



Do traumatic events have more impact on the development of dental anxiety than negative, non-traumatic events?

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8 **Do traumatic events have more impact on the development of dental anxiety**
9 **than negative, non-traumatic events?**
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42 Running title: Impact of traumatic events on dental anxiety
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5 impact on the development of dental anxiety than negative, non-traumatic events? Eur J Oral Sci
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10 Abstract

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12 The importance of exposure to traumatic events for the development of dental anxiety has not
13
14 been investigated. The aim of the present study was to test the hypotheses that individuals who
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16 reported having been exposed to a traumatic event (that is, fulfilling the A criterion of the
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18 Diagnostic and Statistical Manual, DSM-5, for post-traumatic stress disorder, PTSD) as the
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20 cause of their dental anxiety would report significantly higher levels of dental anxiety, typical
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22 trauma-related (PTSD) symptoms, and greater disturbance of memories involving these events
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24 than those who reported being exposed to non-traumatic events. Patients of a specialized dental
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26 fear clinic (n=90) were divided into those who reported a traumatic event that initiated their
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28 dental trait anxiety, and those who did not. The two groups did not differ in their severity of
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30 dental anxiety and number of PTSD symptoms, but the memories of those who had been exposed
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32 to traumatic events were significantly more vivid than of those in the reference group. Length of
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34 time since the event took place did not play a role. Hence, traumatic events are remembered
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36 more vividly, but do not seem to initiate more severe forms of dental anxiety than other events.
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46 Key words: dental anxiety; fear; post-traumatic stress disorder (PTSD); specific phobia; trauma
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3 About one-quarter of the population reports having anxiety about dental treatment (1),
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6 whereas about 4% suffer from dental phobia, a disproportionate or pathological fear response (1-
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8 2). Dental fear and phobia are both known to arise from distressing, so-called ‘conditioning
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10 events’ in the past (3). In a study among 173 highly dentally anxious patients, it was found that
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12 73% of them reported having experienced at least one such event at some time in their lives (4).
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14 That was significantly more frequent than individuals in a low-anxious reference group (21%).
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16 Individuals who reported having ever been exposed to a distressing event appeared to have
17
18 significantly higher levels of dental anxiety than those who had not (4). This suggests a direct
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20 relationship between exposure to distressing events and the development of dental anxiety.
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25 Not all individuals with high levels of dental anxiety report horrific dental histories (4).
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27 This makes it likely that multiple pathways play a role in the acquisition of dental anxiety, and
28
29 that an accumulation of dental experiences other than direct conditioning events, such as
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31 vicarious learning, negative information, or events outside the dental office, may also contribute
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33 to the onset of peoples’ dental fear or phobia (4, 5). Indeed, there is evidence to suggest that
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35 exposure to interpersonal violence, combat, life-threatening accidents or natural disasters,
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37 potentially predispose people to the development of pathological forms of dental anxiety. For
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39 example, it has been found that the presence of dental phobia was 5.6 times more likely in people
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41 who one had ever experienced a traumatic violent crime in one’s life (4).
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46 Although exposure to dentistry-related distressing events most frequently has been
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48 studied in relation to dental anxiety and dental (specific) phobias (5), those who indicated having
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50 been exposed to such events appear to frequently experience trauma-related symptoms typical of
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52 post-traumatic stress disorder, or PTSD (4). These include distressing and intrusive memories or
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3 nightmares of the event, re-experiencing, avoidance tendencies, an enhanced state of threat
4 sensitivity (hypervigilance), poor concentration, loss of interest and difficulty sleeping (2, 4).
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8 To meet the full criteria for PTSD, the event after which the person has been exposed
9 needs to be 'traumatic'. This means that the type of event should satisfy the so called DSM-5
10 Criterion-A, which requires a confrontation with actual or threatened death, serious injury, or
11 sexual violence (2). Although PTSD has also been reported following the removal of a wisdom
12 tooth (6), it needs to be noted that only a limited proportion of trauma-exposed individuals
13 develop PTSD (7).
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22 The conceptual basis of PTSD is that exposure to traumatic events, such as war or rape,
23 differ significantly from otherwise negative (non-traumatic life) events which occur relatively
24 commonly throughout life, such as loss of employment, or another event that is not a direct threat
25 to someone's physical integrity (2, 8). Although this suggests that someone who has been
26 exposed to any event that satisfies the A criterion (a 'real' traumatic event) would suffer
27 significantly more from typical PTSD symptoms (such as re-experiences of the distressing event)
28 than someone who has not been exposed to such an event (8), studies show contradictory
29 findings. More specifically, some studies found significantly greater PTSD prevalence in those
30 who reported having been exposed to a typical Criterion-A event than those who reported to only
31 having been exposed to non-traumatic events in their lives (9), whereas other studies found
32 significantly greater PTSD prevalence in individuals reporting distressing, non-traumatic life
33 events (8, 10). The differential impact of traumatic memories and non-traumatic memories on the
34 development of dental anxiety has not been investigated.
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53 There is a general notion that autobiographical memories are malleable and show a
54 progressive deterioration over time. Memories of traumatic events seem to fall prey to the same
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3 processes of decay as ordinary events (11). Conversely, there is also evidence to suggest that
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5 traumatic experiences may be quite well remembered and that traumatic memory narratives are
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7 more detailed and vivid than ordinary ones (12). However, no study until now has examined the
8
9 relationship between time and memories of individuals who had been exposed to events that set
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11 the groundwork for their dental anxiety, and the subsequent development of either dental
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13 anxiety, or symptoms of PTSD.
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17 The purpose of the present study was to examine the importance of traumatic events in
18
19 the development of dental (trait) anxiety and trauma-related symptoms. To this end, we
20
21 determined differences between two groups of dental patients. One group consisted of
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23 individuals suffering from dental anxiety who reported to at least once have been exposed to a
24
25 traumatic event (i.e., fulfilling the A criterion for DSM-5) that to their opinion initiated or
26
27 exacerbated their dental trait anxiety. The other group contained individuals who reported to
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29 have never been exposed to an event fulfilling criterion A. Groups were first analyzed in terms of
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31 differences in severity of dental anxiety, symptoms of post-traumatic stress, and memory
32
33 characteristics of the events that initiated their dental trait anxiety. The hypotheses we tested
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35 were that individuals who reported having been exposed to a traumatic event (that is, fulfilling
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37 the A-criterion) that started or seriously exacerbated their dental anxiety, would report
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39 significantly higher levels of both dental anxiety, and typical trauma-related (PTSD) symptoms,
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41 as well as greater emotional intensity (disturbance, vividness and sense of reliving) involving the
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43 memories of these events, than individuals whose memories pertained to events that did not
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45 fulfill the A-criterion. Another aim was to examine the effect of time on these variables. We did
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47 that by determining the relationship between the number of years since the adverse event took
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3 place on the one hand, and severity of dental anxiety, PTSD symptom severity and the vividness,
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5 disturbance and sense of reliving of the memory that initiated their dental anxiety, on the other.
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10 **Material and methods**

11 *Participants*

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13 The participants in this study were all patients of a specialized dental fear clinic in Amsterdam.
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15 To be eligible, patients had to be older than 18 years, speak and understand the Dutch language,
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17 and score 13 or higher on the Dental Anxiety Scale (DAS; 13). They also needed to be able to
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19 bring up at least one memory of an event that initiated or exacerbated their dental anxiety (within
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21 or outside the dental setting).
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29 *Procedure*

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31 The present case-control study was conducted from April 2010 until June 2012, and May 2014
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33 until March 2015. Ethical approval for the study was granted by the local Ethical Committee
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35 (METc VU, protocol number 2007/262).
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39 To determine eligibility for the study, patients had to fill out the DAS (13) prior to
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41 registering at the dental fear clinic. Patients who were considered eligible and could be reached
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43 by telephone (n=305) were invited by a trained dental student to participate in the study. Those
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45 who indicated willingness to participate, and being able to plan an appointment at the clinic
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47 (n=258), were sent a letter containing additional information about the study, along with a
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49 consent form and an appointment card.
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53 During the first appointment, a specialized dentist checked whether there was an
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55 indication for treatment in the clinic, and whether the patient would be eligible for inclusion in
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3 the study (n=226). The second appointment was used to discuss the dental treatment plan.
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5 Patients who fulfilled the inclusion criteria (n=134) were asked to be present 30 minutes before
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7 their third appointment at the clinic for signing their informed consent form in the presence of
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9 the investigator (n=127). Next, two structured clinical interviews were conducted: the MINI plus
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11 (14) to determine whether the patient fulfilled the diagnostic criteria of a specific phobia in terms
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13 of DSM-5, and the 'Full Intrusions Interview' (15) to determine presence, content and
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15 characteristics of the memory of the event that, according to the patient, initiated or exacerbated
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17 his or her dental anxiety. The participants who reported more than one memory were asked to
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19 decide which memory was most closely related to the onset or aggravation of their dental
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21 anxiety. The memories of the events were divided into the following four categories: (i) events
22
23 outside the dental setting fulfilling the A1 criterion for DSM-5; (ii) events outside the dental
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25 setting not fulfilling the A1 criterion for DSM-5; (iii) events within the dental setting fulfilling
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27 the A1-criterion for DSM-5, and (iv) events within the dental setting not fulfilling the A1-
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29 criterion for DSM-5. Two investigators determined after consultation to which category each
30
31 event belonged. Next, the characteristics of that memory were determined (the emotional
32
33 intensity, intrusiveness and avoidance propensity of that memory). Finally, participants were
34
35 requested to complete the Impact of Event Scale (IES; 16) and the Short version of the Dental
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37 Anxiety Inventory (S-DAI; 17).
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48 *Assessment instruments*

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51 Severity of dental trait anxiety was measured before admission to the clinic using the
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53 Dental Anxiety Scale (13). This four-item scale is most widely used in studies of dental anxiety
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55 (18). Responses are scored from 1 to 5, providing total scores ranging from 4 (not anxious at all)
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3 to 20 (extremely anxious). DAS scores of 13 or higher are considered indicative of high dental
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5 trait anxiety. Cronbach's alpha for the DAS in the current study was 0.96.
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8 To index the severity of dental (trait) anxiety at the beginning of the study, the Dutch
9
10 version of the Short version of the Dental Anxiety Inventory (S-DAI; 17) was used. The nine
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12 items (for example, "when I know the dentist is going to extract a tooth, I am already afraid in
13
14 the waiting room") are answered on a five-point Likert type scale, ranging from "totally not
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16 applicable to me" (1) to "totally applicable to me" (5). Total scores on this questionnaire range
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18 from 9 to 45. Cronbach's alpha for the S-DAI in the current study was 0.85.
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22 To measure severity of trauma-related (PTSD) symptoms, the Dutch version of the
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24 Impact of Event Scale (IES; 16, 19) was used. The IES consists of 15 items representing the
25
26 subscales intrusions and avoidance. When using the IES, patients were requested to respond to
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28 the items based upon the memory of the event that in their view initiated or exacerbated their
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30 dental anxiety, and to indicate how frequently the symptoms were present during the previous
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32 seven days. The frequency of each symptom is scored using a 4-point response format, ranging
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34 from 'not at all' (0), 'rarely' (1), 'sometimes' (3) to 'often' (5). The scores can be summed to
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36 produce a total IES score (range 0-75) and two subscale scores for intrusion (range 0-35) and for
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38 avoidance (range 0-40) with a higher score indicating a greater level of intrusion (that is. the loss
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40 of voluntary control over the regulation of thoughts) or avoidance (that is. the extent to which
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42 memories are consciously suppressed). A score of 26 is considered to indicate a clinically
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44 significant level of trauma-related symptomatology (19). Cronbach's alpha scores for the two
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46 subscales in the current study were 0.91 (intrusiveness), and 0.89 (avoidance).
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53 Patients were asked to rate the emotional intensity in terms of vividness, disturbance and
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55 sense of reliving of the memory of the event that, according to the patient, initiated or
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3 exacerbated his or her dental anxiety on separate 11-point Numeric Rating Scales from 0 (for
4 example, “not vivid”) to 10 (for example, “extremely vivid”).
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10 *Statistical analyses*

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12 Statistics were obtained using IBM SPSS Statistics Version 23. Descriptive statistics were used
13 to characterize the sample and the intrusive memories of the interview. Independent samples t-
14 tests were used to test differences in means of the DAS total score, S-DAI, IES score, and the
15 scores of the three questions about the characteristics of the core memory. In order to determine
16 the correlation between time (number of years) since the event took place and severity of dental
17 anxiety, severity of PTSD symptoms, vividness, disturbance and sense of reliving of patients’
18 memories, the Pearson correlation coefficient was used. For all statistical analyses, a p-value <
19 0.05 was considered statistically significant.
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34 **Results**

35 *General differences among groups*

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37 Of the 127 patients who participated in the interview 37 (29.1%) indicated that they did not have
38 any memory of an event that initiated or exacerbated their dental anxiety, or could not retrieve
39 such a memory. Of the remaining 90 patients, 46 fulfilled all criteria for the diagnosis ‘specific
40 phobia’, whereas 44 did not fully meet these criteria. The patients were first divided into four
41 groups based upon whether the memory met the Criterion A definition of a traumatic stressor
42 according to DSM-5, and whether the traumatic event took place within, or outside, the dental
43 setting. Table 1 displays the demographic characteristics of the sample in relation to type of
44 event (that is, within vs outside dental setting and fulfilling A-criterion or not).
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Table 1 about here

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11 Since the groups of patients who reported a memory of an event outside the dental setting not
12 fulfilling the A criterion, and those who reported an event within the dental setting who did
13 fulfill the A criterion, contained a very small number of participants, the groups were collapsed
14 in order to determine possible differences between those meeting the stressor Criteria A
15 definition of DSM-5 (n=14; for example, a suicide of a boyfriend, receiving a deadly diagnosis,
16 an airplane crash into her apartment, and a violent robbery), or those not meeting this criterion
17 (n=76; e.g., a painful incident during dental treatment, having heard a horrific story about dental
18 treatment). Both groups did not differ on any of the socio-demographic variables (age, gender
19 and country of birth).
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34 *Dental anxiety, PTSD symptoms, disturbance, vividness and sense of reliving of events in*
35 *relation to the A criterion*
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Table 2 about here

Table 2 presents the data concerning dental anxiety, PTSD symptoms (intrusion and avoidance), and the characteristics (disturbance, vividness and sense of reliving) of the memories of events that initiated or exacerbated dental trait anxiety. Results of a series of independent samples t-tests are displayed in Table 2. As can be seen, the hypothesis that individuals who had been exposed to a distressing or traumatic event (fulfilling the A-criterion) that started, or seriously exacerbated, their dental anxiety, would report more PTSD symptoms compared to those

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3 individuals not fulfilling the A criterion, could not be supported. Also with regard to level of
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5 dental anxiety no difference could be detected. For only one variable (i.e., vividness of the
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7 memory, $P = 0.02$) a significant difference was found; that is, patients who reported an event
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9 meeting the A criterion reported significantly more vivid memories of such event than those who
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11 reported an event not fulfilling this criterion.
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15 None of a series of Pearson product-moment correlations between either K-ATB or DAS,
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17 on the one side, and IES total or any of the memory characteristics on the other, appeared to be
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19 significant. In contrast, the total IES score was found to be significantly associated with
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21 disturbance ($r = 0.42$, $P < 0.001$), vividness ($r = 0.46$, $P < 0.001$), and “sense of reliving” ($r =$
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23 0.52 , $P < 0.001$).
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29 *The influence of the time since the traumatic event took place*

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31 From the 90 individuals, data about the age of the patient at which the traumatic event took place
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33 was missing in 14 cases. For each of the remaining 76 patients, number of years since the event
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35 took place was calculated, and correlated to severity of dental trait anxiety (DAS and S-DAI),
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37 frequency of PTSD symptoms (IES total score), and the VAS scores that pertain to vividness,
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39 disturbance and sense of reliving of the memory of that event. Both among the individuals who
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41 did, and who did not, fulfilled the A-criterion, none of these variables appeared to be associated
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43 with the number of years since the event took place ($P > 0.10$ for all).
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50 **Discussion**

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52 To our knowledge, this is the first study to examine the differential effects of traumatic
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54 and non-traumatic events in terms of DSM-5 in relation to dental anxiety severity. The findings
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3 did not support the contention that patients who indicated that they ever experienced an event
4 that would classify as a traumatic event according to DSM-5, and in their view initiated of
5 exacerbated their dental anxiety, suffer more frequently from symptoms of typical trauma-related
6 symptoms or a more severe form of dental trait anxiety than those not meeting this criterion. The
7 only difference between both groups was that the memories of individuals who reported an event
8 that would classify as 'a real' traumatic event were significantly more vivid.
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18 Although the study hypotheses have not been tested earlier, the findings do not support
19 those of a previous study on this topic showing that having experienced a violent crime was
20 uniquely predictive for a positive diagnostic screen of dental phobia (4). However, in that study
21 patients were requested to indicate whether they had ever experienced an extremely frightening,
22 traumatic, or horrible experience in their life using a list of specified traumatic events that fulfill
23 criterion A. In the present study, the instructions to the patients were different, in that they were
24 requested to report about the event that, according to them, initiated or exacerbated their dental
25 anxiety. Thus, the convergent findings may be explained by differences in the methods that were
26 used to identify both the traumatic event and the measurement level of the dependent variable
27 (the presence of dental phobia *versus* severity of dental anxiety; that is, dichotomized *versus*
28 continuous). Therefore, in a future study it would be enlightening to identify the potential
29 traumatic events to which patients may have been exposed, and to diagnose both PTSD and
30 dental phobia in a standardized way, for example by using structured diagnostic interviews, like
31 the Clinical Administered interview for PTSD (CAPS, 20), and the Mini International
32 Neuropsychiatric Interview Plus (14). That the present study failed to detect a difference between
33 those who developed dental anxiety following a traumatic event, and an event that was not
34 criterion-A worthy, could also be considered in the light of the findings in the field of PTSD.
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3 Namely, it has frequently been observed that events fulfilling the definition of trauma in DSM
4 produced *less*, rather than more PTSD symptoms in response to these events than non-traumatic
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6 ones (18, 21).
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10 Our other main finding was that neither the severity of anxiety, nor the frequency of
11 PTSD symptoms, nor how patients remembered the conditioning event were associated with the
12 number of years since the event took place. To this end, the findings are consistent with research
13 supporting the notion that vividness, overall quality, and sensory components remain virtually
14 unchanged and consistent years after their occurrence, and that, particularly, memories of
15 emotionally arousing events are often well retained (22). In other words, if one ever develops a
16 severe form of dental anxiety, this will not wear off automatically in the course of time because
17 unresolved memories remain to get activated every time dentally anxious individuals are faced
18 with the dental treatment situation (23). This is in accordance with findings from other studies,
19 mainly in the domain of PTSD, showing that it is not likely that, once a condition such as PTSD
20 has developed, the symptoms alleviate or fade away easily (24). The present findings further
21 support the notion that dental phobia in its severe form may be considered as a mild form of
22 PTSD, and that this condition is not only the result of confrontations with conditioning events in
23 the dental domain, but that other types of (traumatic) incidents significantly contribute to the
24 development of dental fear or dental phobia.
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45 There are several limitations of this study. Firstly, it is impossible to rule out the
46 possibility that individuals had experienced multiple traumas in their lives, and had more
47 relevant memories contributing to their current level of dental anxiety, than they indicated during
48 the memory interview. Secondly, a number of patients of the specialized dental fear clinic
49 refused to participate in this study or cancelled the appointment for the memory interview. It is
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3 difficult to predict how this may have influenced the current findings, but it is conceivable that
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5 individuals with the highest level of dental fear were not willing to participate in a study such as
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7 the present one. Thirdly, given that our sample consisted of patients of only one dental fear
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9 clinic, the ability to generalize the findings to other populations or settings is limited. Finally, a
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11 number of statistical tests were performed, but no correction for capitalization on chance has
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13 been applied. Therefore, we reported uncorrected p-values so that readers can decide whether to
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15 interpret these directly, or to correct them for multiple testing first. It should also be noted that,
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17 given the relative low number of participants in the stressor Criterion A group, it cannot be ruled
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19 out that existing differences could not be shown as a result of limited power.
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25 In conclusion, the present findings suggest that memories of dental patients pertaining to
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27 ‘traumatic’ events (meeting DSM-5 Criterion A) are significantly more vivid than those of
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29 patients reporting other types of negative events related to the development of dental anxiety.
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31 However, such memories do not seem to exert a great influence upon the development of anxiety
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33 about dental treatment in terms of symptom severity. Also, ‘old’ memories, like to pertaining to
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35 childhood, do not seem of more relevance to dental anxiety symptom severity than more recent
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37 ones.
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53 authorship and/or publication of this article.
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Table 1
Demographic characteristics as a function of event (within vs outside dental setting and fulfilling A-criterion or not)

	Outside dental setting fulfilling A-criterion (n=10)	Outside dental setting not fulfilling A-criterion (n=1)	Within dental setting fulfilling A-criterion (n=4)	Within dental setting not fulfilling A-criterion (n=75)
Mean age (S.D)	44.1 (15.9)	65.0 (*)	51.5 (7.3)	44.8 (11.6)
Female (%)	80.0	100.0	100.0	65.3
Male (%)	20.0	0.0	0.0	34.7
Dutch nationality (%)	90.0	100.0	100	92.0
Turkish nationality (%)	0.0	0.0	0.0	1.3
Surinamese nationality (%)	0.0	0.0	0.0	4.0
Immigrants from the EU (%)	10.0	0.0	0.0	2.7

*SD could not be calculated

Table 2. Differences in dental anxiety, PTSD symptoms, disturbance, vividness and sense of reliving of events of individuals who reported a memory of an event not PTSD A1 criterion worthy, and of those who reported a memory of an A criterion worthy event.

Category	Fulfilling A criterion (n=14)	Not fulfilling A Criterion (n=76)	<i>P</i>
DAS (intake)	17.9	17.4	0.48
N	11	66	
SD	2.3	2.4	
S-DAI (intake)	41.4	39.5	0.37
N	9	59	
SD	3.7	6.3	
IES total (intake)	38.4	28.7	0.15
N	10	57	
SD	19.1	19.4	
IES intrusion	18.0	13.5	0.18
N	10	57	
SD	10.6	9.7	
IES avoidance	20.4	15.2	0.15
N	10	57	
SD	10.0	10.6	
Vividness	8.6	7.0	0.02*
N	14	75	
SD	1.2	2.4	
Disturbance	7.4	8.0	0.39

N	14	75	
SD	2.9	2.2	
Sense of reliving	6.2	5.1	0.22
N	14	75	
SD	3.0	3.1	

*p<0.05

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