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### Anxiety, fainting and gagging in dentistry: Separate or overlapping constructs?

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“

Until today, I have avoided to visit a dentist for almost sixty years. When I was seven years old the dentist gave me an extremely painful injection. Then he extracted my molar, although the anesthesia didn't work properly. The dentist didn't believe me. After all these years, his angry face still comes to my mind and makes me anxious again.

”

# CHAPTER 4

**Presence, content and characteristics of memories of  
individuals with dental phobia**

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## Introduction

Enhanced memory of emotional events is a well-known phenomenon (De Quervain et al., 2009). Intrusive, involuntary memories of an aversive or distressing event, whereby the specific content of the memory corresponds with that of the event, are among the key features of posttraumatic stress disorder (PTSD; American Psychiatric Association, 2000; Holmes et al., 2005). These memories involve a range of sensory modalities, albeit visual aspects are most commonly reported (e.g., Ehlers et al., 2002; Engelhard et al., 2002), and include characteristics such as vividness, intrusiveness, and the sense that the event seems to be happening again in the present (Michael et al., 2005). Some of these characteristics have been found to be associated with disturbance and emotion (Arntz et al., 2005; Michael et al., 2005), as well as symptom severity (Whitaker et al., 2008; Rubin et al., 2004; Berntsen et al., 2003; Willert & Rubin, 2003).

In recent years, a number of studies have shown that intrusive mental imagery is not unique for PTSD *per se* and also occurs in other psychiatric disorders (Hagenaars & Holmes, 2012), including anxiety disorders such as social phobia (Hackmann et al., 2000; Hackmann et al., 1998), agoraphobia (Day et al., 2004), obsessive compulsive disorder (Clark & Rhyno, 2005), and health anxiety (Muse et al., 2010).

Despite the fact that theories regarding phobia onset predict that disproportionate anxiety results from exposure to negative, disturbing life events (Davey, 1997), a surprisingly limited number of studies have been conducted to study the relationship between aversive memories and the presence of fears or specific phobias. One of the exceptions is a study on spider phobia in which the participants were asked whether they had experienced intrusive spider images and whether there was a specific early memory closely linked to that image (Pratt et al., 2004). The majority of individuals in the spider-anxious group, but none of a control group, reported spontaneous, recurrent images associated with their fear of spiders. About half of the participants (55%) reported that their images were associated with an early memory. A study among individuals with and without emetophobia found that significantly more phobic individuals could recall at least one memory of their own vomiting compared with the control group without emetophobia (Veale et al., 2013). Moreover, they rated the memories of their own vomiting experiences as significantly more distressing than individuals in the control group. Thus, it seems that in specific phobias, memories of distressing events play a significant role.

A substantial part of the existing studies regarding memories of individuals suffering from a specific phobia has been conducted in the area of dental phobia and dental fear. It has been found that dentally anxious individuals are likely to report a disturbing dental experience (Moore et al., 1991) and suffer from significantly more symptoms of re-experiencing, insomnia, and avoidance of reminders of past dental events than their moderately anxious



counterparts (De Jongh et al., 2003; De Jongh et al., 2006; De Jongh et al., 2002). For instance, in one study among individuals with high levels of dental anxiety, it was found that 43.3% indicated that they suffered from intrusive re-experiencing of past events when anticipating dental treatment (De Jongh et al., 2006). Thus, memories of past aversive events seem to be common features in dental fear and phobia. However, knowledge about the content and characteristics of specific memories is limited. Also, the possible role of these features in the development, exacerbation, and maintenance of dental fear and dental phobia, as well as the possible association between the characteristics of these memories and current levels of individuals' dental trait anxiety, is generally unclear.

Therefore, the first aim of the present study was to assess the presence, content, and characteristics (i.e., vividness, disturbance, and sense of reliving) of memories of events that initiated or exacerbated dental trait anxiety levels of individuals with dental phobia ( $n = 42$ ). The results were compared with two reference groups, that is, individuals with (1) a high level of dental trait anxiety, but not fulfilling the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition* (DSM-IV) criteria of dental phobia ('subthreshold dental phobia';  $n = 41$ ), and (2) a normal level of dental trait anxiety ('normal controls';  $n = 70$ ). It was hypothesized that a significantly higher proportion of the dental phobic patients would report disturbing core memories relative to the normal controls and based on PTSD research, that their memories would have a greater emotional intensity, intrusiveness, and avoidance propensity. Based upon the literature, it is not clear whether or not patients who are dentally anxious, but do not meet the threshold of dental phobia, would differ from both groups in terms of their memory characteristics. Therefore, examining these possible differences was also an aim of the present study, but was exploratory in nature.

The third aim of the present study was to determine the relationship between patients' severity of dental trait anxiety and some key features of these memories. It was predicted that greater severity of dental trait anxiety was positively associated with higher emotional intensity, intrusiveness, and avoidance propensity of the disturbing core memory.

## Method

### Participants

Three groups of participants were included in the current study: (1) phobic patients visiting a special dental fear clinic in Amsterdam, the Netherlands (further referred to as 'dental phobics'); (2) subthreshold phobic patients visiting this dental fear clinic (further referred to as 'subthreshold dental phobics'); and (3) patients of a general dental practice in the Netherlands with normal levels of dental trait anxiety (further referred to as 'normal controls'). In order to apply for treatment at the dental fear clinic, patients needed to fulfill

strict criteria such as a minimal score on several dental anxiety questionnaires, evidence of severe avoidance behavior in the past, or being difficult or impossible to treat by a dentist in a general dental practice.

## Measures

### Materials

Dental trait anxiety was indexed using the Dental Anxiety Scale (DAS; Corah, 1969). This four-item measuring scale is the questionnaire most widely used in studies of dental anxiety (Corah, Gale & Illig, 1978). Responses are scored from 1 to 5, providing total scores ranging from 4 (not anxious at all) to 20 (extremely anxious). DAS scores of 13 or higher are considered indicative of high dental trait anxiety. The test–retest reliability of the DAS showed an intraclass correlation of 0.82 (Corah, 1969). Cronbach’s alpha in the current study was 0.69 for phobics, 0.83 for subthreshold phobics, and 0.80 for controls (overall  $\alpha = 0.96$ ).

The level of exposure to distressing (dental) events was assessed using the Level of Exposure–Dental Experiences Questionnaire (LOE-DEQ), a self-report checklist inquiring about potentially overwhelming events in the individual’s past (Oosterink et al., 2008). The LOE-DEQ had a satisfactory test–retest reliability (intraclass correlation coefficient = 0.78; Oosterink et al., 2008). The format of this inventory allows for calculating scores for the presence of separate trauma areas with respect to 21 typical dental and potentially traumatic experiences and eight general/other traumatic life events fulfilling the DSM-IV Text Revision (DSM-IV-TR) stressor criteria (e.g., a serious accident or being a victim of a violent crime). Dental experiences were dental procedures (e.g., a root canal treatment or an injection), behavior of the dentist or oral surgeon (e.g., a treatment by an impolite or rude dentist or being criticized by a dentist), patients’ emotions during a dental treatment (e.g., embarrassment or helplessness), and negative dental events (e.g., witnessing a treatment of an extremely anxious dental patient). Participants are requested to indicate whether they had ‘ever’ (1) or ‘never’ (0) experienced any of these events. Items are scored and summed to give an overall frequency score ranging from 0 to 21 for dental experiences and 0 to 8 for general traumatic experiences.

The Phobia Checklist was used for the assessment of dental phobia (Oosterink, De Jongh & Hoogstraten, 2009). This screening tool was validated against the Structured Clinical Interview for DSM-IV (First & Gibbon, 2004) and has proven to be a valid instrument for the assessment of dental phobia (i.e., sensitivity = 0.95, specificity = 0.99, overall hit rate = 97%; Oosterink et al., 2009). The Phobia Checklist consists of four questions based on the DSM-IV-TR criteria (APA, 2000) for specific phobia. An individual is classified as a dental phobic only when all four questions of the Phobia Checklist are answered in the affirmative. In



the present study, an individual was classified as a subthreshold dental phobic when he or she had indicated a high level of dental trait anxiety as indexed by the DAS (Corah, 1969), and less than four questions of the Phobia Checklist were answered in the affirmative. An individual was classified as a normal control when he or she visited a dental practice, had normal levels of dental trait anxiety (i.e., a score of  $\leq 12$  on the DAS), and less than four questions of the Phobia Checklist were answered in the affirmative.

A semi-structured interview, the so called 'Full Intrusions Interview' adapted from Reynolds and Brewin (1999) was administered to identify whether the participants had memories of distressing events that initiated or exacerbated dental anxiety. Next, the characteristics of that memory were determined (i.e., the emotional intensity, intrusiveness, and avoidance propensity of that memory). Patients were asked to rate the emotional intensity (i.e., vividness, disturbance, and sense of reliving) of the memory on an 11-point Numeric Rating Scale. The Dutch version of the Impact of Event Scale (IES; Horowitz et al., 1979; Kleber et al., 1992) was used to index intrusiveness and avoidance propensity of this memory. Patients were explicitly instructed to fill out the IES related to this memory. The IES consists of 15 items constituting the subscales intrusions and avoidance. Adequate test-retest reliabilities were reported for the two subscales of the IES (0.87 for IES intrusion and 0.79 for IES avoidance; Horowitz et al., 1979). When scoring the IES, subjects are asked to indicate how frequently the symptoms were present during the past seven days. The frequency of each symptom is scored using a four-point response format, ranging from 'not at all' (0), 'rarely' (1), 'sometimes' (3) to 'often' (5). The scores can be summed to produce a total IES score (range 0–75), and two subscale scores for intrusion (range 0–35) and for avoidance (range 0–40) with a higher score indicating a greater level of intrusion (i.e., the loss of voluntary control over the regulation of thoughts) or avoidance (i.e., the extent to which memories are consciously suppressed). A score of 26 is considered the cut-off point for a clinically significant level of trauma-related symptomatology (Kleber et al., 1992). Cronbach's alpha for the current study for the IES intrusions scale was 0.89 for phobics, 0.87 for subthreshold phobics, and 0.86 for normal controls (overall  $\alpha = 0.92$ ). For the avoidance scale, Cronbach's alpha was 0.79 for phobics, 0.87 for subthreshold phobics, and 0.90 for controls (overall  $\alpha = 0.89$ ).

The independent variable in the current study was the group to which the subject belonged (i.e., dental phobics, subthreshold dental phobics, or normal controls). Dependent variables in the current study were gender, age, country of birth, level of dental trait anxiety, level of exposure to distressing (dental) events, and the emotional intensity, intrusiveness, and avoidance propensity of the memory.

### Procedure

The study was based on a prospective design with two assessment points (T1 and T2; see Figure 1 for the flowchart) and was conducted between April 2010 and June 2012. Trained dental students invited patients of the dental fear clinic ( $n = 267$ , i.e., both dental phobics and subthreshold dental phobics) and patients of the general dental practice (i.e., the normal controls,  $n = 103$ ) by telephone to participate in the study, and checked whether the patients fulfilled the inclusion criteria (i.e., age  $\geq 18$  years, good skills of the Dutch language, and no cognitive impairment) and were willing to participate (T0). Those who were willing to participate and fulfilled the inclusion criteria were sent a letter containing additional information and a request to fill out measures on severity of dental trait anxiety and the level of exposure to prior distressing (dental) events (T1). Of the participants, 140 patients of the dental fear clinic and 85 of the ordinary dental practice completed these measures. Patients of the general dental practice were excluded from the study if they were highly anxious (DAS

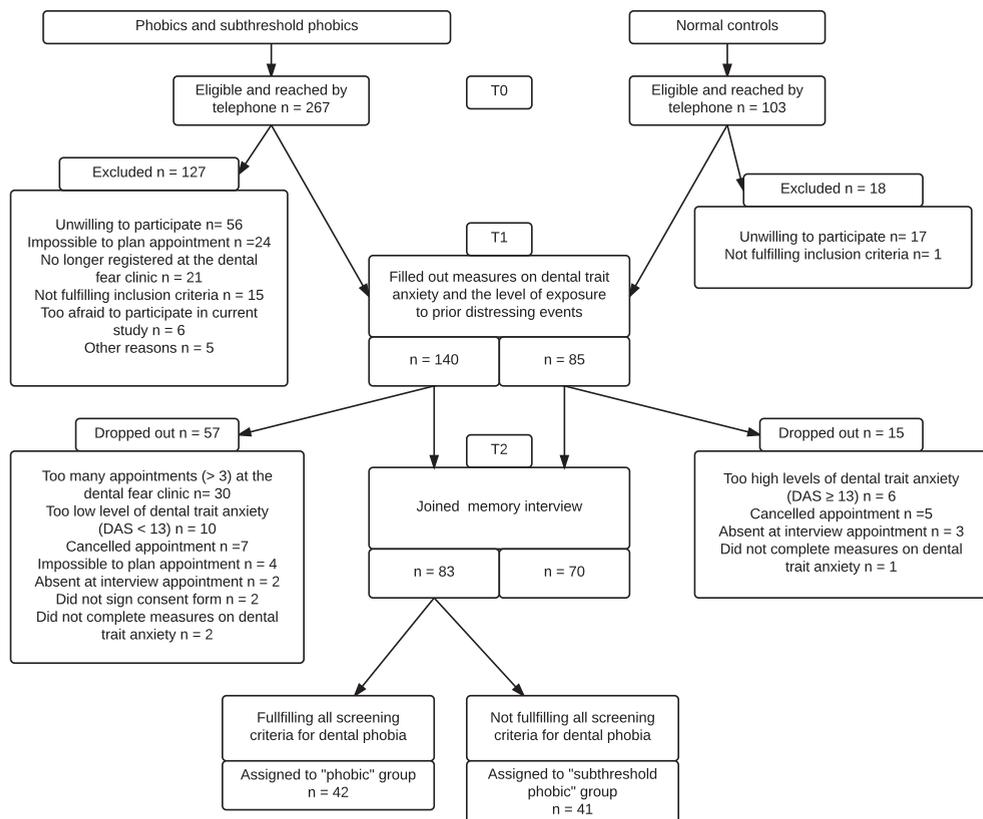


Figure 1. Flowchart

score  $\geq 13$ ) or met the criteria for dental phobia, in order to include a true sample of dentally high anxious cases with low anxious controls.

All groups of participants had to undergo both a structured and a semi-structured interview (T2) conducted by one researcher, Caroline van Houtem (CVH). Dental phobics and subthreshold dental phobics were interviewed prior to their third appointment, at the beginning of an anxiety reducing treatment program (for a description of the treatment, see Aartman et al., 2000). Normal controls were interviewed before an appointment at the general dental practice. During this interview, demographic data were collected (i.e., gender and country of birth). Next, the Phobia Checklist (Oosterink et al., 2009) was used to identify whether or not the diagnostic criteria of dental phobia (APA, 2000) were met. If so, patients were assigned to the dental phobic group ( $n = 42$ ), or to a group with individuals not fulfilling all screening criteria for dental phobia (i.e., the subthreshold dental phobic group;  $n = 41$ ; Figure 1). Then, a semi-structured interview (Reynolds & Brewin, 1999), lasting approximately 30 minutes, was conducted to investigate the presence, content, and characteristics of the memory of the event that, according to the patient, initiated or exacerbated his or her dental anxiety. For the purpose of the present study, memories had to consist of a specific scene that had actually happened, being a dental experience or another traumatic life event. The participants who were able to report more than one memory had to decide which memory was most closely related to the onset or aggravation of their dental anxiety. One dental phobic and one subthreshold dental phobic came late for the assessment procedure and, consequently, did not complete the assessment in time. Ethical approval for the study was granted by the local ethical committee (METc VU, protocol number 2007/262).

## Results

### General differences among groups

The descriptive statistics are displayed in Table 1. Although there was a trend showing a higher prevalence of women in the phobic and high anxious group, the groups did not differ significantly in terms of distribution of gender according to the chi-square test [ $\chi^2(2) = 5.52$ ;  $p = 0.063$ ]. No significant difference among groups was found in country of birth [ $\chi^2(2) = 0.88$ ;  $p = 0.64$ ], but one-way analysis of variance (ANOVA) showed that groups differed significantly in mean age [ $F(2, 149) = 3.97$ ;  $p = 0.021$ ]. Post-hoc analyses demonstrated that the normal controls had a significantly higher mean age than both other groups ( $p < 0.05$ ). Results of two-way (groups by gender) ANOVA on dental trait anxiety showed that the groups differed significantly [ $F(2, 150) = 392.74$ ;  $p < 0.001$ ]. Post-hoc analyses showed that the normal controls had significantly lower levels of dental trait anxiety than the other groups ( $ps < 0.001$ ). The difference in anxiety level was present in both men and women;

**Table 1.** Demographic variables, mean dental trait anxiety (DAS) and level of exposure to distressing events within and outside the dental setting (LOE-DEQ) in male and female dental phobics, subthreshold dental phobics and normal controls

|                              | Dental phobic    |          | Subthreshold dental phobic |          | Normal control   |          | P        | $\eta^2_p$ |
|------------------------------|------------------|----------|----------------------------|----------|------------------|----------|----------|------------|
|                              | Proportion       | n        | Proportion                 | n        | Proportion       | n        |          |            |
| <b>Gender</b>                |                  | 42       |                            | 41       |                  | 70       |          |            |
| Male                         | 31.0%            | 13       | 31.7%                      | 13       | 50.0%            | 35       | 0.063    | -          |
| Female                       | 69.0%            | 29       | 68.3%                      | 28       | 50.0%            | 35       |          |            |
| <b>Country of birth</b>      |                  | 42       |                            | 40       |                  | 70       |          |            |
| Dutch                        | 90.5%            | 38       | 87.5%                      | 35       | 92.9%            | 65       | 0.64     | -          |
| Other                        | 9.5%             | 4        | 12.5%                      | 5        | 7.1%             | 5        |          |            |
|                              | <b>Mean ± SD</b> | <b>n</b> | <b>Mean ± SD</b>           | <b>n</b> | <b>Mean ± SD</b> | <b>n</b> | <b>P</b> |            |
| <b>Mean age in years</b>     | 45.78 12.43      | 42       | 45.18 12.25                | 41       | 51.70 14.90      | 69       | 0.021    | -          |
| Male                         | 43.55 10.98      | 13       | 44.81 12.51                | 13       | 53.42 11.45      | 35       | 0.034    | -          |
| Female                       | 46.78 13.08      | 29       | 45.36 12.35                | 28       | 49.93 15.36      | 34       | 0.41     | -          |
| <b>Mean DAS score (4-20)</b> | 17.71 2.17       | 42       | 16.88 2.56                 | 41       | 7.31 1.98        | 70       | <0.001   | 0.84       |
| Male                         | 17.08 2.40       | 13       | 16.77 3.00                 | 13       | 7.09 2.01        | 35       | <0.001   | 0.82       |
| Female                       | 18.00 2.04       | 29       | 16.93 2.39                 | 28       | 7.54 1.96        | 35       | <0.001   | 0.84       |
| Within dental setting (0-21) | 13.38 4.48       | 21       | 12.56 3.96                 | 18       | 5.02 4.66        | 63       | <0.001   | 0.43       |
| Outside dental setting (0-8) | 3.52 1.86        | 21       | 3.67 1.61                  | 18       | 2.59 1.76        | 63       | 0.022    | 0.074      |

that is, no interaction between dental trait anxiety (groups) and gender was found [ $F(2, 147) = 0.28; p = 0.76$ ]. Another set of two-way (groups by gender) ANOVAs on the level of exposure to distressing events (on the subscales within and outside the dental setting) showed that the groups differed significantly for events both within [ $F(2, 99) = 37.93; p < 0.001$ ] and outside the dental setting [ $F(2, 99) = 3.98; p = 0.022$ ]. Post-hoc analyses revealed that the normal controls reported significantly lower levels of exposure to distressing events on both subscales than both other groups ( $ps < 0.05$ ). No interaction between individuals' level of exposure to distressing events inside the dental setting [ $F(2, 96) = 0.11; p = 0.90$ ] and outside the dental setting [ $F(2, 96) = 0.24; p = 0.79$ ], and gender was found.

### Differences in memories among groups

#### *Differences in presence of the memories*

Of the dental phobic ( $n = 41$ ) and subthreshold phobic ( $n = 40$ ), individuals who completed the memory interview on T2 97.6% ( $n = 40$ ) and 95.0% ( $n = 38$ ), respectively, reported a memory of an aversive or distressing event that initiated or exacerbated their dental anxiety.

ety. Both the proportion of phobic individuals and the proportion of subthreshold phobic individuals were significantly higher than the proportion of normal controls reporting a memory [72.9%,  $n = 51$ ;  $\chi^2(2) = 14.76$ ,  $p = 0.001$ ; and  $\chi^2(2) = 15.00$ ;  $p < 0.001$  respectively]. The remaining phobics ( $n = 1$ ) and subthreshold phobics ( $n = 2$ ) reported memories of several traumatic events and were not able to select any specific memory related to the cause or exacerbation of their dental anxiety.

#### *Differences in content of the memories*

Memories were categorized in terms of content related to (1) the dental setting; and (2) another negative life event. See Table 2 for examples of memories that were reported. Significant differences were found regarding the content of the memory of the dental phobic and the control group, and between the subthreshold phobic and the control group. Compared with the normal controls reported both the dental phobics and the subthreshold dental phobics significantly more often to have a memory with a content related to a negative life event [ $\chi^2(1) = 5.33$ ;  $p = 0.021$ , and  $\chi^2(1) = 5.62$ ;  $p = 0.018$ , respectively]. However, the majority of the memories of the phobic (90.0%;  $n = 36$ ) and subthreshold phobics (89.5%;  $n = 34$ ), and all the memories of the normal controls who reported such a memory (100%;  $n = 51$ ) involved the dental setting.

**Table 2.** Examples of memories

| Content                          | Examples   |
|----------------------------------|--|
| <b>Dental setting</b>            | <p>“As a child a molar was extracted while the anesthesia didn’t work properly. It was extremely painful and the dentist ignored that.”</p> <p>“A dentist visited my school. During the check-up I didn’t want to open my mouth. The dentist put rings of steel on his fingers and pulls my jaws open.</p> <p>“I had a root canal treatment without local anesthesia. The dentist prohibited me to complain. I felt helpless.”</p> |
| <b>Other negative life event</b> | <p>“My boyfriend committed suicide.”</p> <p>“I received a wrong medical diagnosis.”</p> <p>“An airplane crashed into my apartment.”</p>  |

#### **Differences in memory characteristics**

##### *Time since event*

Table 3 presents the data concerning the time span and characteristics (i.e., emotional intensity and PTSD symptom severity) of the memories of all groups. Using a one-way ANOVA, no significant difference was found between groups in the time that passed since the disturbing event described in the memory occurred [ $F(2, 123) = 0.48$ ;  $p = 0.62$ ].

**Table 3.** Memory characteristics in male and female dental phobics, subthreshold dental phobics and normal controls

| Memory characteristics                      | Dental phobic |          |          | Subthreshold dental phobic |          |          | Normal control |          |          | <i>p</i> | $\eta^2_p$ |
|---|---------------|----------|----------|----------------------------|----------|----------|----------------|----------|----------|----------|------------|
|   | Mean          | $\pm$ SD | <i>n</i> | Mean                       | $\pm$ SD | <i>n</i> | Mean           | $\pm$ SD | <i>n</i> |          |            |
| <b>Time span (years ago)</b>                | 25.44         | 15.01    | 39       | 21.92                      | 16.74    | 38       | 24.95          | 19.12    | 49       | 0.71     | 0.008      |
| <b>Emotional intensity</b>                  |               |          |          |                            |          |          |                |          |          |          |            |
| <b>Vividness (0-10)</b>                     | 7.13          | 2.20     | 39       | 7.37                       | 2.27     | 38       | 4.08           | 2.99     | 49       | <0.001   | 0.27       |
| male  | 6.25          | 2.92     | 12       | 7.62                       | 1.81     | 13       | 3.32           | 2.95     | 25       | <0.001   |            |
| female                                      | 7.52          | 1.72     | 27       | 7.24                       | 2.51     | 25       | 4.88           | 2.88     | 24       | <0.001   |            |
| <b>Disturbance (0-10)</b>                   | 7.72          | 2.70     | 39       | 7.87                       | 2.58     | 38       | 4.02           | 3.25     | 49       | <0.001   | 0.29       |
| male  | 6.83          | 3.69     | 12       | 8.15                       | 2.23     | 13       | 3.13           | 3.24     | 25       | <0.001   |            |
| female                                      | 8.11          | 2.08     | 27       | 7.72                       | 2.78     | 25       | 4.96           | 3.04     | 24       | <0.001   |            |
| <b>Sense of reliving (0-10)</b>             | 5.67          | 3.18     | 39       | 4.74                       | 3.18     | 38       | 1.59           | 2.03     | 49       | <0.001   | 0.30       |
| male  | 4.92          | 3.78     | 12       | 4.62                       | 3.23     | 13       | 1.56           | 2.14     | 25       | 0.001    |            |
| female                                      | 6.00          | 2.89     | 27       | 4.80                       | 3.22     | 25       | 1.63           | 1.95     | 24       | <0.001   |            |
| <b>Intrusiveness and avoidance tendency</b> |               |          |          |                            |          |          |                |          |          |          |            |
| <b>IES total (0-75)</b>                     | 32.04         | 19.41    | 37       | 26.91                      | 18.95    | 33       | 5.67           | 10.38    | 51       | <0.001   | 0.36       |
| male  | 25.09         | 20.60    | 11       | 26.82                      | 19.55    | 11       | 4.08           | 7.93     | 25       | <0.001   |            |
| female                                      | 34.98         | 18.51    | 26       | 26.95                      | 19.10    | 22       | 7.19           | 12.25    | 26       | <0.001   |            |
| <b>IES intrusion (0-35)</b>                 | 15.01         | 10.33    | 37       | 12.55                      | 9.20     | 33       | 2.69           | 4.93     | 51       | <0.001   | 0.33       |
| male  | 10.27         | 10.85    | 11       | 12.09                      | 10.19    | 11       | 1.84           | 3.57     | 25       | 0.001    |            |
| Female                                      | 17.02         | 9.62     | 26       | 12.77                      | 8.90     | 22       | 3.50           | 5.91     | 26       | <0.001   |            |
| <b>IES avoidance (0-40)</b>                 | 17.03         | 10.26    | 37       | 14.36                      | 10.54    | 33       | 2.98           | 5.87     | 51       | <0.001   | 0.35       |
| Male  | 14.82         | 11.42    | 11       | 14.73                      | 10.01    | 11       | 2.24           | 5.04     | 25       | <0.001   |            |
| female                                      | 17.96         | 9.81     | 26       | 14.18                      | 11.03    | 22       | 3.69           | 6.60     | 26       | <0.001   |            |

*Differences in emotional intensity of the memories*

The three groups were compared regarding vividness, disturbance, and sense of reliving using a two-way (group by gender) ANOVA. The memories of the groups differed significantly in vividness, [F (2, 123) = 22.99;  $p < 0.001$ ], disturbance [F (2, 123) = 25.48;  $p < 0.001$ ] and sense of reliving [F (2, 123) = 26.26;  $p < 0.001$ ]. Post-hoc analyses revealed that the memories of the normal controls had a significantly lower level of vividness, disturbance, and sense of reliving compared with the memories of both the dental phobic and the subthreshold phobic group (all  $ps < 0.001$ ). No differences between the dental phobic and subthreshold dental phobic group were found. No interaction with gender was found for the scores on vividness [F (2, 121) = 1.43;  $p = 0.24$ ], disturbance [F (2, 121) = 1.73;  $p = 0.18$ ], and the sense of reliving [F (2, 121) = 0.34;  $p = 0.71$ ] of the memories.

*Differences in intrusiveness and avoidance tendency of the memories*

The three groups were compared on IES total scores, intrusion, and avoidance scores using a two-way (group by gender) ANOVA. The groups differed significantly on IES total scores [ $F(2, 118) = 33.71; p < 0.001$ ], on intrusion [ $F(2, 118) = 28.76; p < 0.001$ ], and on avoidance scores [ $F(2, 118) = 32.22; p < 0.001$ ]. Post-hoc analyses showed that normal controls had significantly lower levels of IES total scores and lower levels of intrusion and avoidance scores than both other groups (all  $ps < 0.001$ ). For neither IES total score [ $F(2, 115) = 0.75; p = 0.47$ ], nor intrusion [ $F(2, 115) = 1.33; p = 0.27$ ], nor avoidance [ $F(2, 115) = 0.33; p = 0.72$ ], an interaction with gender was found.

*Relationship between dental trait anxiety and memory characteristics of the disturbing memory in anxious individuals and controls*

Table 4 shows Pearson's correlation coefficients between dental trait anxiety and memory characteristics of the disturbing memories in all groups. All three groups combined resulted in strong positive relationships between the level of dental trait anxiety (DAS) and all of the memory characteristics (i.e., vividness, disturbance, sense of reliving, and level of intrusiveness and avoidance tendency; all  $ps < 0.001$ ).

**Table 4.** Relation between dental trait anxiety (DAS) and memory characteristics in dental phobics, subthreshold dental phobics and normal controls

| Memory characteristics                      | Dental phobic |          | Subthreshold dental phobic |          | Normal control |          | Overall   |          |
|---|---------------|----------|----------------------------|----------|----------------|----------|-----------|----------|
|   | <i>r</i>      | <i>n</i> | <i>r</i>                   | <i>n</i> | <i>r</i>       | <i>n</i> | <i>r</i>  | <i>N</i> |
| <b>Emotional intensity</b>                  |               |          |                            |          |                |          |           |          |
| <i>Vividness</i>                            | 0.216*        | 39       | 0.145*                     | 38       | 0.346***       | 49       | 0.557**** | 127      |
| <i>Disturbance</i>                          | 0.239*        | 39       | 0.082*                     | 38       | 0.449****      | 49       | 0.582**** | 127      |
| <i>Sense of reliving</i>                    | 0.166*        | 39       | 0.263*                     | 38       | 0.363***       | 49       | 0.582**** | 127      |
| <b>Intrusiveness and avoidance tendency</b> |               |          |                            |          |                |          |           |          |
| <i>IES total</i>                            | 0.360**       | 37       | 0.240*                     | 33       | 0.727****      | 51       | 0.687**** | 121      |
| <i>IES intrusion</i>                        | 0.359***      | 37       | 0.235*                     | 33       | 0.708***       | 51       | 0.649***  | 121      |
| <i>IES avoidance</i>                        | 0.320**       | 37       | 0.227*                     | 33       | 0.691****      | 51       | 0.663**** | 121      |

\* $p > 0.05$ ; \*\*  $p = 0.054$ ; \*\*\* $p < 0.05$ ; \*\*\*\*  $p < 0.001$

## Discussion

Limited research has been conducted on crucial and fear-evoking memories of individuals suffering from specific phobias. The present study examined not only the presence but also the content and some key characteristics of memories of events underlying dental

phobia, one of the most prevalent phobia subtypes in western societies (Oosterink et al., 2009).

The finding that both dental phobics and normal controls reported the presence of disturbing memories is in line with earlier findings (Liddell & Gosse, 1998; Locker et al., 1996). Further, the results supported our hypothesis that individuals with dental phobia would be significantly more likely to report such a memory than normal controls. Nearly all of the dental phobics reported a memory of an aversive or distressing event that they believed initiated or exacerbated their fear or phobia. Although in the present study, participants were explicitly asked about the memory 'that contributed most to their current anxiety', the proportion of dental phobics reporting a disturbing memory is comparable with reports of unpleasant memories of significant events in both individuals with other phobias, such as agoraphobia (100%; Day et al., 2004), and social phobia (96%; Hackmann et al., 2000). This suggests that having disturbing memories is a key feature of those suffering from pathological levels of anxiety and fear.

Another finding is that all participants recalled their most disturbing event as one that occurred in early adulthood, more than 20 years ago. Most of the memories were related to a disturbing dental event. This is in line with Pavlovian fear-conditioning theories (e.g., Davey, 1997), which predicts that irrational and pathological forms of dental anxiety are the result of previous exposure to aversive events within the dental setting (see also Moore et al., 1991; Oosterink et al., 2009). Conceivably, when individuals who have experienced a horrific dental incident are confronted with a stimulus situation comparable with the original incident, they feel overwhelmed by anxiety-eliciting memories. To this end, the present findings are supportive of the view that distressing events and their consequences, the disturbing memories of these experiences, play a critical role in the development and maintenance of dental anxiety.

Although it is known that memories of emotional (i.e., negative or positive) events vary highly between individuals (Haas & Canli, 2008) and are exacerbated in individuals with mood and anxiety disorders (e.g., PTSD; de Quervain et al., 2009; Haas & Canli, 2008), the present study is unique in its attempt to study differences in memory characteristics of individuals with dental phobia and normal controls. The results were supportive of our hypothesis in that the memories of the dental phobics were not only found to be significantly more vivid, disturbing, and displayed a significantly higher sense of reliving than the memories of the normal controls but also proved significantly more likely to show features typically seen in individuals suffering from PTSD (i.e., higher levels of intrusiveness and avoidance). Based on the memory identified during the memory interview, almost two-third (64.9%) of those suffering from dental phobia displayed these characteristics (i.e., IES  $\geq$  26). This is in sharp contrast with the normal control patients of which only a very small proportion (7.8%) showed such features. This similarity in trauma sequelae between dental anxiety and PTSD

corroborates the findings reported by previous studies (Oosterink et al., 2009; De Jongh et al., 2006, 2003, 2002).

The fact that the memory characteristics of individuals suffering from dental phobia resembled those with subthreshold dental phobia suggests that these groups should not be considered as separate entities but related conditions along a single continuum of severity of fear and anxious behavior (see also De Jongh et al., 2011). This is particularly relevant in the light of the concept of dimensionality introduced in the new version of the DSM (DSM-5; American Psychiatric Association, 2013), which allows more latitude regarding the assessment of the severity of a disorder with regard to defining a concrete threshold between 'normality' and a 'disorder'. It is conceivable that applying a strictly categorical model, as was carried out in previous editions of the DSM, might lead to situations that patients, who do not fulfill all criteria of a certain mental health condition, do not obtain the required treatment because of failure to meet a diagnostic threshold.

The third aim of the present study was to assess the relationship between a number of key phenomenological properties of patients' memories and severity of dental trait anxiety. Between both the patients with dental phobia and the normal controls, a significant positive association was found between greater level of intrusiveness and avoidance of the memory and severity of dental trait anxiety. Also patients' heightened sense of reliving was significantly related to level of dental trait anxiety. This is in line with a study on PTSD (Berntsen et al., 2003) showing that memory characteristics were associated with symptom severity. However, such a linear association in the domain of fears and phobias has not been established in earlier studies.

At the present time, recommended treatments of dental fear and phobias do not take into account the need to address disturbing memories but mainly involve a strict cognitive behavioral approach in which patients are exposed to their anxiety eliciting stimuli ('*in vivo* exposure') or carry out experiments that maximally violate expectancies about the frequency or intensity of possible aversive outcomes (Craske et al., 2014). It has been argued that such a procedure produces new memory representations that rival with previous learning and inhibit its effects (Brewin, 2006). The present findings may be considered as support for the feasibility of a different (i.e., 'trauma-focused') approach, namely one that is aimed to resolve patients' fear-related and disturbing memories, by directly changing the vividness and the disturbance of these memories, thereby inducing a long-lasting or permanent alleviation of the fear response (De Jongh et al., 2013; De Jongh et al., 2002; Doering et al., 2013). Yet, clearly, the most important advice is to prevent sensitization and accumulation of new disturbing memories by preventing the occurrence of negative events and the accompanying high levels of distress, during dental treatments.

This study has a number of limitations. Firstly, it is possible that at the time of the assessment, the dental phobic or subthreshold dental phobic individuals in the present sample

suffered from an episode of a mood or anxiety disorder, including depression and PTSD. These conditions can be comorbid in this patient group (e.g., Roy-Byrne et al., 1994) and affect the level of intrusion of aversive memories (Brewin, 2006), which might have confounded our results. In future studies on memory characteristics associated with specific phobia, the assessment of possible comorbidity needs to be taken into account. Secondly, a large number of patients with dental phobia and subthreshold dental phobia were unwilling to participate or canceled the appointment for the memory interview. It is likely that individuals with the highest levels of dental anxiety avoided participation in the present study. Therefore, current findings may be an underestimation of the differences between individuals with pathological levels of dental anxiety and low anxious individuals. Thirdly, because we sampled only patients from one dental fear clinic, our ability to generalize to other populations is limited. However, the fact that the present study comprised a relative small group of participants and that it was possible to obtain such strong results suggests that the effects are robust. Fourthly, the mean age in the normal control group was significantly higher than in the dental phobic and subthreshold dental phobic group. To investigate the possible effect of age, all data regarding memory characteristics were re-analyzed with age as a covariate; this did not affect the results or changed any of the outcomes of the study.

Apparently, having a memory of a distressing event that initiated or exacerbated dental anxiety is a common phenomenon not only in those suffering from dental phobia but also in those who are simply less apprehensive of dental treatment. Our findings indicate that individuals with dental phobia and subthreshold levels of dental phobia are likely to experience intrusive thoughts of earlier events associated with their fear. Such memories seem to share a number of key memory characteristics with trauma memories, like being vivid, disturbing, and uncontrollable. This suggests that specific phobias and fears are not simply a conditioned response to an initial neutral stimulus but one underpinned by the retrieval of stored memories following exposure to a negative or horrific event. Repeated triggering and re-experiencing of these memories are likely to play an important role in maintaining fears and specific phobias in that every reactivation of such disturbing memory further strengthens the aversive memory trace (De Quervain & Margraf, 2008). This means that activation of aversive memories not only plays an important role in the symptomatology of fears and phobias but also in the process contributing to the maintenance and aggravation of these symptoms.

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