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ORIGINAL ARTICLE

Oral health and its influence on cognitive behavioral therapy in patients fulfilling the Diagnostic and Statistical Manual of Mental Disorders-IV criteria for intra-oral injection phobia

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Abstract

Objective. To describe self-perceived and clinically assessed oral health and oral treatment needs among intra-oral injection-phobic patients (Diagnostic and Statistical Manual of Mental Disorders-IV) and to explore whether these factors have an impact on the outcome of cognitive behavioral therapy (CBT). ***Material and methods.*** Fifty-five patients (43 women, mean age 32.5 years, range 18–62 years) were treated with short-duration CBT. Dental anxiety (Dental Anxiety Scale and Dental Fear Survey) and self-perceived oral health were assessed by means of questionnaires. Three dentists assessed oral health by means of clinical examination and radiographs. Treatment outcome was measured by ability to receive an intra-oral injection by a general dentist within a 1-year follow-up (FU) period or ability to complete a behavioral avoidance test (BAT) at FU, and changes in dental anxiety and positive and negative thoughts from pretreatment to FU. ***Results.*** Forty percent of patients ranged their oral health as "good" or "very good". Mean decayed teeth (DT) was 2.2 (range 0–15). The total number of teeth in need of treatment, periodontal treatment, endodontic treatment and extractions ranged from 0 to 15, 0 to 19, 0 to 4 and 0 to 5, respectively. Self-rated oral health correlated significantly with clinical oral health. The outcome of CBT in terms of being able to receive a dental injection during FU was not influenced by oral health status. However, correlation analyses indicated that patients with the poorest oral health had the greatest increase in positive thoughts and the greatest decrease in negative thoughts from pretreatment to FU. ***Conclusions.*** The oral health of intra-oral injection-phobic patients varies substantially, but is comparable to that of the normal population. Coping with a dental injection after CBT is not influenced by oral health and treatment needs.

Key Words: *Blood–injury–injection phobia, dental anxiety, dental health*

Introduction

Studies have concluded that oral health among patients with dental anxiety and dental phobia is worse compared to that of the regular population [1,2]. It has also been reported that these patients are frequently afraid of having dental injections [3,4]. Intra-oral injection phobia, a subdivision of blood–injury–injection (BII) phobia, is characterized by a marked and persistent fear of dental injections [5]. It is reported that 5–31% of BII-phobic patients are also afraid of the dentist [3,4,6]. Since subjects with intra-oral injection phobia often report avoidance of dental care [4,7], and since dental status has been shown to be strongly affected by fear and avoidance [8], it is reasonable to assume that dental health is compromised in these patients. However, this has never been shown.

When dealing with painful dental procedures, patients who are afraid of the intra-oral injection tend to avoid it and instead endure the pain involved. These experiences of painful treatment within the dental setting may reinforce dental anxiety [9]. Another possible reason for dental anxiety among patients with intra-oral injection phobia is the fear of fainting in the dental setting [10].

Treating BII-phobic patients using cognitive behavioral therapy (CBT) is shown to be highly effective

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[11,12]. In a recent randomized clinical treatment study of intra-oral injection-phobic patients, Vika et al. [13] tested the effect of one-session CBT and found that 89% of the patients were able to have an intra-oral injection after a 1-year follow-up period. In a similar study of odontophobic patients, it was shown that poor oral health and high oral treatment needs had a negative effect on treatment outcome in terms of patients' cognitions during dental treatment 1 year after the phobia treatment [1]. Based on the reported overlap between fear of intra-oral injections and dental anxiety [4], we wanted to study whether the oral health status of patients with intra-oral injection phobia had a similar impact on the outcome of CBT. To our knowledge there are no studies reporting oral health and oral treatment needs among patients clinically diagnosed with intra-oral injection phobia.

The aims of this study were to evaluate (1) the oral health status (self-perceived as well as clinically assessed) and dental treatment needs of patients clinically diagnosed with intra-oral injection phobia [Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV], and (2) whether these factors affect the outcomes of the phobia treatment. Based on previous results among patients with odontophobia [1], we hypothesized that poor oral health has a negative effect on the treatment outcome of intra-oral injection phobia.

Material and methods

The present study was part of a clinical study in which the outcome of CBT, performed by specially trained dentists, was evaluated in a sample of patients who fulfilled the DSM-IV criteria for intra-oral injection phobia. It was concluded that CBT had a significant treatment effect since 89% of the patients had received an intra-oral injection from a general dentist during a 1-year follow-up period [13].

Subjects

The sample consisted of 55 patients (43 females) aged 18–62 years, with a mean (SD) age of 32.5 years (12.2 years). Most of the patients who attended the Center for Odontophobia in Bergen to be treated for their injection phobia were recruited from an advertisement in a local newspaper. To be included in the study, the patients had to meet the American Psychiatric Association DSM-IV criteria [5] for specific phobia (intra-oral injection phobia) and, in the case of comorbidity, intra-oral injection phobia had to be the most prominent diagnosis. The patients had not previously undergone phobia treatment. Time since last intra-oral injection ranged from 0 to 40 years, with a mean of 6.1 years [13].

Procedure

At the first appointment the patients completed a set of questionnaires, including the Dental Anxiety Scale (DAS) [14], the Dental Fear Survey (DFS) [15] and a single-item questionnaire assessing their self-perceived oral health.

Immediately after a diagnostic interview [16], the patients approached an intra-oral injection during a behavioral avoidance test (BAT) with hierarchical and gradually more difficult exposure to the dental injection [13]. The test was conducted by a general dentist. The patients could discontinue the test at any time and the number of steps completed was recorded. Directly after performing the BAT the patients were asked to record the maximum anxiety felt during the test. They also answered a questionnaire addressing negative and positive feelings felt in the feared situation.

The phobia treatment started 1 week after the interview and was performed by three general dentists who had received supervised training in CBT [13]. All the patients (with the exception of one who had a full-mouth radiograph status) had an orthopantomogram (OPG) and two bite-wings (BWs) taken before the start of the phobia treatment. After the treatment the patients went back to their own dentists or were referred to a new general practitioner, who was recruited based on an advertisement in the local dental association journal. A reply form was sent to the dentists, asking them to report whether the patients had attended and if they had received one or more oral injections.

One year after the phobia treatment the patients were recalled to the research center to complete the same questionnaire as used pretreatment. They had a short follow-up interview with a psychologist and completed a new BAT.

The study design was approved by the National Committee for Research Ethics in Norway.

Measures

Last dental visit. Time since the last dental visit was recorded in years based on a single question: "When was your last dental visit?"

Self-perceived oral health. The self-report of oral-health was assessed by a single-item questionnaire rating oral health as (1) very good, (2) good, (3) neither good nor bad, (4) poor or (5) very poor.

Clinically assessed oral health and treatment needs. All patients were examined clinically and the examination was usually done at the beginning of the phobia treatment by the treating dentist. Three dentists

(including the two treating dentists) separately recorded oral health and treatment needs based on the radiographs (BWs and orthopantomogram). With access to the initial clinical recordings, the diagnostic registrations were then discussed among the three dentists until a consensus was achieved.

Oral health. Number of teeth present. All teeth with a clinical crown. The third molars were excluded, except when they were fully erupted and had the position of a second molar.

Sound teeth. Number of erupted teeth without signs of pathology (caries, periodontal disease and periradicular lesions according to the criteria below).

Caries (DMFT). D = primary or secondary caries in dentine. M = missing due to caries or carious tooth beyond repair (roots). F = filled/restored tooth with no sign of caries in dentine.

Periodontal disease. Number of teeth were recorded at two severity levels:

(1) Advanced marginal bone loss: marginal bone level > 4 mm from the cemento–enamel junction and coronal to the apical third of the root.
(2) Total marginal bone loss: marginal bone level in the apical third of the root.

Root-filled teeth. Number of teeth with root canal treatment, also if present as remnants of roots.

Remnants of roots. Number of destroyed teeth that could not be restored. Multiple rooted teeth were recorded as one tooth.

Periradicular bone lesions. Number of teeth, except root remnants, with pathologically altered lamina dura and apical radiolucency.

Number of third molars. All third molars erupted or not erupted, if not situated in the second molar position.

Oral treatment needs. Restorations. Number of teeth in need of restorative treatment (filling or crown).

Periodontal treatment. Number of teeth with marginal bone level > 4 mm from the cemento–enamel junction and coronal to the apical third of the root.

Root filling. Number of restorable teeth recorded with periradicular bone lesions and/or obvious pulp involvement.

Replacements. Number of teeth missing or in need of extraction in the region mesial to the first molars (incisors, canines, premolars).

Dentures. Number of dentures needed.

Extractions. Number of (1) root remnants, (2) teeth with marginal bone level in apical third of the root, (3) third molars with signs of pathology, partially erupted or retained with obvious communication to the oral cavity.

Total number of teeth in need of treatment. All teeth with diagnoses that need treatment (decayed, marginal bone loss, roots or apical lesions), according to the above criteria.

Treatment outcome variables. Dental anxiety. The DAS [14] is a four-item self-report scale. The person's subjective reactions in four dental situations are rated on a five-point Likert scale. Summation of the scores gives an overall anxiety score ranging from five (not anxious at all) to 20 (extremely anxious). The DFS [15] records behavioral, psychological and cognitive aspects related to dental treatment. It consists of 20 items with scores ranging from one to five. Higher sum-scores represent higher dental anxiety. The differences between pretreatment and follow-up scores on the DAS and DFS were estimates of reduction in dental anxiety.

Cognitions during the behavioral avoidance test. The BAT [13] contained 13 steps, where the first step was "Entering the dental office", the ninth step was "Injecting a few drops of local anesthetic" and the 13th step was "Is there any region in the oral cavity you could not have an injection?". If the test was disrupted before step 9, the patients were considered unsuccessful with regard to having an oral injection. Immediately after the BAT the patients reported the frequency of five negative and five positive thoughts on a scale ranging from 0 to 4 (0 = never, 4 = very often). The negative thoughts were "I can't do this", "I'm going to fail", "I'll faint", "I need to get out of this situation" and "I can't stand this". The positive thoughts were "I have control over the situation", "It's going well—better than I thought it would", "It's not as unpleasant as I thought", "I feel calm and safe" and "I'm satisfied with myself". These cognitions have previously been used by Öst et al. [12]. The maximum anxiety during the test was recorded on a visual analog scale ranging from 0 (no) to 100 (maximum). Pretreatment values of these self-reports were compared with 1-year follow-up values.

Ability to have an intraoral injection at the general practitioner. A reply form was sent to the patients and the general practitioners asking them to report the number of intra-oral injections within the first three dental visits after the phobia treatment.

Statistical analyses

The data were analyzed using the SPSS statistical package (version 14.0; SPSS Inc., Chicago, IL).

Simple descriptive statistics were used to describe oral health measures and oral treatment needs. Student's *t*-test was used for comparison of oral health in patients who were successful or unsuccessful in

having an intra-oral injection at 1-year follow-up and for comparison of oral health in patients avoiding or not avoiding dental treatment previous to the CBT.

Spearman's correlation was used to evaluate bivariate relationships between oral health and oral treatment needs versus cognitive perceptions during the BAT and changes in dental anxiety from pretreatment to follow-up. The Kruskal–Wallis non-parametric test was used for testing the relationship between self-perceived oral health and objective measures of oral health.

Results

Self-perceived oral health

The distribution of the reports of self-perceived oral health rated as "very good", "good", "neither good nor poor", "poor" and "very poor" was 9.1%, 30.9%, 27.3%, 21.8% and 10.9%, respectively.

Clinically assessed oral health

Twenty-two of the patients (40%) had no oral disease according to the clinical and radiological examinations.

Number of teeth present. The mean number of teeth present was 26.7 (SD 2.5) and ranged from 14 to 28 (median 28). Fifty-three patients (96.4%) had 23 or more teeth present. Three patients needed replacement of teeth because of a lack of teeth in the region between the first molars (incisors, canines, premolars).

Caries. The DMFT scores, which are displayed in Table I, ranged from 0 to 28, with a mean of 11.5 (SD 8.2, median 13). Filled teeth comprised 72.8% and decayed teeth 19.1% of the total DMFT score.

Periodontal disease. Eighty-five percent of the patients did not have any teeth with advanced periodontal bone loss (≥ 4 mm from the cemento–enamel junction). One patient had 19 teeth and nine patients had one to seven teeth with advanced bone loss. Among the patients with advanced bone loss, one had a tooth with total bone loss.

Roots, periradicular lesions, root fillings and third molars. Roots were present in three patients, while five had one to four teeth with apical bone lesions. Forty-eight patients (87.3%) had neither roots nor periradicular lesions. One or two root canal treatments had been done in 17 patients (31%), while 38 patients (69%) had never had a root filling. One or more third molars were present in 38 patients (69.1%).

Treatment needs. A total of 33 patients (60%) had teeth in need of dental treatment, nine of whom had more than five teeth in need of treatment. The distributions of restorations, extractions, root canal treatments and/or periodontal treatment are displayed in Table II. Restorations and root canal treatment were the most and least frequent treatment needs, respectively. A total of 18 patients (32.7%) needed at least one extraction, including 14 who needed extraction of one or more third molars.

Relationship between self-perceived and clinically assessed oral health and treatment needs

There were statistically significant relationships between most of the self-rated oral health reports and clinical diagnoses and the measures of oral treatment need (Table III). Clinically assessed periodontal disease, roots present and the number of wisdom teeth present were not significantly associated with the patients' self-perceived oral health, neither was the clinically assessed need for extraction of wisdom teeth and other teeth.

Oral health and treatment need in relation to time since last dental visit

Mean time since last dental visit was 2.4 years (SD 3.6 years, range 0–15 years, median 1 year). There

Table I. Mean DMFT scores and the D, M and F portions according to age group and for the total sample. No statistically significant differences between the groups were found.

Age group (years) (*n*)	D; mean (SD) median (range)	M; median (range)	F; median (range)	DMFT; mean (SD) median (range)
< 31 (29)	2,3 (4.2) 0.0 (0–15)	0.0 (0–4)	3.0 (0–18)	4.0 (7.8) 4.0 (0–24)
31–41 (14)	1,8 (3.1) 1.0 (0–11)	0.0 (0–4)	9.5 (0–19)	1.8 (6.3) 11.5 (0–20)
> 41 (12)	2.3 (2.5) 1.5 (0–8)	0.5 (0–14)	13.5 (8–25)	19.0 (4.6) 18.0 (13–28)
Total (55)	2,2 (3,5) 1.0 (0–15)	0.0 (0–14)	8.0 (0–25)	11.5 (8.2) 13.0 (0–28)

Table II. Distribution of teeth in need of restoration, periodontal treatment (advanced periodontal bone loss), root canal treatment and extractions and total number of teeth in need of treatment, according to age group. No statistically significant differences between the groups were found.

Age group (years) (*n*)	Restoration; mean (SD) median (range)	Periodontal treatment; median (range)	Root canal treatment; median (range)	Extraction; median (range)	Total number of teeth in need of treatment; mean (SD) median (range)
<31 (29)	2.4 (4.2) 0.0 (0–15)	0.0 (0)	0.0 (0–4)	0.0 (0–1)	2.4 (4.3) 0.0 (0–16)
31–41 (14)	1.8 (3.4) 0.5 (0–12)	0.0 (0–1)	0.0 (0–2)	0.0 (0–5)	2.8 (4.8) 1.0 (0–17)
>41 (12)	2.3 (2.5) 1.5 (0–8)	1.0 (0–19)	0.0 (0–2)	0.0 (0–1)	5.4 (4.7) 4.0 (0–19)
Total (55)	2.2 (3.6) 1.0 (0–15)	0.0 (0–19)	0.0 (0–4)	0.0 (0–5)	3.3 (4.6) 1.0 (0–15)

were no significant correlations between time since last dental visit and measures of oral health and treatment need for the whole group. However, patients who had been to the dentist within the last 6 years (mean+1SD, $n = 41$) had significantly less decayed teeth ($P = 0.026$), filled teeth ($P = 0.038$), DMFT ($P = 0.001$) and total number of teeth in need of dental treatment ($P = 0.028$) than patients who had not been to the dentist during the last 6 years ($n = 14$). Self-perceived oral health was statistically significantly poorer in the group of patients who had not seen the dentist during the last 6 years ($P = 0.00$).

There were no significant correlations between time during which intra-oral injections had been avoided and any of the oral health and treatment need measures.

Table III. Self-perceived oral health (very good, good, neither good nor poor, poor or very poor) related to clinical diagnoses and measures of oral treatment need (Kruskal–Wallis test).

	Chi-square	*P*
Oral health		
Carious teeth	18.3	0.001
Missing teeth	14.9	0.005
Filled and healthy teeth	4.9	0.294
DMFT	13.6	0.009
Teeth with advanced periodontal disease	7.5	0.113
Teeth with root canal filling	12.8	0.012
Roots	6.4	0.171
Teeth with apical periodontitis	12.1	0.016
Wisdom teeth	3.7	0.448
Healthy teeth	22.6	0.000
Treatment need		
Number of restorations	18.2	0.001
Number of extractions excluding wisdom teeth	4.1	0.396
Wisdom teeth extractions	2.8	0.60
Teeth in need of endodontic treatment	18.4	0.001
Total number of teeth in need of treatment	21.8	0.000

Relationship between outcome variables of the phobia treatment and oral health and treatment needs

Since the outcome of the phobia treatment was similar in the one- and five-session treatment groups [13], these groups were pooled. The group of patients who were estimated as having been unsuccessfully treated for their phobia ($N = 6$, 10.9%; either no injections at the dentist during the 1-year follow-up period or unable to complete the behavioral test at 1-year follow-up because of high anxiety [13]) had similar age and oral health conditions compared to those who managed intra-oral injections during the follow-up period ($N = 49$, 89.1%).

From pretreatment to 1-year follow-up, the mean DAS score reduced from 15.4 (SD 3.0, range 8–20) to 10.1 (SD 3.7, range 4–20) and the mean DFS score reduced from 78.4 (SD 12.4, range 37–96) to 51.2 (SD 21.8, range 21–100) [13]. This reduction in dental anxiety did not correlate significantly with any of the clinically assessed oral health measures (Table IV). The DFS reduction, however, correlated significantly with self-perceived oral health ($r = 0.35$, $P = 0.01$), indicating that patients with the poorest self-perceived oral health had the highest reduction in dental anxiety from pretreatment to 1-year follow-up.

Table IV. Mean age and oral health measures in patients who were successfully and unsuccessfully treated. All values are presented in the form mean (SD), unless otherwise stated.

	Successfully treated ($n = 49$)	Unsuccessfully treated ($n = 6$)	*P* (*t*-test)
Age (years); mean (range)	32.9 (18–62)	29.0 (18–45)	0.46
DMFT	11.4 (8.3)	12.5 (8.0)	0.75
DT	1.9 (3.2)	4.5 (5.4)	0.09
MT	1.0 (2.6)	0.3 (0.8)	0.53
FT	8.5 (6.5)	7.7 (7.5)	0.79
Total number of teeth in need of treatment	3.0 (4.5)	5.0 (5.1)	0.33

DT, Decayed teeth; MT, Missing teeth; FT, Filled teeth.

Table V. Correlations (Spearman) between oral health/oral treatment needs and change in psychometric measures from pretreatment to 1-year follow-up (bold typeface indicates statistically significant values).

Decrease in DAS			Decrease in DFS	Decrease in negative thoughts	Increase in positive thoughts
Oral health					
Self-perceived oral health	*r*	–0.24	**–0.35**	–0.23	**0.33**
	P	0.09	**0.018**	0.14	**0.03**
Healthy teeth (*n*)	*r*	–0.13	0.11	**0.39**	**–0.36**
	P	0.37	0.47	**0.023**	**0.017**
DT	*r*	0.23	–0.02	–0.29	**0.39**
	P	0.11	0.87	0.06	**0.01**
Missing (*n*)	*r*	0.07	–0.13	**–0.34**	**0.37**
	P	0.64	0.37	**0.023**	**0.014**
Treatment needs					
Restoration (*n*)	*r*	0.23	–0.02	–0.29	**0.39**
	P	0.11	0.87	0.06	**0.01**
Total number of teeth in need of treatment (*n*)	*r*	0.13	–0.11	**–0.35**	0.265
	P	0.35	0.46	**0.021**	0.08

A total of 45 of the 55 patients performed behavioral tests both before treatment and at 1-year follow-up, including measurement of positive and negative thoughts. The significant correlations between decrease in negative thoughts and oral health and treatment needs indicate that patients with the poorest oral conditions had the greatest reduction in negative thoughts from pretreatment to 1-year follow-up (Table V). The significant correlations between increase in positive thoughts and oral health and treatment needs indicated that patients with the poorest oral health also had the greatest increase in positive thoughts during the follow-up.

Discussion

In the present study we found that the oral health, both self-perceived and clinically assessed, of a group of intra-oral injection-phobic patients varied from excellent to very poor. The mean age of the patients was 32.5 years, and their oral health was quite similar to what was found among 35-year-old Norwegian citizens [17–19]. Eight patients (14.5%), with a mean age of 22.6 years, had no caries, fillings or missed teeth (DMFT = 0), compared to 2% of the general population of 35-year-old Norwegians [18]. Most of the patients went for regular dental check-ups (n = 41), although a small group with long-term avoidance (> 6 years; n = 14) had poor oral health.

Self-perceived oral health has not previously been evaluated among intra-oral injection-phobic patients. Forty percent of our patients rated their oral health as either good or very good. The patients' rating was in accordance with the clinical and radiological examinations in terms of statistically significant relationships with DMFT values, number of root-filled teeth, teeth with periapical periodontitis and healthy teeth (Table III). This seems reasonable since these are clinical variables that patients are able to perceive. The number of teeth with marginal bone loss, wisdom teeth present and wisdom teeth in need of extractions are clinical variables that patients cannot so easily perceive, which explains the lack of a significant relationship with self-perceived oral health. This was in accordance with the findings of Gilbert et al. [20], who did not find significant correlations between self-rated oral health and marginal periodontal bone loss. A self-perceived rating of oral health has been found to be a reliable measure of dental health status in a general population [21,22]. However, as discussed by Merstedt et al. [23] and also experienced in our clinical practice, patients with high dental anxiety seem to be more pessimistic about their oral health. Our findings indicate that this is not the case in patients with intra-oral injection phobia, even if their dental anxiety is higher than that of the general population.

The patients' level of dental anxiety before treatment, as measured by the DAS and DFS, was much higher than in regular populations [13]. Based on the comorbidity between dental anxiety and intra-oral injection phobia [24], we expected the oral health in the present group of intra-oral injection-phobic patients to be compromised to a similar extent as that in other populations with high dental anxiety [2]. This was the case in a study by Poulton et al. [3], who found that the oral health in patients suffering from both BII-phobia and high dental anxiety was poorer than in patients with BII-phobia alone or among the regular population. This could not be supported in the present study, where the oral health of the patients with oral-injection phobia, most of whom also had high dental anxiety, was similar to the oral health of the regular population [17–19].

We had the opportunity to compare the oral health data in the present study group with similar data from a previous treatment study of patients formally diagnosed as dental phobics [1]. For the whole group we found better oral health among the injection phobics in terms of statistically significant lower DMFT (11.5 versus 16.4, $P = 0.002$) and most of the other oral health variables. This finding may possibly have been due to the fact that the mean time since the last dental visit was higher among the dental phobics (11 years, range 3–30 years [1]) than among the present group of injection phobics (2.4 years, range 0–15 years). Many of the injection-phobia patients had been to the dentist and managed to have treatment as long as it could be done without local anesthetics. Our finding that the group of injection-phobic patients who had not been to the dentist during the last 6 years had poorer oral health than the rest of the group supports the vicious circle theory [8] of avoidance behavior as an important factor influencing deterioration of oral health, irrespective of the type of phobia.

Based on the finding that the group of patients who were not successfully treated for their phobia ($N = 6$, 10.9%) had similar oral health, self-perceived as well as clinically assessed, and treatment needs as patients who were successfully treated ($N = 49$, 89.1%) (Table IV), our main conclusion is that CBT may be effective in terms of managing intra-oral injections, irrespective of the patients' oral health conditions. Our hypothesis that poor oral health would have a negative effect on treatment outcome was therefore partly rejected. However, the relationship between oral health status and the reduction of self-reported cognitions during the behavioral test indicates that the cognitive outcome during the year after treatment seems to be partly dependent upon some oral health status factors (Table V). Even if the correlation coefficients are rather low ($r = 0.28$–0.39), they indicate an increased beneficial treatment outcome in terms of reduced dental anxiety, increased positive thoughts and reduced negative thoughts as assessed by a BAT when receiving an intra-oral injection for those with the poorest oral health.

Our assumption that poor oral health might have a negative effect on treatment outcome was based on previous findings among odontophobic patients [1]. The literature also shows that patients with high expectations of extensive dental treatment report more anxiety in the dental setting [25] and less control over negative thoughts [26]. In the present study, patients with a self-report of poor oral health had the highest pretreatment dental anxiety, the most negative thoughts and the fewest positive thoughts. To what extent regression to the mean may have influenced the reduction in dental anxiety and improvement in cognitions for subjects with the most extreme scores is not possible to measure. However, not all pretreatment variables were related to oral health status, thereby indicating that the cognitive outcome 1 year after treatment was only partly dependent upon some of the oral health status factors, as displayed in Table V.

Concerning the second aim of this study, i.e. whether oral health status affects the outcome of the phobia treatment, it may be asked which variables are the most valid. Oral health was measured as self-perceived and by means of a number of clinical variables, while treatment outcome was measured as successful or not and by means of self-assessments. Since our hypothesis was based on findings that patients with high expectations of extensive dental treatment seem to be more anxious in the dental setting and have less control over negative thoughts [1,25,26], we estimate 'self-perceived oral health' to be the most valid variable. Among the clinically assessed variables we estimate 'total number of teeth in need of treatment' to be a compound variable that pools the more specific measures of oral health. Regarding outcome of treatment, the most important variable was the definition of successful versus unsuccessful treatment, since it was based on behavior, i.e. whether the patients were able to receive a dental injection or not.

In our study the patients were only exposed to intra-oral injections without receiving any kind of dental treatment during CBT, even if many of them had obvious treatment needs. Poulton et al. [3] concluded in their study that the most efficient treatment for patients with both dental and injection phobia is to focus on both types of fears, as these fears seem to be at least partially independent. Our findings can neither verify nor disprove this conclusion since our aim was solely to treat their intra-oral injection phobia, but it seems that this kind of treatment has also contributed to a discontinuation of dental avoidance behavior for many of patients and thereby facilitated dental treatment. However, when treating patients with both intra-oral injection phobia and high dental anxiety in clinical practice, it may very well be useful to apply CBT and approach both anxieties simultaneously, as suggested by Poulton et al. [3].

The main limitation of the present study is the small sample size. Problems connected with recruitment of a sufficiently large sample of patients suffering from low-prevalence phobias are well known. Whether a larger sample size would have given more statistically significant differences between those successfully and not successfully treated may only be speculated upon.

The main conclusion of our study is that the oral health and treatment needs of patients suffering from intra-oral injection phobia are comparable with those in the regular population. Furthermore, it seems that their oral health status does not affect their ability to master intra-oral injections 1 year after phobia treatment. However, our findings indicate that patients reporting poor oral health experience more favorable

changes in dental anxiety and cognitions during intra-oral injections during a 1-year follow-up period compared to those with better oral health.

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