

## ORIGINAL ARTICLE

# Dental anxiety treatment by a dentist in primary care: A 1-year follow-up study

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## Abstract

In an earlier randomized controlled trial of dental anxiety treatments ( $n = 96$ ) we compared the effects of dentist-administered cognitive behavioural therapy (D-CBT) and dental treatment supplemented with the Four Habits communication model plus midazolam sedation. Both treatments, applied in a general dental practice, were associated with a clinically relevant decrease in dental anxiety. In this follow-up study, 52 of the 82 treatment completers responded to an online questionnaire 1 year post-treatment. Reduction in dental anxiety persisted for both treatment groups. From baseline to 1 year post-treatment the Modified Dental Anxiety Scale was reduced by 7.8 [SD: 4.4; Cohen's  $d$  effect size: 1.2 (CI: 0.8–1.7)] and 7.8 [SD: 4.2; Cohen's  $d$ : 1.4 (0.9–1.8)] in the D-CBT and Four Habits/midazolam groups, respectively. Most patients (74% for D-CBT, 80% for Four Habits/midazolam) continued with dental treatment. Nine patients in the D-CBT and seven in the Four Habits/midazolam groups received additional CBT treatment from a psychologist/dentist team. Both methods tested should be accessible to interested dentists who receive adequate training. Effective first-line treatments for dental anxiety in general dental practice can generate more accessible care pathways for patients with dental anxiety. Evidence-based dental anxiety treatment programmes should be included in the dental curriculum and established as best practice for dentists.

## KEYWORDS

cognitive behavioural therapy, health communication, midazolam, randomized controlled trial

## INTRODUCTION

Although the prevalence of dental anxiety has declined in the Nordic countries in recent years, it affects as much as 8% of the adult Nordic population [1, 2]. Dental anxiety is an important contributor to poor oral health [3] and psychosocial distress [4, 5]. In Norway, fear of dental treatment is the second most common reason (after cost) for not attending

dental appointments during the previous 12 months [6]. In addition, treating patients with dental anxiety may cause work-related stress among oral health personnel. In a recent German study, the risk of burnout among dentists was associated with the proportion of anxious patients treated [7]. The development and provision of accessible and effective dental anxiety treatments should therefore be a priority in oral healthcare services.

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The dental anxiety treatments described in the current literature are typically administered in specialist clinics by interdisciplinary teams, which include psychologists [8, 9]. If effective methods for treating dental anxiety were available to general dental practitioners, patients with dental anxiety could receive treatment for anxiety within the framework of general dental practice. At a societal level, such a model would provide first-line treatment for dental anxiety within primary care. Many of the existing barriers to treatment, such as waiting lists, and travel distances to specialist clinics, would be reduced by offering such a treatment in general dental practices. Dentist-administered treatments for dental anxiety could also be more cost-effective than interdisciplinary approaches. Treatment acceptability for dental anxiety patients who, for various reasons, react negatively to psychologists [10] might also increase. Another advantage would be a more seamless progression from dental anxiety to dental treatment.

Both Willumsen and Vassend [11] and Aartman et al. [12] have demonstrated good long-term effects of dentist-administered methods of treating adults for dental anxiety. However, in these studies, the dental anxiety treatment was delivered in special clinics (university and dental anxiety clinics). Follow-up studies of dental anxiety treatments in general dental practice are limited.

In a 2021 study [13], dentist-administered cognitive behavioural therapy (D-CBT) was compared to Four Habits/midazolam in a randomized controlled trial (RCT). The treatments were carried out by the current study's first author (MSH), a dentist in a general dental practice, with both treatments lasting 5 h. D-CBT is a manualized CBT-approach designed to be administered by a dentist. The Four Habits/midazolam condition is a combination of the evidence-based communication method known as the 'Four Habits Model' [14] plus conscious sedation to facilitate dental treatment. Post-treatment, the patients were offered a choice of either receiving dental treatment with a different general dental practitioner at regular cost or applying for CBT treatment at a dental anxiety clinic, where psychologists and dentists work together. This interdisciplinary treatment option exists within the Norwegian public healthcare system and is available to patients diagnosed with dental phobia [15]. Both anxiety and dental treatments are free of charge for participating patients. Self-referral is possible. The patients in the RCT study were thoroughly informed of the public treatment option and encouraged to use it. Referrals were made for all the patients who desired this option (31/96 or 32%).

In the RCT study, both D-CBT and Four Habits/midazolam led to a large reduction in patient dental anxiety [13]. This finding is in line with earlier studies on the use of CBT methods to treat dental anxiety [9] and partly in line with prior research on sedation treatment for patients with dental

anxiety [16, 17]. While reduced dental anxiety following CBT treatments administered by a dentist has shown to be stable in the long term [11, 12, 18], the long-term effects of sedation treatments seem to differ in the literature. In a study by Jöhren et al. [19], anxiety was initially reduced in patients who received midazolam before dental surgery but returned to baseline levels 2 months post-treatment. Since long-term outcomes are imperative for all treatments, the present follow-up study aimed to determine the effect of D-CBT and Four Habits/midazolam at 1 year post-treatment.

The main hypotheses tested were as follows:

*Hypothesis 1:* Patients treated with Four Habits/midazolam or D-CBT in a general dental practice will have reduced dental anxiety and increased dental attendance 1 year post-treatment.

*Hypothesis 2:* Patients treated with Four Habits/midazolam or D-CBT in a general dental practice will score more favourably on measures of oral health-related quality of life and satisfaction with life and have better self-reported oral health 1 year post-treatment.

*Hypothesis 3:* Patients initially treated with D-CBT will have a larger reduction in 1-year dental anxiety than patients treated with Four Habits/midazolam.

## MATERIAL AND METHODS

This study was conducted with the understanding and written consent of each participant and approved by the Norwegian Regional Committee for Medical and Health Research Ethics with ID number 2017/97; the study has been registered at [clinicaltrials.gov](https://clinicaltrials.gov) (identifier: NCT03293342).

This follow-up study was done 1 year after the RCT study [13], between 2018 and 2020. A questionnaire was sent by mail to all patients who had completed the dental anxiety treatment ( $n = 82$ ), 1 year after the treatment. Two reminders were sent to those who did not respond. The Nettskjema tool was used to conduct the online survey. The data were stored at the Services for Sensitive Data facility at the University of Oslo, which is integrated with Nettskjema. Nettskjema is also developed and operated by the University Center for Information Technology at the University of Oslo.

The D-CBT is a manualized CBT approach designed for use by dentists. The manual and e-learning programme are available and can be downloaded from the web resources of the University of Oslo [20] (in Norwegian; an English version is available as the Appendix to the RCT study [13]). The intervention is brief (five sessions) and was carried out by following the detailed written manual, step-by-step.

The Four Habits/midazolam condition combines conscious sedation with midazolam (oral administration) and the Four

Habits Model for evidence-based communication [14]. This intervention is further described in Appendix 1 of the Supporting Information.

## Patient sample and dentist

The inclusion criteria for the initial RCT study were as follows: (i) self-reported dental anxiety at a level of severity that affected the participant's ability to receive dental treatment; and (ii) the ability to communicate fluently in Norwegian. In total, 96 patients participated in the RCT study and were randomly assigned to dental anxiety treatment with D-CBT [ $n = 48$  (39 completed)] or Four Habits/midazolam [ $n = 48$  (43 completed)]. The allocation ratio was 1:1. Reasons for drop-out for the 14 patients who did not complete treatment are specified in the flow chart of the study (Figure 1). A loss of data at the digital storage facility (Services for Sensitive Data) had resulted in loss of the post-treatment registrations of two D-CBT patients and three Four Habits/midazolam patients (see Appendix 2). These five patients were included in the analysis because their pre-treatment and 1-year registrations were complete. Hence, all of the 82 patients invited to the follow-up study had previously completed treatment under one of the two treatment conditions, D-CBT or Four Habits/midazolam, implemented by MSH.

The participating patients were offered two alternatives for continued dental care, following the D-CBT or Four Habits/midazolam treatment: (i) a referral for dental treatment with a general dental practitioner of their choice (excluding MSH) at regular cost, or (ii) a referral for further dental anxiety treatment and free dental treatment at a specialized dental anxiety clinic. For ethical reasons five patients were given permission to continue dental treatment with MSH. These patients were included in the follow-up study.

The dentist responsible for all treatments in the RCT study, MSH, had 12 years of experience from general dental practice in the use of sedation with midazolam in treatment of patients with dental anxiety. MSH had also completed a theoretical exam on CBT treatment for dental anxiety (equivalent to a 40-h course) and participated in additional video-assisted training in the practical use of CBT, provided by the co-authors. The RCT study was conducted in a dental practice setting that included two other general dental practitioners, two specialists (surgery and endodontics), and one dental hygienist. The facility had a shared waiting room. All sessions were videotaped, and a random selection of tapes were assessed for adherence to manuals by the co-authors. The manuals were condensed to check-lists and it was verified that all the themes on the list were included in the treatment in a relevant manner [13].

## Baseline measures

At baseline (i.e., at the start of the RCT study's anxiety treatment), each patient's age, gender, and years since the last completed dental treatment were registered along with dental anxiety severity and symptoms of post-traumatic stress disorder, anxiety and depression, life satisfaction and oral health-related quality of life (see details on the different measures below). Post-treatment, the total number of patients who chose to be referred to a public interdisciplinary team for continuing dental anxiety treatment was recorded, and the measures taken at baseline were repeated. The measures were repeated again in the 1-year follow-up survey, conducted online. In the 1-year survey patients also reported whether they had continued their regular dental treatment. All of the scales employed are used extensively worldwide and have shown to be valid and reliable (see references in the scale descriptions).

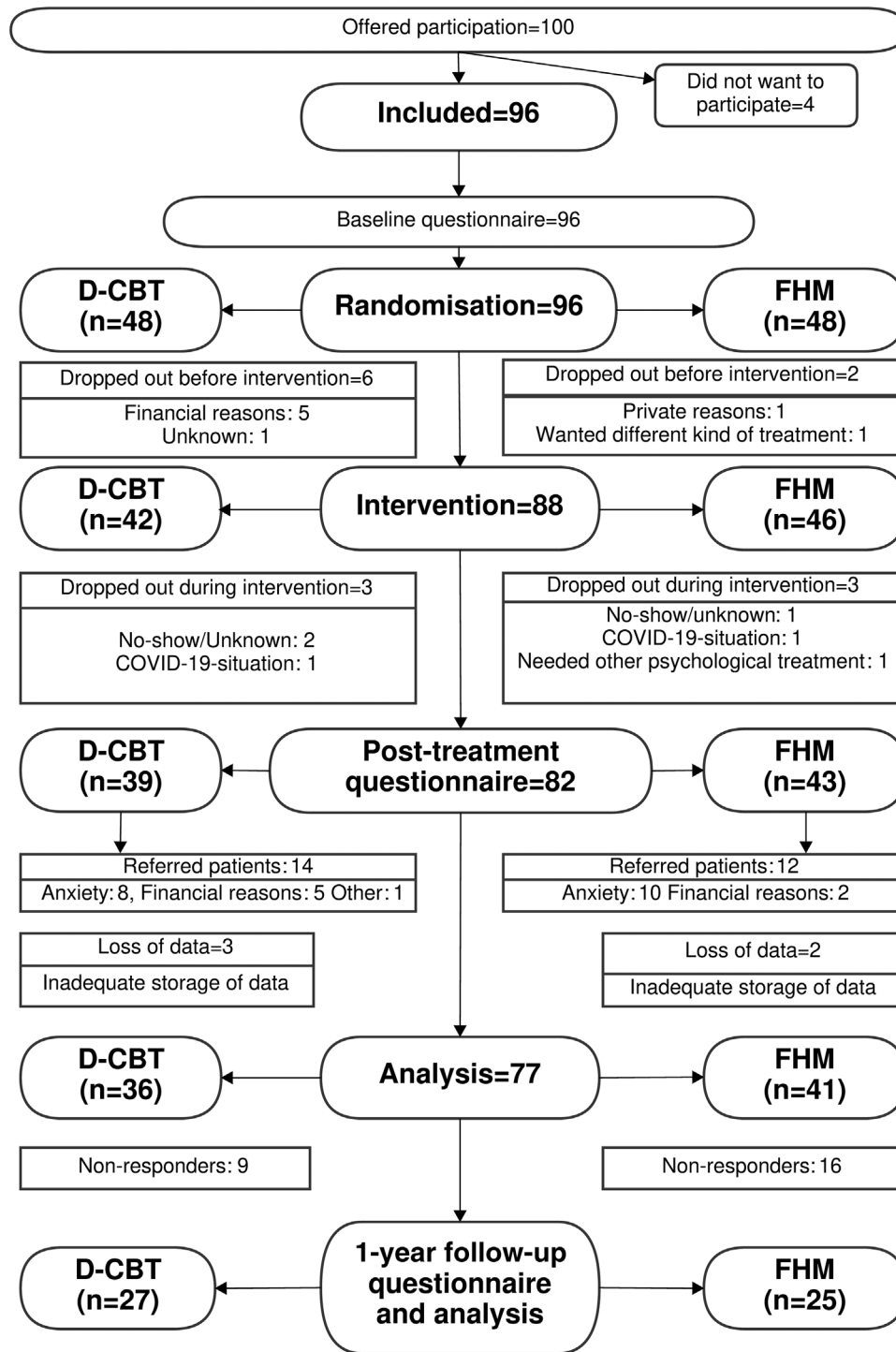
The ability to continue dental treatment and the change in dental anxiety from pre-treatment to 1 year post-treatment were the primary outcomes. The secondary treatment outcomes were changes in life satisfaction and oral health-related quality of life as well as patient satisfaction and self-perceived oral health.

## Primary outcome measures

The participants provided 'yes' or 'no' responses to the following questions: (i) Have you completed dental treatment and scheduled follow-up appointments? (ii) Have you completed dental treatment without scheduling follow-up appointments? (iii) Do you still receive dental treatment? (iv) Have you discontinued dental treatment? (v) Other. Patients who said yes to (i), (ii), or (iii) were registered as patients who had continued their dental treatment. Patients who had not continued dental treatment were asked about the reason and provided the following choice of options: (i) Anxiety; (ii) Financial considerations; (iii) Lack of time; and (iv) Other.

Dental anxiety at baseline was assessed using the Modified Dental Anxiety Scale (MDAS) [21] and the Index of Dental Anxiety and Fear (IDAF-4C+). The MDAS includes five potentially frightening stimuli, which are scored using a 5-point scale. A total score (ranging from 5 to 25) of  $\geq 15$  or  $\geq 19$  indicated high or extremely high dental anxiety, respectively.

Dental anxiety was also measured using the IDAF-4C, developed by Armfield in 2010. The IDAF-4C+ has three modules (IDAF-4C, IDAF-S, and IDAF-P), which can be used separately or in combination [22]. The IDAF-4C dental anxiety and fear module comprises eight items, with two items each measuring the emotional, behavioural, cognitive,



**FIGURE 1** Overview of the study flow. D-CBT, dentist-administered dental anxiety treatment; FHM, Four Habits/midazolam treatment.

and physiological components of anxiety. The items were scored on a 5-point scale, with responses ranging from 1 ('disagree') to 5 ('strongly agree'). As recommended, the mean of all items was calculated to obtain an overall score (range: 1–5). A cut-off score of >2.50 is used to indicate the potential for moderate to extreme dental fear. In a Scandinavian sample, the fear and stimulus modules showed good validity [23, 24]. The Cronbach's  $\alpha$  in a Swedish clinical

sample was 0.95 [23] while in the present study it was 0.71.

### Secondary outcome measures

The Satisfaction With Life Scale (SWLS), which was used to map general life satisfaction, comprises five questions, rated

on a scale of 7. The total scores were categorized as very highly satisfied (30–35), highly satisfied (25–29), moderately satisfied (15–24), dissatisfied (10–14), and extremely dissatisfied (5–9) [25]. The Oral Impact of Daily Performances (OIDP) maps how often oral health issues have a negative impact on daily tasks (brushing teeth, sleep, smiling, etc.) through eight questions [26, 27]. Each question is answered on a 5-point scale to assess the frequency of such impacts on daily tasks in each area; the answers are reverse-scored, ranging from 5 ('every day') to 1 ('never'). Total scores range from 5 to 40, with higher scores indicating that oral issues have a more negative impact on daily life. Good validity and internal consistency have been demonstrated [28, 29]. The Cronbach's  $\alpha$  in our sample was 0.91.

To explore self-estimates of the changes in quality of life and oral health, a set of questions was discussed among the authors based on theoretical and clinical experiences until consensus was achieved (not tested for validity and reliability). The following two questions were adopted: 'How has the dental anxiety treatment in this project and the subsequent dental treatment affected your quality of life?' and 'How do you perceive your teeth and oral health today, compared to before the dental anxiety treatment?' Respondents completed the replies (beginning 'My quality of life is ...' or 'My teeth and my oral health is ...') by selecting from 'Much better', 'Better', 'The same', 'Worse', or 'Much worse'. In addition, they were asked to rate their satisfaction with treatment by responding to the question, 'Can you score the dental anxiety treatment you received on a scale of 1–6, where six is the most favourable score?'

## Statistical analysis

Most of the variables were non-normally distributed (see Tables S1 and S2 for normality tests); hence, the Wilcoxon signed-rank test was used to compare means pre- and post-treatment, and the Wilcoxon rank-sum test was used to compare means between different patient groups [30]. Cohen's  $d$  was used to calculate effect sizes.

The primary analysis was an intention-to-treat (ITT) analysis using the imputation technique of last observation carried forward (LOCF). To further determine the non-response sensitivity of the findings, two more ITT analyses were done with one of the primary outcome measures (MDAS). In one of these analyses imputation by mean was used for all missing 1-year MDAS values; in each case the missing value was set to the pre-treatment MDAS value minus the mean change in MDAS values estimated in those that had responded to the 1-year survey. In the second analysis a worst-case scenario was constructed. In this scenario all the missing 1-year MDAS values were set using the patient's pre-treatment MDAS value minus the mean change in MDAS values seen in responding

patients who had not continued dental treatment after the study. Of all groups investigated this was the group of patients showing the least improvement in dental anxiety during study treatment. In addition, a per protocol analysis was done. Statistical analyses used Stata/SE 16.0 (StataCorp).

## RESULTS

A total of 52 (63%) of the 82 completers of the RCT responded to the 1-year questionnaire (see the flow chart in Figure 1).

ITT analyses (Table 1) found both the D-CBT group and the Four Habits/midazolam group to have improved significantly with regard to dental anxiety (IDAF-4C and MDAS) and oral-related quality of life (OIDP) between baseline and follow-up. The Cohen's  $d$  effect sizes (calculated by mean changes in MDAS) were 1.2 [confidence interval (CI): 0.8–1.7] in the D-CBT treatment condition and 1.4 (CI: 0.9–1.8) in the Four Habits/midazolam condition. No significant changes were found in general satisfaction with life (SWLS) in either study group over time. The per protocol analyses supported the outcome of the ITT analyses (Table 2).

A total of eight patients (15%) had discontinued dental treatment after the RCT (Table 3); four cited remaining dental anxiety as their main reason for discontinuing treatment, while two cited financial issues, and two mentioned mixed reasons.

In the patient evaluation, 17 patients (63%) in the D-CBT group and 18 patients (72%) in the Four Habits/midazolam group indicated that their oral health had improved following dental anxiety treatment. No patients indicated that self-rated quality of life had worsened following treatment, and 78% ( $n = 21$ ) of the patients in the D-CBT group and 76% ( $n = 19$ ) of those in the midazolam/Four Habits group indicated an improvement in self-rated quality of life.

When comparing the treatment conditions, Four Habits/midazolam and D-CBT, no between-group differences were found in relation to any of the outcome variables: dental anxiety, quality of life, or oral-related quality of life (Table 1). The patients' self-evaluations of quality of life and oral health were also comparable in both treatment conditions. Treatment satisfaction scores did not differ and mean scores were 5.5 (SD 0.8) in the D-CBT group and 5.3 (SD: 0.7) in the Four Habits/midazolam group. Only one patient in each group indicated a score lower than 4 on a 1–6 scale of treatment satisfaction.

After completing the initial anxiety treatment, nine patients (33%) among 1-year responders in the D-CBT group and seven patients (28%) in the Four Habits/midazolam group applied for continued CBT treatment from psychologists and dentists working together, followed by dental treatment, all within the public system. No differences in background factors were found at follow-up between those who were thus

**TABLE 1** Results of intention-to-treat analysis by last observation carried forward (brackets contain standard deviations) of outcome measures for the D-CBT ( $n = 48$ ) and FHM ( $n = 48$ ) treatment groups

		Mean score before treatment	Mean score after treatment	Mean score 1 year after treatment	Mean difference*	Timeeffect <sup>†</sup>	Groupeffect <sup>‡</sup>
MDAS	D-CBT:	21.0 (2.9)	16.0 (5.2)	15.4 (5.8)	5.6 (4.9)	$p < 0.001$	$p = 0.696$
	FHM:	21.0 (2.9)	15.5 (5.2)	15.2 (5.3)	5.9 (4.6)	$p < 0.001$	
IDAF-4C	D-CBT:	4.2 (0.5)	3.4 (1.2)	3.2 (1.3)	1.0 (1.2)	$p < 0.001$	$p = 0.735$
	FHM:	4.1 (0.7)	3.3 (1.0)	3.1 (1.1)	1.1 (1.2)	$p < 0.001$	
OIDP	D-CBT:	19.7 (9.1)	18.4 (8.8)	16.8 (9.0)	2.9 (4.7)	$p < 0.001$	$p = 0.713$
	FHM:	20.9 (8.9)	20.1 (8.4)	16.7 (8.7)	4.2 (7.5)	$p < 0.001$	
SWLS	D-CBT:	23.5 (8.1)	23.4 (7.7)	23.1 (8.3)	0.4 (3.5)	$p = 0.422$	$p = 0.068$
	FHM:	23.4 (7.8)	24.0 (6.6)	24.2 (7.0)	-0.9 (4.7)	$p = 0.118$	

Abbreviations: D-CBT, Dentist-administered Cognitive Behavioural Therapy; FHM, Four Habits/midazolam; IDAF-4C, Index of Dental Anxiety and Fear, fear module; MDAS, Modified Dental Anxiety Scale; OIDP, Oral Impact of Daily Performances; SWLS, Satisfaction With Life Scale.

\*Mean difference in outcomes before treatment and 1 year after treatment.

<sup>†</sup>Wilcoxon signed-rank test results.

<sup>‡</sup>Wilcoxon rank-sum test results, comparing differences between the two treatment conditions.

**TABLE 2** Results of per protocol analysis compared to substitution by mean and a worst-case scenario (standard deviations in brackets)

		Mean MDAS score* before treatment	Mean MDAS-score 1 year after treatment	Mean difference	Time-effect <sup>†</sup>
Per protocol <sup>‡</sup>	D-CBT, ( $n = 27$ ):	20.7 (3.4)	12.9 (5.4)	7.8 (4.4)	$p < 0.001$
	FHM, ( $n = 25$ ):	21.5 (3.1)	13.7 (5.6)	7.8 (4.2)	$p < 0.001$
Substitution by mean <sup>§</sup>	D-CBT, ( $n = 48$ ):	21.0 (2.9)	13.2 (2.9)	7.8 (3.4)	$p < 0.001$
	FHM, ( $n = 48$ ):	21.0 (2.9)	13.2 (2.9)	7.8 (4.0)	$p < 0.001$
Worst-case scenario <sup>¶</sup>	D-CBT, ( $n = 48$ ):	21.0 (2.9)	14.9 (4.8)	6.1 (3.8)	$p < 0.001$
	FHM, ( $n = 48$ ):	21.0 (2.9)	15.1 (4.7)	6.0 (3.6)	$p < 0.001$

Abbreviations: D-CBT, Dentist-administered Cognitive Behavioural Therapy; FHM, Four Habits/midazolam; MDAS, Modified Dental Anxiety Scale.

\*Sum score on the Modified Dental Anxiety Scale.

<sup>†</sup>Wilcoxon signed-rank test results.

<sup>‡</sup>Analysis including all participating patients that completed the 1-year survey.

<sup>§</sup>Intention-to-treat analysis in which the changes in scores were assumed to be same in non-repliers as the mean change in repliers.

<sup>¶</sup>Intention-to-treat analysis in which all non-repliers were assumed to have had a reduction in scores similar to what was seen in the patients that were unable to continue dental treatment after study completion.

**TABLE 3** Dental attendance 1 year after treatment (in responders to the 1-year survey)

	D-CBT	FHM
Continued dental treatment*	20 (74%)	20 (80%)
Discontinued dental treatment <sup>†</sup>	4 (15%)	4 (16%)
Waiting-list <sup>‡</sup>	3 (11%)	1 (4%)

Abbreviations: D-CBT, Dentist-administered Cognitive Behavioural Therapy; FHM, Four Habits/midazolam.

\*Patients that continued with dental treatment with a general practicing dentist after project participation.

<sup>†</sup>Patients that did not continue with dental treatment after project participation.

<sup>‡</sup>Patients that were on waiting list for treatment in public interdisciplinary teams.

referred and those who were not. Nearly all of the total reduction in mean MDAS score seen 1 year post-treatment occurred during the initial treatment with both D-CBT or Four Habits/midazolam and not during the following year

(Table 1). When excluding these referred 16 patients to avoid bias introduced by the interdisciplinary follow-up treatment, the analysis of patients not continuing with anxiety treatment still revealed large changes in dental anxiety, as measured by MDAS, 1 year post-treatment [ $n = 36$ , mean MDAS reduction: 8.0 (CI: 6.6–9.5),  $p < 0.001$ ] (Figure S1 and S2 in the Supporting Information).

## Missing data

Analysis revealed that the patients who did not respond to the 1-year follow-up questionnaire had higher dental anxiety immediately post-treatment than those who did respond ( $p = 0.039$ ,  $z = 2.06$ ). The other background variables did not vary between those who responded to the 1-year questionnaire and those who did not. The per protocol analyses as well as three

different ITT analyses produced findings that were comparable (Tables 1 and 2).

## DISCUSSION

One year after participation, patients who underwent either D-CBT or Four Habits/midazolam dental anxiety treatment had lower dental anxiety scores, and three out of four reported improvements in self-rated quality of life. Nearly all patients were satisfied with the treatment they received. No difference in main outcome was detected between the treatment conditions.

This study had limitations as well as strengths. The small sample size in the follow-up study weakened the study findings. In addition, only self-report scales were used, which can be considered a weakness.

The treatment conditions were designed for use in an ordinary dental practice; hence, no psychological/psychiatric evaluations or dental phobia diagnostics were available before the dental anxiety treatment. The lack of a formal diagnosis may complicate comparison of the present findings with those of other studies of patients with dental phobia and could be considered a weakness of this follow-up study. On the other hand, this study design represents a first-line primary care treatment with a low threshold for inclusion. These broader criteria may be regarded as a preventive measure, designed to prevent current levels of dental anxiety from developing into more serious cases of anxiety.

A considerable proportion of the patients (37%) failed to respond to the 1-year questionnaire. Analyses showed a poorer treatment outcome from the initial RCT study for these non-responders. It may therefore be assumed that patients who did not reply to the questionnaire in the follow-up study were not randomly selected. This probably biased our findings, and end-scores on dental anxiety would probably have been higher if we had been able to include all patients invited. However, as the attrition rate was comparable to that observed in another follow-up study at a private dental practice [18], the attrition rate was expected and taken into consideration in the trial power analysis. Several imputations of missing data were carried out to investigate the robustness of the findings. The main analysis was conducted using the conservative LOCF imputation method. All analyses support the study's main findings; the mean reduction in dental anxiety from baseline to 1 year post-treatment remained large for both treatment conditions. This strongly indicates that the bias potentially introduced by non-repliers did not alter the main study findings.

Generalization to other dentists could not be assessed since a single dentist performed all dental anxiety treatments, which is a limitation of the present study design. However, this design was also advantageous in preventing dentist variability from influencing the study findings. As both

treatment methods were delivered with strict adherence to detailed treatment manuals, the treatment is available for other dentists to implement.

A possible source of bias was found among the 16 patients who were referred to additional anxiety treatment under a psychologist/dentist team in the available public service after receiving their treatment in the project. Twelve of these patients had received the additional dental anxiety treatment from a psychologist and dentist together before the follow-up study was conducted (the remaining four were still on waiting lists at the time of the follow-up study). Had these patients experienced a larger decrease in dental anxiety because of the interdisciplinary treatment, they could have biased the follow-up study findings in a positive direction. However, analyses excluding these patients were comparable to the main analyses. Notably, most of the dental anxiety decrease in patients was seen during the initial treatment by the trained general dental practitioner and not during the following year, when the interdisciplinary treatment was conducted.

The important strengths of this follow-up study are the underlying RCT design, the use of well-validated scales, well-defined manualized treatment conditions, and a comparably long-term follow-up. Location is also an important strength in the present study design, as the two dental anxiety treatment conditions were tested in a general dental practice.

The present findings support the first hypothesis: Four Habits/midazolam or D-CBT delivered in primary care caused a reduction in patient dental anxiety that persisted 1 year post-treatment. As expected, lower dental anxiety was accompanied by increased dental attendance. These findings support previous studies of dentist-administered dental anxiety treatments [11, 12, 18]. In a Swedish qualitative study of barriers to continued dental treatment after a behavioural intervention for dental anxiety, the most important barrier was the cost of treatment, with dental anxiety being the second [10]. Dental anxiety, cost, or a combination of the two, were the also main reasons for discontinuing treatment in this follow-up study.

Hypothesis 2 was partly supported: The patients reported an improved quality of life after the dental anxiety treatment. Although their global life satisfaction did not change, their scores on oral health-related quality of life suggested that oral problems were having a less negative influence on everyday life. Approximately two-thirds of the patients reported improved oral health.

The third hypothesis was not supported: No difference in dental anxiety reduction was found between the two treatment conditions as measured by MDAS or IDAF-4C. The likelihood of dropping out of dental treatment was also comparable in both treatment conditions. The study by Jöhren et al. on sedation treatment compared to CBT did not reveal the same findings [19]. The obvious difference between that study and the present one is the lack of other adaptations, such

as a communication model, in the treatment sessions with midazolam. In an update on conscious sedation for dentistry published in 2007 it was emphasized that ‘Conscious sedation is a technique for dealing with dental phobia; it is not an alternative to effective local anaesthesia or good behavioural management’ [31]. It could consequently be argued that the findings of studies that describe sedation treatment without ensuring adequate communication are becoming increasingly irrelevant. It has been suggested that the long-term reduction in dental anxiety after sedation treatment may be partially due to cognitive restructuring through new and positive experiences in the dental treatment situation [32]. Although the rationale for conscious sedation has traditionally been a short-term reduction in anxiety to enable the patient to receive treatment, extant studies have shown its potential for anxiety reduction in the long term, at least if combined with adequate communication and/or behavioural techniques [11, 13, 32, 33]. Midazolam sedation may inhibit patient learning because of known side effects, including impaired cognitive skills and amnesia [31]. However, since the Four Habits/midazolam method aims to deliver dental treatment within a state of reduced stress and anxiety, the patients often retain positive memories of their dental treatment situations. Cognitive restructuring due to new and positive experiences may thus in fact explain part of the long-term changes in dental anxiety also seen in sedation patients. To achieve such an effect, it was probably decisive that sedation was applied as a combination treatment, involving the use of an evidence-based communication method. Unfortunately, the findings do not reveal which treatment elements were most important in shaping the observed treatment effects. Perhaps use of the Four Habits Model alone can induce important changes in patient dental anxiety, provided that the patients would dare to start treatment without sedation. This topic should be investigated further in future studies.

Throughout the RCT, the patient-dentist relationship was found to be good in nearly all cases [13]. The relationship is of importance when dentists interact with dental anxiety patients [34, 35], and particularly when they deliver exposure therapy [15]. Therefore, it seems relevant to argue that a good patient-dentist relationship (or alliance) is of utmost importance when treating patients with dental anxiety in a general dental practice. Future research should investigate the alliance between dental anxiety patients and their dentists, how this relationship affects treatment outcomes, and importantly, how dentists can achieve adequate communication skills and succeed in forming adequate relationships with patients.

Eight patients reported that they had not continued dental treatment after participating in the study. However, the mean dental anxiety reduction in discontinuers was substantial and stable from a 1-year perspective. It may be expected that both the reduced dental anxiety level and the availability of a specially trained general dental practitioner at a nearby dental

clinic may lower the threshold for seeking dental treatment in the future.

Many of today’s practicing dentists are likely to be trained in administering conscious sedation, as defined in the Four Habits/midazolam treatment condition. The other treatment condition, D-CBT, is designed to be accessible and should be within the capacity of interested general dentist practitioners. The dentist (MSH) who administered all of the interventions in the RCT study had standard undergraduate knowledge and had attended postgraduate courses on the treatment of patients with dental anxiety. She had no formal psychological education. Considering her non-specialized background, it can be assumed that other interested dentists potentially could learn both treatment methods if given adequate training. A training programme for D-CBT should include both theoretical knowledge and relational skills, as well as supervised practical training; the exact requirements should be further investigated in future studies.

In conclusion, the findings of this study strongly support a model in which adequately educated dentists play an important role in alleviating dental anxiety in primary healthcare services. Interdisciplinary teams that include psychologists would, in this model, serve as a secondary healthcare option for patients who cannot be sufficiently helped in primary care. This model follows the principle of delivering health services at the lowest effective level of care. Models for delivery and care pathways should be the subject of further research, along with ways to best prepare general practicing dentists to administer evidence-based dental anxiety treatment methods.

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## CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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### SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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