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Mental Retrieval of Treatment Context in Dental Phobia

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Background: The effect of mental retrieval of an exposure session was investigated during a follow-up examination in dental phobia patients. **Method:** The exposure session took place at the psychology unit and the follow-up a week later at the dental clinic prior to dental treatment while patients were seated in the dental chair. During exposure, individuals with dental phobia ($N = 72$) were shown a video of a dental appointment, after which they were instructed to imagine themselves receiving dental treatment. During follow-up half of the participants received instructions to mentally retrieve the exposure session and the other half were asked to recall everyday activities. Before and after exposure treatment, and after mental retrieval, participants were shown three dental instruments while heart rate (HR) and avoidance and subjective units of discomfort (SUD) were recorded. **Results:** Questionnaires of phobic anxiety administered before and after treatment indicated significant improvement. Mental retrieval of treatment was moderately superior to the control condition with regard to avoidance. Over 80% of patients underwent the subsequent dental treatment session. Those not adhering showed initially more dysfunctional cognitions and more desire for control. **Conclusion:** There is some evidence that retrieval of treatment context may have a moderately beneficial effect on avoidance.

Keywords: Dental phobia, mental retrieval, exposure, heart rate.

Introduction

Dental phobia is highly pervasive. Some 80% of adults reported being apprehensive about dental treatment and up to 5% avoid dental treatment altogether (Getka and Glass, 1992),

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thereby meeting criteria of a diagnosis of specific phobia. Dental phobia has an early onset at a mean age of 12 years (Öst, 1987) but can occur throughout the life-time. Additional to the discomfort engendered by the phobia, avoidance of dental treatment imposes a considerable health risk (Mostofsky, Forgione and Giddon, 2006). A dental examination revealed the presence of eight to nine decaying teeth in dental phobia patients (Thom, Sartory and Jöhren, 2000) compared with one or two teeth that require treatment in the general population at any one time.

There are discrepant findings with regard to the mode of acquisition of dental phobia, with some studies finding a conditioning origin and others failing to do so. In an epidemiological study of unselected adults, few reported negative dental experiences that, moreover, were only moderately related to subsequent dental fear (Armfield, 2010). Similarly, in unselected children, type and number of dental treatments could not be shown to be clearly associated with dental fear (Ten Berge, Veerkamp and Hoogstraten, 2002). In contrast, Öst (1991) reported a conditioning onset in some 50% of patients with blood and injury phobia, a partly related disorder. In our own study of 272 dental phobia patients, 79.4% remembered a distinct event after which they started to avoid dental treatment. The majority of these patients experienced strong pain and others loss of control or a combination of the two during dental treatment (Sartory and Wannemüller, 2010).

A number of treatment studies attest to the effectiveness of cognitive behavioural techniques in dental phobia. A meta-analysis of 38 randomized controlled studies resulted in an ES of 1.8 regarding the reduction of subjectively reported dental fear (Kvale, Berggren and Milgrom, 2004). There are fewer long-term investigations of the treatment effect. However, on average, 77% of treated dental phobics still attended regular dental check-ups within 4 years following psychological treatment. The results show that cognitive-behavioural treatment is highly successful but also that not all of the patients benefit from treatment. One of the reasons for the failure of treatment could be the difference in environmental cues between exposure during psychological treatment and the subsequent dental treatment situation. Recently, there have been attempts to reformulate processes occurring during fear extinction.

According to Rescorla (2001) and Bouton et al. (Bouton, Woods, Moody, Sunsay and García-Gutiérrez, 2006) the extinction process consists not of unlearning or the destruction of the originally learned response but of the instalment of a new neuronal network that has an inhibiting or suppressing effect on the former. There are a number of learning phenomena supporting the assumption of an unrelated extinction network such as spontaneous recovery, renewal, i.e. the return of the originally learned response with a change of context following extinction (Bouton, 2004), or reinstatement, i.e. the return of an extinguished reaction after renewed exposure to the unconditioned stimulus. Similar to findings in animal research, conditioning studies in humans also found a renewal effect upon presentation of an acquisition retrieval cue (Vansteenwegen et al., 2006). In the clinical context, reinstatement is a well-known cause of relapse in substance related disorders (e.g. McFarland and Kalivas, 2001). In turn, cues retrieving the extinction context could reverse this process.

Findings from animal research indicate that the presentation of cues associated with extinction could attenuate the recovery of a conditioned response (Brooks and Bouton, 1993). Similar results were reported in human conditioning experiments (Vansteenwegen et al., 2006; Dibbets, Havermans and Arntz, 2008). The memory enhancing effect of the

mental retrieval of environmental cues of the learning context has been investigated some time ago. Studies on learning of word lists showed that recall is superior if conducted in the same context in which learning has taken place (Smith, 1988). However, the original context can also be recalled mentally in a different environment. Smith (1979) instructed participants to recall the original learning environment prior to recall of a list of words in a different environment and found their recall performance to be enhanced. Similar studies have confirmed that environmental-context dependent memory, tested by cued and free recall, is enhanced when participants are asked to recall the original learning context while being confronted with a novel test context (e.g. Frerk, Holcombe, Johnson and Nelson, 1985).

There are first indications that similar processes might occur during emotional learning. Mystowski, Craske, Echiverri and Labus (2006) reported a beneficial effect in spider-fearful individuals by mental retrieval of the extinction context during a follow-up test. (The authors employed the term "reinstatement", which has, however, been previously defined as the re-emergence of a conditioned response, e.g. a craving response, which is why the term "retrieval" is used here in preference). Before retest participants were instructed to mentally retrieve the exposure treatment context whereas the control condition consisted of recalling neutral memories. The cognitive strategy of mental retrieval of the treatment context had a fear-reducing effect. Mental retrieval could therefore become a useful tool among therapeutic techniques of exposure treatment. Studies so far have been carried out on animals or analogue participants who were either conditioned or fearful student samples. In order to assess whether retrieval of extinction or rather of the treatment context could serve as a therapeutic tool, the present study was carried out in individuals with a diagnosed specific dental phobia. Additionally, to assess the benefit in clinical use, patients received a full session of exposure treatment as in the Mystkowski et al. (2006) study instead of an experimentally standardized and limited extinction procedure.

One-session treatment has been found to be considerably effective, with long-lasting benefits in individuals with spider phobia (Öst, 1989). Single exposure sessions were similarly successful in dental phobia patients (Thom et al., 2000) with 73% of them continuing to observe dental appointments over the following 6 months (Schmid-Leuz, Elsesser, Lohrmann, Jöhren and Sartory, 2007). In an attempt to investigate factors predictive of adherence to dental appointments, Sartory, Heinen, Pundt and Jöhren (2006) found that a high desire for control coupled with low perceived control over dental treatment as assessed by the Iowa Dental Control Index (Logan, Baron, Keeley, Law and Stein, 1991) was a significant predictor of avoidance of dental appointments. Other cognitive factors such as dysfunctional cognitions or degree of self-efficacy in dealing with problems and, in particular, with health problems may conceivably also have an effect on adherence. Perceived ability to control symptoms has previously been found to be related to dental anxiety (Kent and Gibbons, 1987).

In the present study, dental phobia patients were given exposure treatment in the psychology unit with a follow-up test being carried out a week later prior to dental treatment. Half the participants were instructed to mentally retrieve the context of the exposure treatment and the other half was asked to recall a neutral memory. We expected to find fear reduction due to the retrieval of the treatment context. Additionally, we aimed to replicate the result of desire for control as partly determining adherence to dental treatment and to explore further contributory factors.

Method

Participants

A total of 72 dental phobic patients (42 women and 30 men) with a mean age of 36 years ($SD = 10.9$; range 19 to 62) were included in the study. They were consecutive referrals from the Dental Clinic of the Augusta Hospital in Bochum. Patients were included in the study if they met DSM-IV criteria of specific (dental) phobia, required invasive dental treatment (extraction or filling), took no anxiolytic medication or medication affecting the cardiovascular system and took part in the complete programme of three sessions. Additional 14 patients failed the latter criterion (one failed to take part in therapy and 13 in the follow-up). Data of another 8 patients were excluded because of equipment malfunction. Those participating had avoided dental treatment for a mean of 9.7 years ($SD = 8.1$; range 1 to 38 years). An average of nine of their teeth required treatment. Single or multiple comorbid disorders were diagnosed in 25 participants (9 specific phobia, 9 social phobia, 4 panic disorder with or without agoraphobia, 2 OCD, 2 major depression, 3 previous substance related disorder, 2 generalized anxiety disorder and one each of hypochondriasis and bipolar disorder). All patients gave their informed consent before taking part in the study. The study was approved by the Ethics Committee of the University of Wuppertal.

Design

Patients were allocated randomly to two groups (mental retrieval of treatment context vs. recall of everyday activities). Randomization was carried out according to an odd/even procedure, with the first patient being allocated to the retrieval group, the second to the control group, and so on. Both groups were treated with one exposure session. A week later, at the follow-up (FU) preceding dental treatment, half the participants were instructed to mentally retrieve the treatment session (mental retrieval) and the other half were instructed to think about everyday activities such as getting up and having breakfast (control memory).

Patients were given questionnaires to complete during the week before and at FU. Also, before and after treatment and again after the retrieval instruction at FU, patients underwent a laboratory procedure during which they were shown three dental instruments (dental probe, forceps, drill) while heart rate (HR), avoidance in terms of latency in picking them up, and SUD were recorded.

Screening and clinical assessment

The study was carried out at the Dental Clinic of the Augusta Hospital, Bochum and the Department of Psychology at the University of Wuppertal. Upon entering the Dental Clinic, patients were routinely asked whether they were afraid of dental treatment. In case of an affirmative answer they were asked to complete the Hierarchical Anxiety Questionnaire (HAF; Jöhren, 1999). This self-rating questionnaire consists of 11 hierarchically ordered situations that dental phobics typically fear. Patients are asked to indicate how much anxiety they would experience in each of them on a scale from 1 to 5. Scores can range from 11 to 55 and 35 is considered the cut-off score for dental phobia (Jöhren and Sartory, 2002). An internal consistency index of Cronbach's $\alpha = .80$ has been reported (Sartory et al., 2006). Patients with a score >35 were referred to the clinical psychologist. Data regarding the number of decayed,

missing and filled teeth (DMFT- Index) were provided by an initial dental examination (on the basis of 28 teeth).

A clinical psychologist assessed the patients with a structured interview (Diagnostisches Interview bei psychischen Störungen [DIPS]; Schneider and Margraf, 2006, the German adaptation of the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV), Brown, Di Nardo and Barlow, 1994) to confirm DSM-IV criteria of a specific dental phobia and determine comorbid disorders. The DIPS has a good test-retest reliability ($r = .64$ - .89) and inter-rater reliability (kappa $r = .80 – 1.00$; Schneider and Margraf, 2006). Additionally, an exploration was carried out as to the individual bodily symptoms, thoughts and type of situations that the patient has experienced.

Questionnaires

Dental Anxiety Scale (DAS; Corah, 1969; German version translated by the authors). This self-rating questionnaire is the most frequently used instrument in dental anxiety research and consists of four items relating to dental treatment. Patients are asked to rate how anxious they would be if they had to submit to these situations the following day. Scores range from 4 to 20. Corah, Gale and Illig (1978) reported a mean score of 9.07 in 2,103 non-selected participants, with women having a significantly higher score ($M = 9.53$) than men ($M = 8.56$). Dental phobic patients had a mean score of 17.20 ($SD = 1.80$). A score of 15 is considered the cut-off for dental phobia (Corah et al., 1978). An internal consistency index of Cronbach's $\alpha =$ .64 has been reported for the German version (Sartory et al., 2006).

Dental Cognitions Questionnaire (DCQ; De Jongh, Muris, Schoenmakers and Ter Horst, 1995; German version translated by the authors). This self-rating questionnaire consists of 38 negative cognitions (beliefs and self-statements) related to dental treatment. Fourteen items concern negative beliefs pertaining to dentistry in general (e.g. "Dentists don't care. . .") and to the patients themselves (e.g. "I can't stand pain"); the remaining 24 items contain negative self-statements (e.g. "Everything is going wrong"). Patients are asked to indicate whether these negative beliefs occur to them during dental treatment resulting in the frequency score of negative cognitions (DCQ: range = 0–38). Individuals with dental phobia were found to have a significantly higher number of negative cognitions than non-phobic controls (De Jongh et al., 1995). Data of a previous study yielded a Cronbach's $\alpha = .90$ (Sartory et al., 2006).

Revised Iowa Dental Control Index (IDCI; Brunsman, Logan, Patil and Baron, 2003; German version translated by the authors). This self-rating questionnaire consists of nine items, five of which concern the desire for control (e.g. "To what degree would you like control over what will happen to you in the dental chair?") (Cronbach's $\alpha > .78–.79$) and the other four concern perceived control during dental treatment (e.g. "How much do you think you can control what will happen to you while in the dental chair?") (Cronbach's $\alpha > .75–.80$). Items are rated from 1 (none) to 5 (totally) and summed. Dental patients with a high desire for control coupled with a low feeling of control reported high levels of dental distress compared to low scorers (Logan et al., 1991).

State-Trait Anxiety Inventory (STAI X1, X2; German version by Laux, Glanzmann, Schaffner and Spielberger, 1981). Both scales contain 20 items describing emotional states. Participants are asked to indicate the degree to which a given statement applies to them at present (state) and during the last two weeks (trait version). Scores range from 20 (no anxiety)

to 80 (high anxiety). An internal consistency score of Cronbach's $\alpha > .90$ was reported (Laux et al., 1981).

Beck Depression Inventory (BDI). The German version by Hautzinger, Bailer, Worall and Keller (1994) was used. This 21-item inventory indexes depression intensity with a score range of 0–63. A score between 11 and 17 is considered indicative of mild depressive symptoms, and a score of 18 or above is indicative of severe depression. Internal consistency scores have been reported to exceed Cronbach's $\alpha > .74$ in healthy subjects and .92 in depressed patients (Hautzinger et al., 1994).

Aachen Self Efficacy Questionnaire (ASF; Wälte, Ebe, Brandenburg and Kröger, 1999). This self-rating questionnaire consists of 20 items detailing a variety of problem situations and a successful way of dealing with them. Participants are asked to indicate from 1 to 5 whether the behaviour applies to them. The total score can range from 20 to 100. A study of 650 attendants of a clinic for psychosomatic disorders found the internal consistency to be high (Cronbach's $\alpha = .90$). A factor analysis allocated the items to four subscales, one of which concerns self-efficacy in terms of health (e.g. "I can deal with health problems") which was analyzed separately.

Treatment

Patients were first shown a video film that had been produced professionally by a local television crew. It showed a number of scenes from the perspective of a patient going to have dental treatment, i.e. being in the area in front of the practice and entering it, being seen by the receptionist, sitting in the waiting room, entering the treatment room, sitting in the dental chair and seeing the instruments. Finally, a dentist appear**s** with a face mask, handl**es** the instruments and mov**es** them towards the viewer's face. The film lasted for 12 min and was projected by a beamer (NEC MultiSync MT 830+, Tokyo, Japan) onto a screen with a picture size of 100 × 75 cm and participants viewing at a distance of 1.6 m. Having seen the video film, participants were instructed to visualize the scenes as vividly as possible with themselves in place of the patient. During that time a clinical psychologist described the scenes, together with anxious thoughts and bodily fear reactions that the patient had reported during the initial interview. Patients were asked repeatedly as to the extent of their fear between 0 and 100 regarding the imagined scenes. Over time, imagery was progressively directed toward scenes that were particularly anxiety-provoking. Treatment duration was 90 min.

Laboratory procedure

Participants were shown three dental instruments in randomized order (dental probe, forceps and the hand piece of a slow drill). They were placed in the drawers of a small chest and presented consecutively. At first, each drawer was opened for 20 s and patients were instructed to look at the instrument while heart-rate was recorded (HR). Afterwards, the instruments were shown again and patients were instructed to hold them for 10 s. Time until picking up the instrument was recorded (avoidance). If patients failed to pick up an instrument within 10 s, the experimenter proceeded to the next one. After each instrument display, patients were asked to give a fear rating from 0 to 100 (subjective units of discomfort, SUD).

Heart-rate (HR)

The electro-cardiogram was recorded using chest electrodes with a BIOPAC amplifier system (med-NATIC, Germany). The sampling rate was 1000 Hz. R-waves were detected online and interbeat intervals converted with one RR-interval delay into HR in beats per minute (bpm). Resting HR was determined as mean HR of the last of a 3-min rest period before stimuli were administered. Mean HR reaction to the instruments was calculated over 10 s after onset of stimuli and baseline-corrected taking 1s before stimulus onset into account. Respiration was recorded with a respiratory belt that was placed around the chest. Recordings were inspected and employed for artefact control in regard to the HR analysis.

Procedure

After the initial screening and dental examination at the Dental Clinic, patients were given the psychological assessment and questionnaires there a week later. Those meeting DSM-IV criteria for specific dental phobia were invited to take part in the study. Treatment was carried out a week later at the Department of Clinical Psychology of Wuppertal University where they were shown the video with exposure in imagery. Before (pre) and after (post) treatment, participants underwent the laboratory procedure. The follow-up assessment (FU) was carried out back at the Dental Clinic where participants were asked to complete the questionnaires again. Afterwards, they were seated in a dental chair awaiting dental treatment. They were instructed to either mentally retrieve the treatment session or remember activities they had carried out since getting up earlier that day. Afterwards they received the laboratory procedure again (FU) and went into dental treatment. All dental treatments involved invasive procedures, i.e. an extraction or a filling.

Data reduction and analysis

Only participants who took part in all three sessions (assessment, treatment and follow-up) were included in the study. Missing data were replaced by the group mean of the measure at that measurement occasion. ANOVAs were carried out comparing the retrieval and control group with regard to demographic and dental health data as well as questionnaire scores before and after exposure. Similarly, patients with and without comorbid disorder were compared in regard to questionnaire scores. Laboratory measures were then submitted to MANOVA comparing groups, instruments and measurement occasions. Furthermore, patients adhering to the dental appointment after FU ($N = 58$) were compared with those not adhering ($N = 13$) with regard to the questionnaire data before and after exposure by means of *T*-tests (in consideration of the large difference in group sizes). Finally, relations between questionnaire and laboratory data were explored. In order to reduce data sets, a principal component analysis (PCA) was carried out on the questionnaire scores and laboratory data averaged over instruments. The PCA resulted in three components: a general anxiety factor (23.6 % of the variance) with loadings of BDI, STAI trait and ASF (self-efficacy); a dental phobia factor (23.6 %) with loadings of DAS, HAF, DCQ and STAI state; and finally, a perceived control factor (13.6 %). The factor scores were then correlated with the averaged laboratory data.

Table 1. Group means and *SD*s of demographic and dental health data

	Recall condition	
	Treatment retrieval	Control memory
Sex m/f	16/20	14/22
Age	36.75 (11.11)	35.22 (10.88)
DAS (pre treatment)	16.81 (2.03)	17.36 (2.33)
Avoidance of dental treatment (years)	9.43 (7.75)	9.90 (8.49)
DMF-T Index		
- decayed	9.66 (6.96)	8.16 (6.18)
- missing	5.03 (4.52)	5.94 (5.1)
- filled	3.77 (5.40)	2.82 (5.25)
Subsequent dental treatment % (*N*)	86.10 (31)	75.00 (27)

Notes: DAS – Dental Anxiety Scale; DMF-T – decayed, missing, filled teeth)

Results

There were no significant group differences with regard to demographic or dental health variables between the retrieval and the control group (Table 1). There were, however, more patients with comorbid disorders in the retrieval ($N = 18$) than the control group ($N = 7$) ($\chi^2 = 5.0, p < .03$). There were no significant group differences (neither between retrieval and control nor between patients with and without comorbid disorders) with regard to the number of patients undergoing dental treatment after the psychological intervention. Overall, 81.7% of the patients proceeded with dental treatment; the remaining ones left after completing the testing procedure at FU.

Questionnaires

There were no significant differences between the retrieval and control group with regard to the questionnaire measures at either occasion and data were therefore pooled across groups. Means and *SD*s are shown in Table 2, together with *F*-ratios comparing measures before and after exposure treatment. There were significant pre - post measurement effects in regard to all questionnaires apart from ASF health (self-efficacy). All phobia and anxiety/depression-related scores decreased highly significantly from before to after treatment, with IDCI (desired control) decreasing only moderately (Table 2). The comparison of patients with ($N = 25$) and without ($N = 47$) comorbid disorders yielded significantly elevated scores in the former with regard to trait anxiety and depression (both $p < .01$). There was no significant group × measurement occasion effect.

Laboratory measures. Pre, post and FU measurements of SUDs, HR reaction and avoidance of the two retrieval conditions were entered into ANOVA.

Subjective Units of Discomfort (SUDs). SUDs regarding the dental instruments were subjected to MANOVA with a 2 × 3 × 3 (retrieval × instrument × measurement) design. SUDs differed significantly with regard to instruments ($F(2,136) = 13.08$, $p < .001$, $\eta^2 = .16$), measurement ($F(2,136) = 39.3$, $p < .001$, $\eta^2 = .37$) and instruments × measurement ($F(4,272) = 5.04$, $p < .001$, $\eta^2 = .07$). Post-hoc analyses showed that SUDs of the drill

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Table 2. Group means and *SD*s of questionnaire data before and after exposure treatment (total sample)

Variable	Pre *M* (*SD*)	Post *M* (*SD*)	*F*(1,70)	*p*	η^2
Dental anxiety (HAF)	45.07 (6.75)	37.01 (9.52)	63.89	.001	.48
Dental anxiety (DAS)	17.08 (2.19)	14.01 (3.34)	77.59	.001	.53
Dysfunct. cognitions (DCQ)	19.21 (6.46)	15.28 (8.73)	19.71	.001	.22
IDCI-desired control	20.87 (2.91)	19.98 (3.61)	4.51	.04	.06
IDCI-perceived control	7.92 (3.04)	9.66 (3.08)	24.49	.001	.26
STAI-state anxiety	55.01 (12.0)	44.49 (13.48)	44.45	.001	.39
STAI-trait anxiety	42.56 (9.94)	39.18 (10.75)	33.23	.001	.32
Depression (BDI)	10.67 (9.06)	7.81 (9.25)	18.03	.001	.21
ASF-total (self-efficacy)	3.69 (.61)	3.83 (.62)	11.96	.001	.15
ASF-health related	3.38 (.61)	3.47 (.76)	1.67		

Notes: HAF – Hierarchical Anxiety Questionnaire; DAS – Dental Anxiety Scale; DCQ – Dental Cognitions Questionnaire; ICDI – Iowa Dental Control Index; STAI – State-Trait Anxiety Inventory; BDI – Beck Depression Inventory; ASF – Aachen Self Efficacy Questionnaire)

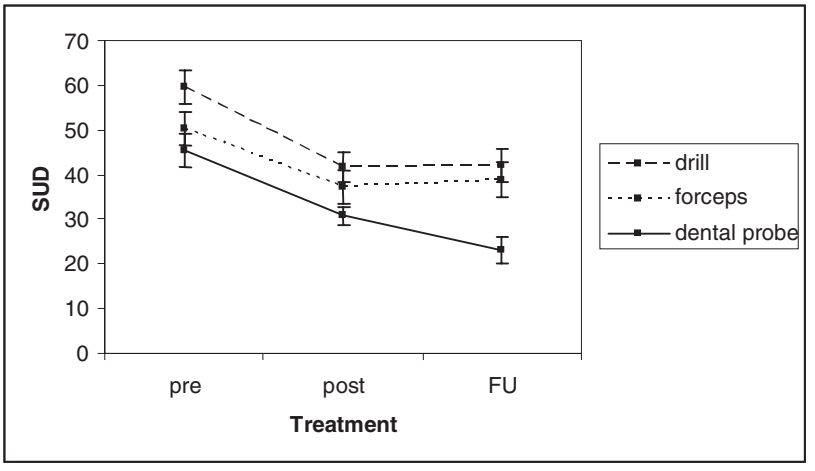

Figure 1. Group means and standard errors of subjective units of discomfort (SUD) while patients were exposed to dental instruments before and after the exposure treatment session (pre, post) and at follow-up a week later while sitting in the dental chair prior to dental treatment. The data represent the total sample

were significantly higher than those of the dental probe ($p < .01$) with SUDs of the forceps in-between (Figure 1). ANOVA of individual instruments yielded significant measurement effects. In case of the dental probe, SUDs decreased significantly from before to after treatment and again at follow-up (all *p*s $< .01$). In case of both forceps and drill, SUDs decreased significantly from before to after treatment (all *p*s $< .01$) and were stable to FU.

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Table 3. Group means and *SD*s of avoidance(s) of dental instruments pre and post exposure treatment and at FU (follow-up)

		Treatment retrieval	Control memory
Forceps	pre	3.53 (2.89)	3.41 (2.99)
	post	2.56 (1.37)	3.10 (3.27)
	FU	1.87 (1.66)	3.18 (3.22)
Drill	pre	3.80 (3.15)	4.01 (3.21)
	post	2.80 (2.17)	2.76 (2.55)
	FU	2.30 (2.13)	2.69 (2.67)
Dental probe	pre	3.61 (2.62)	3.70 (2.90)
	post	2.69 (2.08)	2.91 (2.77)
	FU	2.30 (2.11)	2.50 (2.78)

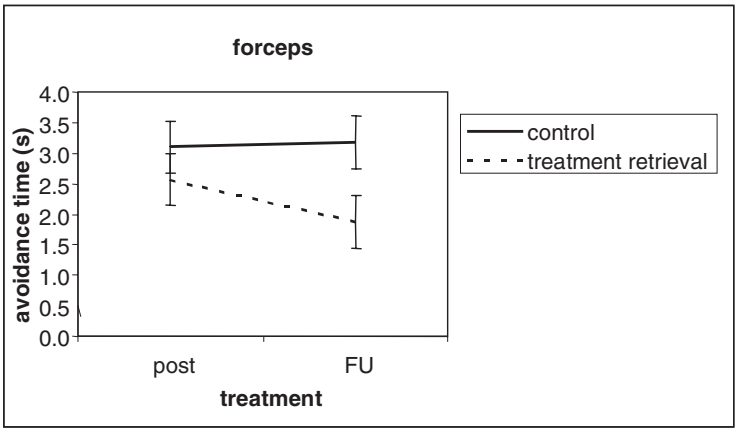

Figure 2. Group means and standard errors of time to pick up the forceps after exposure treatment and during follow-up a week later as a function of retrieval of exposure vs. control memory

Avoidance test. Patients who failed to pick up the instrument within 10 s were given a set avoidance time of 10. Of the 72 patients, 56 picked up all instruments before exposure treatment and 62 picked them up afterwards and at FU, respectively. There were no significant group differences. Avoidance time was submitted to MANOVA with a 2 × 3 × 3 (retrieval × instrument × measurement) design. There was a significant measurement effect ($F(2,136) = 16.59$, $p < .001$, $\eta^2 = .20$) and a significant retrieval × instrument × measurement effect ($F(1,68) = 4.46$, $p < .04$, $\eta^2 = .06$). Post-hoc tests revealed a significantly greater avoidance time with regard to the forceps in the control than the retrieval group at follow-up ($p < .04$; Figure 2). As to the other instruments, there were no significant group differences but significant measurement effects with a decrease from before to after exposure treatment (all *p*s $< .01$) and no further significant decrease to FU (Table 3).

Heart-rate. Resting HR was submitted to ANOVA with a 2 × 3 (retrieval × measurement) design. There was a significant measurement effect ($F(2,67) = 40.58$, $p < .001$, $\eta^2 = .55$). Resting HR decreased from before to after treatment ($p<.01$) and increased again during

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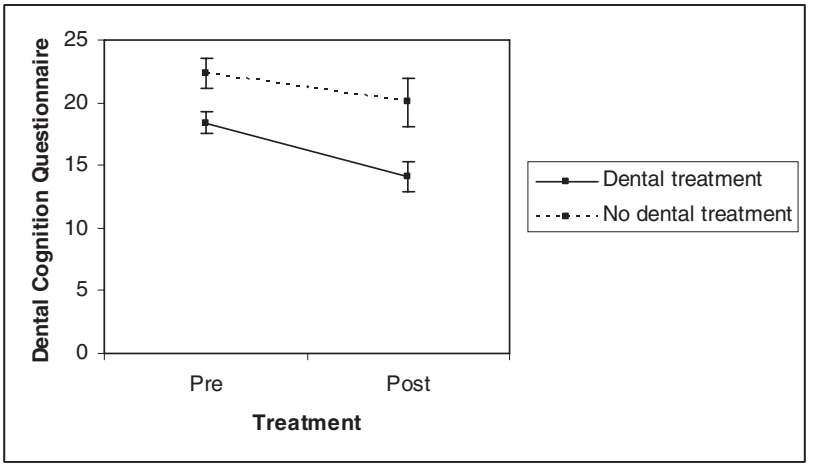

Figure 3. Group means and standard errors of the Dental Cognitions Questionnaire before and after exposure treatment. The total sample was divided into patients subsequently undergoing vs. not undergoing the dental treatment session

follow-up ($p < .01$) when it was higher than before treatment ($p<.02$) (Pre: 77.4 bpm (11.5), post: 72.4 bpm (10.7), FU: 79.9 bpm (11.5).

HR reaction to instruments was submitted to MANOVA with a 2 × 3 × 3 (retrieval × instrument × measurement) design. There was only a significant measurement effect ($F(2,67) = 7.0$, $p < .01$, $\eta^2 = .17$) indicating that HR reactions decreased over measurements (Pre: .93 bpm ($SE = .31$), post: −.31, ($SE = .32$), FU: −.50, ($SE = .25$)).

Adherence

Patients undergoing the dental treatment session after FU ($N = 58$) were compared with those not adhering ($N = 13$) in regard to questionnaire measures completed before the exposure session. Groups differed significantly with regard to number of dysfunctional Dental Cognitions (t ($df = 69$) $= 2.01$, $p < .05$; adherence: 18.4 (6.7), non-adherence: 22.3 (4.3); Figure 3) and *Desire for Control* ($t(df = 69) = 2.24$, $p < .03$; adherence: 20.46 (2.7), non-adherence: 22.38 (3.1)). A group comparison of questionnaire data after exposure revealed significant group differences with regard to the two former variables but also to the Dental Anxiety Scale ($t(df = 69) = 3.68$, $p < .01$; adherence: 13.3 (3.1), non-adherence: 16.8 (2.6). Accordingly, patients not undergoing dental treatment after FU showed initially and after exposure more dysfunctional dental cognitions and desired greater control over dental procedures than patients undergoing dental treatment. The former also maintained a higher fear level after exposure.

Relations between measures

In order to elucidate the data structure, correlational analyses were carried out between the initial questionnaires and the pre-exposure laboratory data. Both data sets were reduced, the

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questionnaire data by principal component analysis and the laboratory data were averaged across instruments (see Data reduction and analysis). The dental phobia factor was significantly correlated with mean avoidance ($r(df = 71) = .26$; $p < .03$) and mean SUD ($r(df = 71) = .25$; $p < .04$) and the two laboratory measures were also significantly intercorrelated ($r(df = 71) = 39$; $p < .01$). Furthermore, perceived control was significantly and inversely correlated with SUD ($r(df = 71) = -.30$; $p < .01$) indicating that the less perceived control over dental treatment the greater the fear of the dental instruments.

Discussion

The one-session exposure treatment of dental phobia was considerably successful in terms of the subsequent attendance of the dental treatment session. Having avoided dental treatment for an average of over 9 years, some 80% of the psychologically treated patients submitted to it. Questionnaire data indicated a significant exposure treatment effect but, at the same time, patients were still markedly fearful. Similarly, mental retrieval of the treatment had only a moderate effect. Patients who were asked to mentally retrieve the treatment picked up one of the three dental instruments, namely, the forceps, faster than patients who were asked to remember morning activities. Retrieval had no significant effect on undergoing the dental treatment session. Instead, an initially inflated number of dysfunctional cognitions and desire for control over dental treatment was predictive of later non-adherence. These patients also benefited less from exposure as indicated by their higher phobic severity after exposure.

The effect of mental retrieval of exposure was only evident in the behavioural domain in the present study whereas it was manifest with regard to self-report in the study in highly spider-fearful participants by Mystkowski et al. (2006). A major difference between the two studies is that in the present study the follow-up took place with the threat of impending dental treatment, whereas Mystkowski et al.'s participants had been exposed to the highest fear item during their past treatment. The marked increase in resting HR while participants were seated in the dental chair supports the conclusion that patients were highly anxious during FU in the present study. As dental treatment is invariably the aim of psychological treatment of dental phobia, participants cannot be spared its impending threat. It is worth considering whether retrieval should take place after the first dental treatment session when it may be effective as a prophylactic means against relapse.

Cognitive factors have so far not been shown to have an extant role in the treatment of spider phobia. The present study was carried out in dental phobia patients in whom dysfunctional cognitions are thought to play a role in maintaining the disorder. One of the reasons is conceivably the age of onset, which is later in dental than spider phobia, at an age when cognitive factors are presumably of greater importance. De Jongh et al. (1995) compiled the Dental Cognitions Questionnaire (DCQ), a list of dysfunctional cognitions dental phobia patients admit to having. The authors grouped cognitions into those relating to beliefs about the lack of competence or care in dentists (e.g. "Dentists don't care") and the state of the patient's teeth (e.g. "I should be ashamed of my teeth"). The questionnaire is correlated with extent of phobic anxiety (Schmid-Leuz et al., 2007) and the present results indicate that an inflated number of dysfunctional cognitions contribute to non-adherence to dental appointments. Interestingly, the DCQ was not related to non-adherence in an untreated sample of dental phobia patients (Sartory et al., 2006). However, non-adherence was also more pervasive in the previous study than after the present single-session exposure treatment. It is

conceivable that patients with marked dysfunctional cognitions need more treatment sessions or else that these cognitions need to be addressed during treatment.

Another cognitive factor contributing to non-adherence in the present study was desire for control over dental treatment procedures as assessed by the Iowa Dental Control Index (IDCI; Logan et al., 1991). A similar finding has been reported previously (Sartory et al., 2006). As in the previous study, the IDCI was not correlated with severity of dental phobia as was reported by Logan et al. (1991). However, their sample was not selected for dental phobia as was the case in the present study. The desire for control in the dental setting was also not correlated with other measures of self-efficacy or locus of control (Sartory et al., 2006). Rather than being a personality trait, the ICDI desire for control appears to be specific to dental anxiety. Instrumental control was previously found to have an anxiety-relieving effect in phobia (Sartory and Daum, 1992). It is conceivable that patients desiring more control experienced its anxiety-relieving effect or, rather, the fear-inducing effect of its lack during the lengthy course of their phobic history. With regard to the clinical management of dental phobia, the results suggest that patients should be given more control over treatment procedures.

A high proportion of dental phobia patients have comorbid disorders. In the present study a third of the patients suffered from a variety of other anxiety disorders, of depression and even, in one case, of bipolar disorder. These patients indicated higher levels of anxiety and depression in the questionnaire measures. However, exposure treatment was just as effective in this subgroup in regard to undergoing the subsequent dental treatment session. It is one of the limitations of this study that the effect of psychological treatment could not be evaluated for separate comorbid disorders as the sample size of the subgroups was too small.

Summarizing, the results provide only moderate indication that mental retrieval of exposure treatment could constitute an additional therapeutic tool, at least, not when patients are faced with the threat of a highly fear-inducing event. Additionally, cognitive factors such as desire for control over dental treatment procedures and dysfunctional cognitions appear to have a maintaining effect on dental phobia and need to be taken into account during both psychological and dental treatment. Among the limitations of the present study is the failure to include the data of patients who failed to complete the experiment in an "intention-to-treat" analysis.

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References

Armfield, J. M. (2010). Towards a better understanding of dental anxiety and fear: cognitions vs. experiences. *European Journal of Oral Sciences, 118*, 259–264.

Bouton, M. E. (2004). Context and behavioural processes in extinction. *Learning and Memory, 11*, 485–494.

Bouton, M. E., Woods, A. M., Moody, E. W., Sunsay, C. and García-Gutiérrez, A. (2006). Counteracting the context-dependence of extinction: relapse and tests of some relapse prevention methods. In M. G. Craske, D. Hermans, D. Vansteenwegen, M. G. Craske, D. Hermans and D. Vansteenwegen (Eds.), *Fear and Learning: from basic processes to clinical implications* (pp. 175–196). Washington, DC: American Psychological Association.

Brooks, D. C. and Bouton, M. E. (1993). A retrieval cue for extinction attenuates spontaneous recovery. *Journal of Experimental Psychology: Animal Behaviour Processes, 19*, 77–89.

Brown, T. A., Di Nardo, P. A. and Barlow, D. H. (1994). *Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV)*. San Antonio, TX: Psychological Corporation/Graywind Publications Inc.

Brunsman, B. A., Logan, H. L., Patil, R. R. and Baron, R. S. (2003). The developement and validation of the Revised Iowa Dental Control Index (IDCI). *Personality and Individual Differences, 34*, 1113–1128.

Corah, N. L. (1969). Development of a dental anxiety scale. *Journal of Dental Research, 48*, 596–602.

Corah, N. L., Gale, E. L. and Illig, S. J. (1978). Assessment of a dental anxiety scale. *Journal of the American Dental Association, 97*, 816–819.

De Jongh, A., Muris, P., Schoenmakers, N. and Ter Horst, G. (1995). Negative cognitions of dental phobics: reliability and validity of the Dental Cognitions Questionnaire. *Behaviour Research and Therapy, 33*, 507–515.

Dibbets, P., Havermans, R. and Arntz, A. (2008). All we need is a cue to remember: the effect of an extinction cue on renewal. *Behaviour Research and Therapy, 46*, 1070–1077.

Frerk, N., Holcombe, L., Johnson, S. and Nelson, T. (1985). *Context-Dependent Learning in a Classroom Situation.* Unpublished manuscript, Gustavus Adolphus College.

Getka, E. J. and Glass, C. R. (1992). Behavioural and cognitive-behavioural approaches to the reduction of dental anxiety. *Behavior Therapy, 23*, 433–448.

Hautzinger, M., Bailer, M., Worall, H. and Keller, F. (1994). *Beck-Depressions-Inventar*. Bern: Huber.

Jöhren, P. (1999). Validierung eines Fragebogens zur Erkennung von Zahnbehandlungsangst. *ZWR - Das Deutsche Zahnärzteblatt, 108*, 104–114.

Jöhren, P. and Sartory, G. (2002). *Zahnbehandlungsangst – Zahnbehandlungsphobie. Ätiologie – Diagnose – Therapie*. Hannover: Schlütersche.

Kent, G. and Gibbons, R. (1987). Self-efficacy and the control of anxious cognitions. *Journal of Behavior Therapy and Experimental Psychiatry, 18*, 33–40.

Kvale, G., Breggren, U. and Milgrom, P. (2004). Dental fear in adults: a meta-analysis of behavioral interventions. *Community Dentistry and Oral Epidemiology, 32*, 250–264.

Laux, L., Glanzmann, P., Schaffner, P. and Spielberger, C. D. (1981). *Das State-Trait-Angst-Inventar*. Weinheim: Beltz.

Logan, H. L., Baron, R. S., Keeley, K., Law, A. and Stein, S. (1991). Desired control and felt control as mediators of stress in a dental setting. *Health Psychology, 10*, 352–359.

McFarland, K. and Kalivas, P. W. (2001). The circuitry mediating cocaine-induced reinstatement of drug-seeking behavior. *The Journal of Neuroscience, 21*, 8655–8663.

Mostofsky, D. I., Forgione, A. G. and Giddon, D. B. (2006). *Behavioral Dentistry*. Oxford: Blackwell Munksgaard.

Mystkowski, J. L., Craske, M. G., Echiverri, A. and Labus, J. S. (2006). Mental reinstatement of context and return of fear in spider-fearful participants. *Behavior Therapy, 37*, 49–60.

Öst, L. G. (1987). Age of onset in different phobias. *Journal of Abnormal Psychology, 96*, 223–229.

Öst, L. G. (1989). One-session treatment of specific phobias. *Behaviour Research and Therapy, 2*, 1–7.

Öst, L. G. (1991). Acquisition of blood and injection phobia and anxiety response patterns in clinical patients. *Behaviour Research and Therapy, 29*, 323–332.

Rescorla, R. (2001). Experimental extinction. In R. R. Mowrer, and S. B. Klein (Eds.), *Handbook of Contemporary Learning Theories* (pp. 119–154). Mahwah, NJ: Erlbaum.

Sartory, G. and Daum, I. (1992). Effects of controllability on subjective and cardiac responses in phobics. *Journal of Psychophysiology, 6*, 131–139.

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

Sartory, G. and Wannemüller, A. (2010). *Fortschritte der Psychotherapie: Zahnbehandlungsphobie*. Göttingen: Hogrefe.

Schmid-Leuz, B., Elsesser, K., Lohrmann, T., Jöhren, P. and Sartory, G. (2007). Attention focusing versus distraction during exposure in dental phobia. *Behaviour Research and Therapy, 45*, 2691–2703.

Schneider, S. and Margraf, J. (2006). *Diagnostisches Interview bei psychischen Störungen: DIPS*. 3. Auflage. Berlin: Springer.

Smith, S. M. (1979). Remembering in and out of context. *Journal Experimental Psychology, Human Learning and Memory, 5*, 460–471.

Smith, S. M. (1988). Environmental context-dependent memory. In G. M. Davies and D. M. Thomson (Eds.), *Memory in Context: context in memory* (pp. 13–34). Chichester: Wiley.

Ten Berge, M., Veerkamp, J. S. and Hoogstraten, J. (2002). The etiology of childhood dental fear: the role of dental and conditioning experiences. *Journal of Anxiety Disorders, 16*, 321–329.

Thom, A., Sartory, G. and Jöhren, P. (2000). Comparison between one-session psychological treatment and benzodiazepine in dental phobia. *Journal of Consulting and Clinical Psychology, 68*, 378–387.

Vansteenwegen, D., Vervliet, B., Hermans, D., Beckers, T., Baeyens, F. and Eelen, P. (2006). Stronger renewal in human fear conditioning when tested with an acquisition retrieval cue than with an extinction retrieval cue. *Behaviour Research and Therapy, 44*, 1717–1725.

Wälte, D., Ebe, H., Brandenburg, U. and Kröger, F. (1999). Kognitive Selbstregulation bei somatoformen Störungen. In F. Kröger and E. Petzold (Eds.), *Selbstorganisation und Ordnungswandel in der Psychosomatik*. Stuttgart: VAS.