data were replaced using the series mean function in SPSS 17. In total, 2.54 % of the data were missing. Patients with incomplete data on post-interview or post-exposure total scores were retained using the last observation carried forward procedure. Differences between the groups on baseline socio-demographic, clinical, and psychological measures were examined using χ^2 (Pearson, Continuity Correction), Student's *t*-test, or Fisher's exact test, as appropriate. To address our first objective, a 2 (pre- and post-intervention) x 2 (IMI and WL groups) repeated measures *ANOVA* was used to compare the two groups on primary outcome measures. The Huynh-Feldt correction was used when $\varepsilon > 0.75$, whereas the Greenhaus-Geisser correction was used when $\varepsilon < 0.75$. For the follow-up data, a 3 (pre-intervention, post-intervention, follow-up) x 2 (IMI and WL groups) repeated measures *ANOVA* was used. Because less than half of the original sample was available at the follow-up assessment, this analysis was conducted on patients with complete data sets only. Effect sizes were calculated using Cohen's *d*. Finally, clinical significance was defined as a statistically reliable change from pre- to post treatment that was also 2 standard deviations below the mean of the dysfunctional population (29). Post treatment scores were subtracted from pre-treatment scores and divided by the standard error of the difference. As a measure of test-retest reliability, we used the originally reported reliabilities of .82 for the DAS (23) and .88 for the DFS (30). In the case of a statistically reliable change (i.e., a value higher than 1.96), the post treatment score was compared to clinical cut-offs. The cut-off for the DAS was based on existing studies using the DAS to measure prevalence of dental fear in the United States and in Scandinavia (31: mean = 7.5, *SD* = 3.1, cut-off: 13.7; 22: mean = 8.9, *SD* = 3.0, cut-off: 14.987). We chose a conservative approach and considered a low score of 13

as a cut-off for a clinically significant level of dental fear. The clinical cut-off for the DFS has been suggested to be 60 (32-33). To reduce type I error resulting from multiple analyses, α levels were corrected to 0.01 for all tests. Data were analysed using SPSS 17.0.

Results

Baseline demographics

Table 1 depicts socio-demographic and clinical characteristics, and pre-intervention scores on the DAS and DFS. 90.2 % of the sample scored 13 or higher on the DAS, indicating that our sample generally consisted of patients with clinically significant levels of dental fear. Prior to the intervention, there were no significant differences between the two groups except for gender. In the IMI group, 63.5 % of the patients were women, compared to 83.7 % of the patients in the WL group. Therefore, we controlled for gender in all subsequent analyses.

The effect of the brief dental intervention compared to a waiting list control

The *ANOVA* showed a significant interaction between time and group [DAS: ($F(1,98) = 42.12$, $p < .001$]; DFS: ($F(1,98) = 34.01$, $p < .001$)], with patients in the IMI group showing significant reduction in dental fear compared to the WL control group (see Table 2a). In addition, when all patients had completed treatment, both groups showed significant reduction in dental fear (see table 2a). No significant interaction effect was found between gender and time (all *p*s > .48).

Effect sizes

Once all patients had completed treatment, we used scores from patients with no missing data to calculate within-group effect sizes. In both the IMI and WL groups, a large effect size was found on both the DAS and the DFS, measuring the overall effect of the treatment [IMI DAS: d = 2.2 (95% CI: 1.6 – 2.8); IMI DFS: d =1.5 (95% CI: 1.0 – 2.0); WL DAS: d = 2.4 (95% CI: 1.6 – 3.2); and WL DFS: d = 1.9 (95% CI: 1.2 – 2.6)] (see Table 2b). While awaiting treatment, completers in the WL group experienced a slight decrease in dental fear [DAS: d = 0.3 (95% CI: -0.1 – 0.7); DFS: d = 0.4 (95% CI: 0.0 – 0.8)], although not of the same magnitude as following treatment.

Clinically significant change

On the basis of Jacobson and Truax's (29) criteria (see *Statistical Analyses* above), 38 out of 59 completers (64.4 %) showed clinically significant change on the DAS, while 35 out of 59 completers (59.3%) showed clinically significant change on the DFS. There was no significant difference between patients who achieved clinically significant improvement according to the DAS and those who did not, on the pre-intervention scores on the DAS (M (n =38) = 15.57, SD = 2.47, *vs.* M (n = 21) = 14.67, SD = 3.15, $t(57) = 1.22$, $p = .23$, $d = .33$), or DFS (M (n =38) = 66.86, SD = 12.93, *vs.* M (n = 21) = 67.23, SD = 12.07, $t(57) = 0.11$, $p = .92$, $d = .02$).

Follow-Up

Forty-five participants returned questionnaires after 2 years (79.5 % women, 25 IMI, 19 WL), but one had missing data on the DAS and was excluded from this analysis. Due to the low number of males remaining, and the fact that the gender distribution was equal across

groups, we chose not to include gender in this analysis. Patients, who completed follow-up (n = 44), had significantly lower pre-intervention scores on the DAS and the DFS compared with patients, who did not complete follow-up (n = 58) [DAS: M = 14.57, SD = 2.84 vs. M = 16.91, SD = 2.72, $t(100) = 2.42$, p = .017; DFS: M = 67.81, SD = 12.60 vs. M = 73.74, SD = 13.58, $t(100) = 2.26$, p = .026].

There was a significant main effect of time [DAS: $F(2,82) = 102.47$, $p < .001$; DFS: $F(2,84) = 65.92$, $p < .001$], with no main or interaction effect of group allocation (p's > .16). Inspection of means showed that changes in scores on the DAS and DFS were taking place from pre- to post intervention, whereas changes from post-intervention to follow-up were minimal, indicating that treatment benefit was maintained over the two year period in patients participating in the follow-up. Also, original allocation to the IMI or WL group had no effect on improvement. The difference between dental fear at pre-intervention and follow-up in terms of effect size was d = 1.8 (95% CI: 1.2 – 2.4) for the DAS and d = 1.2 (95% CI: 0.5 – 1.9) for the DFS in the IMI group, and d = 2.5 (95% CI: 1.6 – 3.4) for the DAS and d = 2.0 (95% CI: 1.2 – 2.8) for the DFS in the WL group (see Table 2b).

As an indication of clinically significant improvement at the two year follow-up, the number of dental appointments following the intervention was recorded, either by looking at the patients' file, if they were still at the clinic (n = 36), or by asking for the information, if they were not (n = 14). Thirty-five out of 50 (68 %) patients who responded to the follow-up invitation (but did not necessarily fill out the questionnaires) had at least one appointment for dental treatment during the 2-year period. Twenty-six (52 %) had more than one appointment (range 2-7).

Discussion

This study examined the effect of a brief dental fear intervention on fearful dental patients. Compared to a waiting list condition, our immediate treatment group showed a significant reduction in dental fear, as measured by a reduction from pre-intervention to post-exposure on the DAS and the DFS. However, after both groups had completed the intervention, they showed comparable reductions in dental fear. A subgroup of patients was available at a two-year follow-up assessment, and, in this group, the reduction in dental fear was maintained.

In general, effect sizes indicated a large effect of the intervention. While awaiting treatment, the WL group showed minor improvement in dental fear, which could indicate a placebo effect. This may reflect that, as some patients expressed, taking the first step and being met with kindness and understanding may be helpful in itself. In addition, it may reflect that the expectation of entering a study, which would include an intervention directed towards reducing dental fear, may be sufficient to produce some fear-reduction. Still, the IMI group showed a much larger improvement than the WL group, indicating that the intervention was far superior to being on a waiting list.

Clinically significant improvement

Overall, 59.3 - 64.4 % of our participants showed clinically significant improvement, which is higher than the rates found for cognitive therapy and relaxation training in generalized anxiety disorder (34). It is comparable to Haukebø et al. (15), who reported a clinically significant improvement in 55 % of their participants (n=20) after only one treatment session. In addition, 52 % of the patients in our study had at least two dental appointments during the two years following the intervention, indicating clinically significant improvement in the same range as Haukebø et al.'s study. However, these results must be interpreted with

caution, as only a subgroup of our sample was available for follow-up analysis. Although patients with clinically significant improvement had slightly higher scores on both the DAS and the DFS at pre-treatment, this difference was not significant. It is possible, though, that the non-significant result was due to a low number of patients available for this analysis, since there was a small effect size of the difference in regard to scores on the DAS.

The need for specialist treatment

It has been argued that studies of brief dental fear intervention should use diagnostic criteria when screening participants (7, 15). Although we recognize the validity of this design issue, dental fear may still have a significant negative impact on the individual patient, even if the diagnostic criteria are not fully met. In addition, when adhering to strict diagnostic criteria for inclusion, the patients recruited often do not reflect those seen in daily clinical practice. Furthermore, the aim of our study was to measure the effect of a brief intervention that could be of use to the general practicing dentist. This intervention technique should preferably be applicable to all patients with dental fear, not only those who fulfil the diagnostic criteria for dental phobia.

The results of the current study indicate that fearful patients may benefit considerably from a brief dental fear intervention performed by a practising dentist. Having the dentist perform the intervention, rather than specialists, has several advantages. First, the intervention may be carried out in the dental clinic and is therefore easily accessible to all fearful patients; second, in most cases it is unnecessary to refer the patients to an intermediary specialist, offering fearful patients immediate intervention in their local clinic instead.

Despite these promising results, it is necessary to recognise that, as de Jongh et al. (35) argued, not all patients are suited for this type of intervention. Therefore, practising

dentists may also need tools to evaluate whether a fearful patient would be likely to benefit from a brief intervention, or instead may require specialist treatment. In our sample, we did not identify a clear relationship between pre-intervention DAS scores and treatment outcome. Although patients who showed an increased chance of clinically significant improvement reported slightly higher dental fear prior to treatment, the effect was not significant. We did find that patients who dropped out of the study prior to the 2-year follow-up had slightly higher scores of dental fear, however the most frequent reasons for drop out were related to the cost of treatment or the extent of dental treatment required, suggesting that higher fear might not have been the primary reason for drop-out in our study. This suggests that the brief intervention is suitable for all patients, regardless of their pre-intervention level of fear. Studies looking into individual factors that may affect the level of dental fear, e.g., self-reported control, frequency of negative cognitions, or trust in the dental staff, could contribute to our understanding of how dental fear may be most successfully treated, and if some patients are less likely to benefit from a brief intervention. These issues should be addressed in future research.

Limitations

The current results should be interpreted with some caution. First, the ethical and practical concerns of not disclosing to patients that they might have to wait for their treatment meant that blinding was not an option. As a related issue, we were unable to include a control group that did not receive the intervention, which could have informed us of the magnitude of spontaneous remittance during the follow-up period. However, the majority of our patients had been suffering from dental fear for at least two years without experiencing spontaneous remittance. Second, the dentists performing the brief dental fear intervention had

psychotherapeutic training and many years of experience with dental fear. Thus, they could be considered more similar to specialists than practising dentists. However, the brief dental fear intervention protocol was developed in order to ensure the intervention could be generalised and performed by general practitioners with brief training. Therefore, the dentists involved in this study attentively adhered to the brief dental fear intervention protocol, and did not employ any therapeutic techniques other than those described in the protocol. Third, the large drop-out rate during the course of the study may have influenced the results. Since we used an intention-to-treat procedure (ITT), the reported differences may have been more or less pronounced if all patients had completed the intervention. Where possible, we compared the results of analyses with ITT data to analyses with complete data. Our high drop-out rate was to be expected, as costs of dental treatment are relatively high; however, this reflected the reality for patients with dental anxiety, as our study avoided the bias of offering treatment completely free of charge. Furthermore, for some patients the dental treatment needs were so acute that they had to be excluded. These are important factors that need to be taken into account in studies of dental fear in the private practice.

Another potential limitation was having the patients fill out the questionnaires at home rather than in the clinic. This could mean that patients 1) did not have supervision available if they did not understand an item and 2) might have answered some questions concerning dental anxiety differently, since they were not in the proximity of the feared situation. To minimize this bias, patients who had difficulty understanding items were offered assistance when arriving at the clinic. Also, the DAS and DFS ask participants to imagine how the feared situation would affect them *if* they were in it – i.e., not while they actually are in it.

In sum, the results of this study indicate that a brief intervention performed by the practising dentist may be sufficient for a considerable percentage of fearful patients to overcome their fear and attend dental treatment regularly. Such an intervention would require dentists to be comfortable with performing the intervention, and also to have the necessary tools to distinguish between patients that may be treated in their clinic and patients who need specialised treatment elsewhere. Using a brief intervention, as described here, may lead to more fearful patients being helped through a relatively cost-effective and manageable effort.

References

1. Halonen H, Salo T, Hakko H, Räsänen P. Association of dental anxiety to personality traits in a general population sample of Finnish University students. Acta Odontol Scand 2012;70:96-100.

2. Astrøm AN, Skaret E, Haugejorden O. Dental anxiety and dental attendance among 25-year-olds in Norway: time trends from 1997 to 2007. BMC Oral Health 2011;11:10.

3. Oosterink FM, de Jongh A, Hoogstraten J. Prevalence of dental fear and phobia relative to other fear and phobia subtypes. Eur J Oral Sci 2009;117:135-143.

4. Nicolas E, Collado V, Faulks D, Bullier B, Hennequin M. A national cross-sectional survey of dental anxiety in the French adult population. BMC Oral Health 2007;10:7-12.

5. Moore R, Birn H, Kirkegaard E, Brødsgaard IA, Scheutz, F. Prevalence and characteristics of dental anxiety in Danish adults. Community Dent Oral Epidemiol 1993;21:292-6.

6. 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.

7. Kvale G, Berggren U, Milgrom P. Dental fear in adults: A meta-analysis of behavioral interventions. Community Dent Oral Epidemiol 2004;32:250-64.

8. Milgrom P, Fiset L, Melnick S, Weinsein P. The prevalence and practice management consequences of dental fear in a major US city. J Am Dent Assoc, 1988;116:641-7

9. Pohjola V, Lahti S, Vehkalahti MM, Tolvanen M, Hausen H. Association between dental fear and dental attendance among adult in Finland. Acta Odontol Scand 2007;65:224-30.

10. 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.

11. Moore R, Brødsgaard I, Rosenberg N. (2004). The contribution of embarrassment to phobic dental anxiety: A qualitative research study. BMC Psychiatry 2004;4:10.

12. Thom A, Sartory G, Jöhren P. Comparison between one-session psychological treatment and benzodiazepine in dental phobia. J Consult Clin Psychol 2000;68: 378-387.

13. de Jongh A, Muris P, ter Horst G, van Zuuren F, Schoenmakers N, Makkes P.(1995). One-session cognitive treatment of dental phobia: Preparing dental phobics for treatment by restructuring negative cognition. Behav Res Ther 1995;33: 947-954.

14. Jöhren P, Enkling N, Heinen R, Sartory G. Clinical outcome of a short-term psychotherapeutic intervention for the treatment of dental phobia. Quintessence International 2007;38:589-596.

15. Haukebø K, Skaret E, Öst LG, Raadal M, Berg E, Sundberg H, et al. One-vs. five-session treatment of dental phobia: A randomized controlled study. J Behav Ther Exp Psychiatry 2008;39:381-390.

16. Wannemueller A, Jöhren P, Haug S, Hatting M, Elsesser K, Sartory G. A practice based comparison of brief cognitive behavioural treatment, two kinds of hypnosis, and general anaesthesia in dental phobia. Psychother Psychosom 2011;80:159-165.

17. Hill KB, Hainsworth JM, Burke FJT, Fairbrother HJ. Evaluation of dentists' perceived needs regarding treatment of the anxious patient. Br Dent J 2008;13:1-5.

18. Friedman N, Cecchini JJ, Wexler M, Pitts WC. A dentist oriented fear reduction technique: The Iatrosedative Process. Compendium of Continuing Education in Dentistry 1989;10: 113-118.

19. Friedman N, Wood GJ. An evaluation of the Iatrosedative Process for treating dental fear. Compendium of Continuing Education in Dentistry 1998;19: 434-442.

20. Milgrom P, Weinstein P, Getz T. Treating fearful dental patients. A patient management handbook. (2nd ed, revised). University of Washington:Seattle, 1995.

21. Sartory G, Heinen R, Pundt I, Jöhren P. Predictors of behavioral avoidance in dental phobia: The role of gender, dysfunctional cognitions, and the need for control. Anxiety, Stress and Coping 2006;19: 279-291.

22. Choy T, Fyer AJ, Lipsitz JD. Treatment of specific phobia in adults. Clin Psychol Rev. 2007;27:266-86.

23. Corah NL. Development of a dental anxiety scale. J Dent Res 1969;48:596.

24. de Jongh A, Muris P, Shoenmakers N, ter Horst G. Negative cognitions of dental phobics: Reliability and validity of the Dental Cognitions Questionnaire. Behav Res Ther 1995;33:507-515.

25. Kleinknecht RA, Klepac RK, Alexander LD. Origins and characteristics of fear of dentistry. J Am Dent Assoc 1973;8:842-848.

26. Kleinknecht RA, Bernstein DA. The assesment of dental fear. Behav Ther 1978;9:626-634.

27. Tönnes S, Mehrstedt M, Eisentraut I. Die Dental Scale (DAS) und das Dental Fear Survey (DFS)- zwei messinstrumente zur erfassung von zahnbehandlungsängsten. Zeitschrift für Medizinische Psychologie 2002;2:63-72.

28. Johansson P, Berggren U. Assessment of dental fear. A comparison of two psychometric instruments. Acta Odont Scand 1992;50:43-49.

29. Jacobsen NS, Truax P. Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. J Consult Clin Psychol 1991;59:12-19.

30. McGlynn FD, McNeil DW, Gallagher SL, Vrana S. Factor structure, stability, and internal consistency of the dental fear survey. Behav Assess 1987; 9: 57–66.

31. Vassend O. Anxiety, pain, and discomfort associated with dental treatment. Behav ResTher 1993;31:659-666.

32. Milgrom P, Getz T, Weinstein P. Recognizing and treating fears in general practice. Dent Clin North Am 1988; 32: 657-65.

33. Milgrom P. Kleinknecht RA, Elliott J, Liu HH, Teo CS. A cross-cultural cross validation of the Dental Fear Survey in South East Asia. Behav Res Ther 1990;28:227-33.

34. Siev J, Chambless DL. Specificity of treatment effects: Cognitive therapy and relaxation for generalized anxiety and panic disorders. J Consult Clin Psychol 2007;75:513-522.

35. de Jongh A, Adair P, Meijerink-Anderson M. Clinical management of dental anxiety: What works for whom? Int Dent J 2005;55:73-80.

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Table 1 Patient characteristics at pre-intervention

	IMI (*n*=52)	**WL (*n=50*)**	**Total**	***p***
Sociodemographics				
Age, Mean(*SD*)	39.8 (11.50)	41.8 (12.18)	40.8 (11.81)	.398
Female gender (*n, %)*	33 (63.5)	41 (83.7)	74 (73.3)	.039*****
Lives alone (*n , %)*	18 (34.6)	18 (36)	36 (35.3)	.594
Further education † (*n, %*)	32 (61.5)	34 (68)	66 (64.7)	.070
Full-time occupation‡ (*n, %)*	33 (68.8)	32 (65.3)	65 (67)	.885
Clinical characteristics				
Medication[1] (*n, %)*	6 (11.5)	8 (16.0)	14 (13.7)	.460
Non-adherence to dental treatment[2] (*n, %)*	31 (59.6)	32 (64)	63 (61.8)	.770
Psychological measures				
DAS, Mean (*SD*)	16.0 (3.03)	16.6 (2.61)	16.3 (2.76)	.333
DFS, Mean (*SD*)	70.1 (13.42)	72.3 (13.47)	71.1 (13.42)	.404

IMI: immediate intervention group; WL: waiting list group; *p*-values for difference between intervention groups using Pearson's χ^2 (Continuity Correction) or Student's *t-test* as appropriate. † Defined as an education after primary school. ‡Full-time student or full-time employee. * $p < .05$.[1]Use of antidepressants (IMI = 3; WL = 8) or anxiolytics (IMI = 3) based on selfreport. [2]Defined as no dental treatment two years prior to entering the study.

Table 2a. Pre- and post intervention scores* on the DAS and the DFS.

Measure	Immediate Intervention		Waiting List		
	Pre-intervention (Mean, SD) (n=52)	Post-intervention (Mean, SD) (n=52)	Pre-intervention (Mean, SD) (n=50)	Post-intervention (Mean, SD) (n=50)	Post-intervention** *d* (95% CI)
Dental Anxiety Scale	16.0 (3.0)	11.6 (4.2)	16.6 (2.6)	15.9 (2.8)	1.3 (0.9 – 1.5)
Dental Fear Survey	70.1 (13.4)	56.8 (15.7)	72.0 (13.4)	72.0 (13.6)	1.1 (0.9 – 1.3)

* Intention to treat scores (includes imputed data)

** Difference between groups

Table 2b. Pre-, post-intervention, and two-year follow-up scores* on the DAS and the DFS.

Measure	Immediate Intervention			Waiting List		
	Pre-intervention (Mean, SD) (n=52)	Post-intervention (Mean, SD) (n=34)	2 year Follow up (Mean, SD) (n=25**)	Pre-intervention (Mean, SD) (n=50)	Post-intervention (Mean, SD) (n=25)	2 year Follow up (Mean, SD) (n=19)
Dental Anxiety Scale	16.0 (3.0)	9.7 (2.9)	10.3 (3.5)	16.6 (2.6)	10.2 (2.8)	9.9 (3.0)
Dental Fear Survey	70.1 (13.4)	49.6 (13.5)	52.1 (17.7)	72.0 (13.4)	46.8 (13.0)	46.2 (11.4)

* Completers only (raw scores), ** For the Dental Anxiety Scale, n=24)

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Figure 1. Participant flowchart