



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

Journal:	<i>European Journal of Oral Sciences</i>
Manuscript ID	EOS-8467-OA-16.R3
Manuscript Type:	Original Article
Date Submitted by the Author:	n/a
Complete List of Authors:	Jongh, Ad; Academic Centre for Dentistry, Social and Behavioral Sciences; Centrum voor Psychotherapie en Psychotrauma, van Eeden, Astrid; Academic Centre for Dentistry, Social and Behavioral Sciences van Houtem, Caroline; Academic Centre for Dentistry Amsterdam (ACTA), Department of Social Dentistry and Behavioural Sciences; TNO, Child Health van Wijk, Arjen; ACTA, Social Dentistry and Behavioural Sciences
Keywords (Please write 3 to 5 keywords according to Index Medicus):	dental anxiety, dental fear, post traumatic stress disorder (PTSD), specific phobia, trauma symptoms
Research Area:	Behavioral sciences

SCHOLARONE™  
Manuscripts

Copy

1  
2  
3  
4  
5  
6  
7  
8 **Do traumatic events have more impact on the development of dental anxiety**  
9 **than negative, non-traumatic events?**  
10  
11  
12  
13  
14  
15  
16  
17

18 A. de Jongh<sup>1,2,3</sup>, A. van Eeden<sup>1</sup>, C.M.H.H. van Houtem<sup>1</sup>, A.J. van Wijk<sup>1</sup>  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29

30 <sup>1</sup> Department of Social Dentistry and Behavioural Sciences ACTA, University of Amsterdam and  
31 VU University Amsterdam, The Netherlands  
32  
33

34 <sup>2</sup> School of Health Sciences, Salford University, Manchester, United Kingdom  
35  
36

37 <sup>3</sup> Institute of Health and Society, University of Worcester, United Kingdom  
38  
39  
40  
41

42 Running title: Impact of traumatic events on dental anxiety  
43  
44  
45

46 \* Correspondence: prof. dr. A. de Jongh, Academic Centre for Dentistry Amsterdam (ACTA),  
47 Gustav Mahlerlaan 3004, 1081 LA Amsterdam, the Netherlands. Tel: +31 (0) 623715237, Fax:  
48 +31 (0) 302294675, E-mail: a.de.jongh@acta.nl  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 De Jongh A, van Eeden, A, van Houtem C.M.H.H., van Wijk AJ. Do traumatic events have more  
4  
5 impact on the development of dental anxiety than negative, non-traumatic events? Eur J Oral Sci  
6  
7  
8  
9

## 10 Abstract

11  
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  
15  
16 reported having been exposed to a traumatic event (that is, fulfilling the A criterion of the  
17  
18 Diagnostic and Statistical Manual, DSM-5, for post-traumatic stress disorder, PTSD) as the  
19  
20 cause of their dental anxiety would report significantly higher levels of dental anxiety, typical  
21  
22 trauma-related (PTSD) symptoms, and greater disturbance of memories involving these events  
23  
24 than those who reported being exposed to non-traumatic events. Patients of a specialized dental  
25  
26 fear clinic (n=90) were divided into those who reported a traumatic event that initiated their  
27  
28 dental trait anxiety, and those who did not. The two groups did not differ in their severity of  
29  
30 dental anxiety and number of PTSD symptoms, but the memories of those who had been exposed  
31  
32 to traumatic events were significantly more vivid than of those in the reference group. Length of  
33  
34 time since the event took place did not play a role. Hence, traumatic events are remembered  
35  
36 more vividly, but do not seem to initiate more severe forms of dental anxiety than other events.  
37  
38  
39  
40  
41  
42  
43  
44

45  
46 Key words: dental anxiety; fear; post-traumatic stress disorder (PTSD); specific phobia; trauma  
47  
48 symptoms  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 About one-quarter of the population reports having anxiety about dental treatment (1),  
4  
5  
6 whereas about 4% suffer from dental phobia, a disproportionate or pathological fear response (1-  
7  
8 2). Dental fear and phobia are both known to arise from distressing, so-called ‘conditioning  
9  
10 events’ in the past (3). In a study among 173 highly dentally anxious patients, it was found that  
11  
12 73% of them reported having experienced at least one such event at some time in their lives (4).  
13  
14 That was significantly more frequent than individuals in a low-anxious reference group (21%).  
15  
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  
19  
20 relationship between exposure to distressing events and the development of dental anxiety.  
21  
22  
23

24  
25 Not all individuals with high levels of dental anxiety report horrific dental histories (4).  
26  
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  
30  
31 vicarious learning, negative information, or events outside the dental office, may also contribute  
32  
33 to the onset of peoples’ dental fear or phobia (4, 5). Indeed, there is evidence to suggest that  
34  
35 exposure to interpersonal violence, combat, life-threatening accidents or natural disasters,  
36  
37 potentially predispose people to the development of pathological forms of dental anxiety. For  
38  
39 example, it has been found that the presence of dental phobia was 5.6 times more likely in people  
40  
41 who one had ever experienced a traumatic violent crime in one’s life (4).  
42  
43  
44

45  
46 Although exposure to dentistry-related distressing events most frequently has been  
47  
48 studied in relation to dental anxiety and dental (specific) phobias (5), those who indicated having  
49  
50 been exposed to such events appear to frequently experience trauma-related symptoms typical of  
51  
52 post-traumatic stress disorder, or PTSD (4). These include distressing and intrusive memories or  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
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).  
5  
6

7  
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).  
14  
15  
16  
17  
18  
19  
20  
21

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.  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51

52  
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  
55  
56  
57  
58  
59  
60

1  
2  
3 processes of decay as ordinary events (11). Conversely, there is also evidence to suggest that  
4  
5 traumatic experiences may be quite well remembered and that traumatic memory narratives are  
6  
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  
10  
11 the groundwork for their dental anxiety, and the subsequent development of either dental  
12  
13 anxiety, or symptoms of PTSD.  
14  
15

16  
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  
22  
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  
28  
29 have never been exposed to an event fulfilling criterion A. Groups were first analyzed in terms of  
30  
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  
34  
35 were that individuals who reported having been exposed to a traumatic event (that is, fulfilling  
36  
37 the A-criterion) that started or seriously exacerbated their dental anxiety, would report  
38  
39 significantly higher levels of both dental anxiety, and typical trauma-related (PTSD) symptoms,  
40  
41 as well as greater emotional intensity (disturbance, vividness and sense of reliving) involving the  
42  
43 memories of these events, than individuals whose memories pertained to events that did not  
44  
45 fulfill the A-criterion. Another aim was to examine the effect of time on these variables. We did  
46  
47 that by determining the relationship between the number of years since the adverse event took  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 place on the one hand, and severity of dental anxiety, PTSD symptom severity and the vividness,  
4  
5 disturbance and sense of reliving of the memory that initiated their dental anxiety, on the other.  
6  
7  
8  
9

## 10 **Material and methods**

### 11 *Participants*

12  
13 The participants in this study were all patients of a specialized dental fear clinic in Amsterdam.  
14  
15 To be eligible, patients had to be older than 18 years, speak and understand the Dutch language,  
16  
17 and score 13 or higher on the Dental Anxiety Scale (DAS; 13). They also needed to be able to  
18  
19 bring up at least one memory of an event that initiated or exacerbated their dental anxiety (within  
20  
21 or outside the dental setting).  
22  
23  
24  
25  
26  
27  
28

### 29 *Procedure*

30  
31 The present case-control study was conducted from April 2010 until June 2012, and May 2014  
32  
33 until March 2015. Ethical approval for the study was granted by the local Ethical Committee  
34  
35 (METc VU, protocol number 2007/262).  
36  
37  
38

39 To determine eligibility for the study, patients had to fill out the DAS (13) prior to  
40  
41 registering at the dental fear clinic. Patients who were considered eligible and could be reached  
42  
43 by telephone (n=305) were invited by a trained dental student to participate in the study. Those  
44  
45 who indicated willingness to participate, and being able to plan an appointment at the clinic  
46  
47 (n=258), were sent a letter containing additional information about the study, along with a  
48  
49 consent form and an appointment card.  
50  
51  
52

53 During the first appointment, a specialized dentist checked whether there was an  
54  
55 indication for treatment in the clinic, and whether the patient would be eligible for inclusion in  
56  
57  
58  
59  
60

1  
2  
3 the study (n=226). The second appointment was used to discuss the dental treatment plan.  
4  
5 Patients who fulfilled the inclusion criteria (n=134) were asked to be present 30 minutes before  
6  
7 their third appointment at the clinic for signing their informed consent form in the presence of  
8  
9 the investigator (n=127). Next, two structured clinical interviews were conducted: the MINI plus  
10  
11 (14) to determine whether the patient fulfilled the diagnostic criteria of a specific phobia in terms  
12  
13 of DSM-5, and the 'Full Intrusions Interview' (15) to determine presence, content and  
14  
15 characteristics of the memory of the event that, according to the patient, initiated or exacerbated  
16  
17 his or her dental anxiety. The participants who reported more than one memory were asked to  
18  
19 decide which memory was most closely related to the onset or aggravation of their dental  
20  
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  
24  
25 setting not fulfilling the A1 criterion for DSM-5; (iii) events within the dental setting fulfilling  
26  
27 the A1-criterion for DSM-5, and (iv) events within the dental setting not fulfilling the A1-  
28  
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  
36  
37 Anxiety Inventory (S-DAI; 17).  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47

#### 48 *Assessment instruments*

49

50  
51 Severity of dental trait anxiety was measured before admission to the clinic using the  
52  
53 Dental Anxiety Scale (13). This four-item scale is most widely used in studies of dental anxiety  
54  
55 (18). Responses are scored from 1 to 5, providing total scores ranging from 4 (not anxious at all)  
56  
57  
58  
59  
60



1  
2  
3 to 20 (extremely anxious). DAS scores of 13 or higher are considered indicative of high dental  
4  
5 trait anxiety. Cronbach's alpha for the DAS in the current study was 0.96.  
6  
7

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  
11  
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  
15  
16 applicable to me" (1) to "totally applicable to me" (5). Total scores on this questionnaire range  
17  
18 from 9 to 45. Cronbach's alpha for the S-DAI in the current study was 0.85.  
19  
20  
21

22 To measure severity of trauma-related (PTSD) symptoms, the Dutch version of the  
23  
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  
27  
28 the items based upon the memory of the event that in their view initiated or exacerbated their  
29  
30 dental anxiety, and to indicate how frequently the symptoms were present during the previous  
31  
32 seven days. The frequency of each symptom is scored using a 4-point response format, ranging  
33  
34 from 'not at all' (0), 'rarely' (1), 'sometimes' (3) to 'often' (5). The scores can be summed to  
35  
36 produce a total IES score (range 0-75) and two subscale scores for intrusion (range 0-35) and for  
37  
38 avoidance (range 0-40) with a higher score indicating a greater level of intrusion (that is. the loss  
39  
40 of voluntary control over the regulation of thoughts) or avoidance (that is. the extent to which  
41  
42 memories are consciously suppressed). A score of 26 is considered to indicate a clinically  
43  
44 significant level of trauma-related symptomatology (19). Cronbach's alpha scores for the two  
45  
46 subscales in the current study were 0.91 (intrusiveness), and 0.89 (avoidance).  
47  
48  
49  
50  
51  
52

53 Patients were asked to rate the emotional intensity in terms of vividness, disturbance and  
54  
55 sense of reliving of the memory of the event that, according to the patient, initiated or  
56  
57  
58  
59  
60

1  
2  
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”).  
5  
6  
7  
8  
9

### 10 *Statistical analyses*

11  
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.  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33

## 34 **Results**

### 35 *General differences among groups*

36  
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).  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

-----  
Table 1 about here  
-----

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
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).  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33

34 *Dental anxiety, PTSD symptoms, disturbance, vividness and sense of reliving of events in*  
35 *relation to the A criterion*  
36  
37  
38

39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

-----  
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

1  
2  
3 individuals not fulfilling the A criterion, could not be supported. Also with regard to level of  
4  
5 dental anxiety no difference could be detected. For only one variable (i.e., vividness of the  
6  
7 memory,  $P = 0.02$ ) a significant difference was found; that is, patients who reported an event  
8  
9 meeting the A criterion reported significantly more vivid memories of such event than those who  
10  
11 reported an event not fulfilling this criterion.  
12  
13

14  
15 None of a series of Pearson product-moment correlations between either K-ATB or DAS,  
16  
17 on the one side, and IES total or any of the memory characteristics on the other, appeared to be  
18  
19 significant. In contrast, the total IES score was found to be significantly associated with  
20  
21 disturbance ( $r = 0.42$ ,  $P < 0.001$ ), vividness ( $r = 0.46$ ,  $P < 0.001$ ), and “sense of reliving” ( $r =$   
22  
23  $0.52$ ,  $P < 0.001$ ).  
24  
25  
26  
27  
28

### 29 *The influence of the time since the traumatic event took place*

30  
31 From the 90 individuals, data about the age of the patient at which the traumatic event took place  
32  
33 was missing in 14 cases. For each of the remaining 76 patients, number of years since the event  
34  
35 took place was calculated, and correlated to severity of dental trait anxiety (DAS and S-DAI),  
36  
37 frequency of PTSD symptoms (IES total score), and the VAS scores that pertain to vividness,  
38  
39 disturbance and sense of reliving of the memory of that event. Both among the individuals who  
40  
41 did, and who did not, fulfilled the A-criterion, none of these variables appeared to be associated  
42  
43 with the number of years since the event took place ( $P > 0.10$  for all).  
44  
45  
46  
47  
48  
49

## 50 **Discussion**

51  
52 To our knowledge, this is the first study to examine the differential effects of traumatic  
53  
54 and non-traumatic events in terms of DSM-5 in relation to dental anxiety severity. The findings  
55  
56  
57  
58  
59  
60

1  
2  
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.  
9  
10  
11  
12  
13  
14  
15  
16

17  
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.  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Namely, it has frequently been observed that events fulfilling the definition of trauma in DSM  
4  
5 produced *less*, rather than more PTSD symptoms in response to these events than non-traumatic  
6  
7 ones (18, 21).  
8  
9

10 Our other main finding was that neither the severity of anxiety, nor the frequency of  
11  
12 PTSD symptoms, nor how patients remembered the conditioning event were associated with the  
13  
14 number of years since the event took place. To this end, the findings are consistent with research  
15  
16 supporting the notion that vividness, overall quality, and sensory components remain virtually  
17  
18 unchanged and consistent years after their occurrence, and that, particularly, memories of  
19  
20 emotionally arousing events are often well retained (22). In other words, if one ever develops a  
21  
22 severe form of dental anxiety, this will not wear off automatically in the course of time because  
23  
24 unresolved memories remain to get activated every time dentally anxious individuals are faced  
25  
26 with the dental treatment situation (23). This is in accordance with findings from other studies,  
27  
28 mainly in the domain of PTSD, showing that it is not likely that, once a condition such as PTSD  
29  
30 has developed, the symptoms alleviate or fade away easily (24). The present findings further  
31  
32 support the notion that dental phobia in its severe form may be considered as a mild form of  
33  
34 PTSD, and that this condition is not only the result of confrontations with conditioning events in  
35  
36 the dental domain, but that other types of (traumatic) incidents significantly contribute to the  
37  
38 development of dental fear or dental phobia.  
39  
40  
41  
42  
43  
44

45 There are several limitations of this study. Firstly, it is impossible to rule out the  
46  
47 possibility that individuals had experienced multiple traumas in their lives, and had more  
48  
49 relevant memories contributing to their current level of dental anxiety, than they indicated during  
50  
51 the memory interview. Secondly, a number of patients of the specialized dental fear clinic  
52  
53 refused to participate in this study or cancelled the appointment for the memory interview. It is  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 difficult to predict how this may have influenced the current findings, but it is conceivable that  
4  
5 individuals with the highest level of dental fear were not willing to participate in a study such as  
6  
7 the present one. Thirdly, given that our sample consisted of patients of only one dental fear  
8  
9 clinic, the ability to generalize the findings to other populations or settings is limited. Finally, a  
10  
11 number of statistical tests were performed, but no correction for capitalization on chance has  
12  
13 been applied. Therefore, we reported uncorrected p-values so that readers can decide whether to  
14  
15 interpret these directly, or to correct them for multiple testing first. It should also be noted that,  
16  
17 given the relative low number of participants in the stressor Criterion A group, it cannot be ruled  
18  
19 out that existing differences could not be shown as a result of limited power.  
20  
21  
22  
23

24  
25 In conclusion, the present findings suggest that memories of dental patients pertaining to  
26  
27 ‘traumatic’ events (meeting DSM-5 Criterion A) are significantly more vivid than those of  
28  
29 patients reporting other types of negative events related to the development of dental anxiety.  
30  
31 However, such memories do not seem to exert a great influence upon the development of anxiety  
32  
33 about dental treatment in terms of symptom severity. Also, ‘old’ memories, like to pertaining to  
34  
35 childhood, do not seem of more relevance to dental anxiety symptom severity than more recent  
36  
37 ones.  
38  
39  
40  
41  
42  
43  
44

45  
46 *Acknowledgements* - This work was not funded.  
47  
48  
49

50  
51 *Conflict of interest* - The authors declare no potential conflicts of interest with respect to the  
52  
53 authorship and/or publication of this article.  
54  
55  
56  
57  
58  
59  
60

## References

1. OOSTERINK-WUBBE F, DE JONGH A, HOOGSTRATEN J. Prevalence of dental fear and phobia relative to other fear and phobia subtypes. *Eur J Oral Sci* 2009, **117**, 135–143.
2. AMERICAN PSYCHIATRIC ASSOCIATION *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition*. Washington, DC: American Psychiatric Association, 2013.
3. MOORE R, BRØDSGAARD I, BIRN H. (1991). Manifestations, acquisition and diagnostic categories of dental fear in a self-referred population. *Behav Res Ther* 1991, **29**, 51-60.
4. DE JONGH A, FRANSEN J, OOSTERINK-WUBBE FMD, AARTMAN IHA. Psychological trauma exposure and trauma symptoms among individuals with high and low levels of dental anxiety. *Eur J Oral Sci* 2006, **114**, 286-292.
5. OOSTERINK-WUBBE F, DE JONGH A, HOOGSTRATEN J. Prevalence of dental fear and phobia relative to other fear and phobia subtypes. *Eur J Oral Sci* 2009, **117**, 135-143.
6. DE JONGH A, OLFF M, VAN HOOLWERF H, AARTMAN IHA, LINDAUER R, BROEKMAN B, BOER F. Anxiety and post-traumatic stress symptoms following wisdom teeth removal. *Behav Res Ther* 2008, **46**, 1305-1310.
7. KESSLER RC, SONNEGA A, BROMET E, HUGHES M, NELSON CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch. General Psychiatry* 1995; **52**, 1048–1060.
8. GOLD SD, MARX BP, SOLER-BAILLO JM, SLOAN DM. Is life stress more traumatic than traumatic stress? *J Anxiety Disord* 2005, **19**, 687–698.
9. KILPATRICK D, RESNICK H, FREEDY J, PELCOVIT D, RESNICK P, ROTH S,.....  
*Posttraumatic stress disorder field trial: evaluation of the PTSD construct-criteria A*. In:  
WIDIGER T, FRANCES A, PINCUS H, ROSS R, FIRST M, DAVIS W. Eds. **DSM-IV sourcebook**. Vol. 4. Washington, DC: American Psychiatric Association 1998, 803-844.



- 1  
2  
3 10. SPITZER C, ABRAHAM G, RESCHKE K, MICHELS F, SIEBEL U. FREYBERGER HJ.  
4 Posttraumatic stress disorder following high- and low-magnitude stressors in psychotherapeutic  
5 inpatients. *Clin Psychol Psychother* 2000, **7**, 379–384.  
6  
7  
8  
9  
10 11. LOFTUS EF, KETCHAM K. The myth of repressed memory: *False memories and*  
11 *allegations of sexual abuse*. New York: St. Martin's Press, 1994.  
12  
13  
14 12. ALEXANDER KW, QUAS JA, GOODMAN GS, GHETTI S, EDELSTEIN RS, REDLICH  
15 AD, CORDON IM, JONES, DP. Traumatic impact predicts long-term memory for documented  
16 child sexual abuse. *Psychol Sci*, 2005, **16**, 33-40.  
17  
18  
19  
20 21. CORAH NL. Development of a dental anxiety scale. *J Am Dent Assoc* 1969; **48**, 596.  
22  
23  
24 24. SHEEHAN DV, LECRUBIER Y, SHEEHAN KH, AMORIM P, JANAVS J, WEILLER E,  
25 HERQUETA, E, BAKER R., DUNBAR, G.C. The Mini-International Neuropsychiatric  
26 Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric  
27 interview for DSM-IV and ICD-10. *J Clin Psychiatr* 1998. Suppl 20:22–33.  
28  
29  
30  
31 32. REYNOLDS M, BREWIN CR. Intrusive memories in depression and posttraumatic stress  
33 disorder. *Behav Res Ther* 1999, **37**, 201-215.  
34  
35  
36  
37 37. HOROWITZ M, WILNER N, & ALVAREZ, W. Impact of Event Scale: A Measure of  
38 Subjective Stress. *Psychosom Med* 1979; **41**: 209-218.  
39  
40  
41  
42 42. AARTMAN IH. Reliability and validity of the short version of the Dental Anxiety Inventory.  
43 *Community Dent Oral Epidemiol* 2009; **26**: 350–4.  
44  
45  
46  
47 47. CORAH NL, GALE EN, ILLIG SJ. Assessment of a dental anxiety scale. *J Am Dent Assoc*  
48 1978; **97**: 816-819.  
49  
50  
51  
52 52. KLEBER RJ, BROM D, DEFARES PB. Coping with trauma. Theory, prevention and  
53 treatment. Lisse: Swets and Zeitlinger, 1992.  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 20. BLAKE DD, WEATHERS FW, NAGY LM, KALOUPEK DG, KLAUMINZER G,  
4 CHARNEY DS, KEANE TM. A clinician rating scale for assessing current and lifetime PTSD:  
5 The CAPS-1. *The Behav Therapist* 1990; **13**: 187–188.  
6  
7  
8  
9  
10 21. MOL SSL, ARNTZ A, METSEMAKERS JFM, DINANT G-J, VILTERS-VAN  
11 MONTFORT PAP, KNOTTNERUS JA. Symptoms of post-traumatic stress disorder after non-  
12 traumatic events: evidence from an open population study. *Br J Psychiatr* 2005; **18**: 494– 499.  
13  
14  
15 22. VAN GIEZEN AE, ARENSMAN E, SPINHOVEN P, WOLTERS G. Consistency of  
16 memory for emotionally arousing events. A review of prospective and experimental studies. *Clin*  
17 *Psychol Rev* 2005, **25**, 935-953.  
18  
19  
20 23. VAN HOUTEM CMHH, VAN WIJK AJ, DE JONGH, A. Autobiographical memory  
21 characteristics in individuals with high and low levels of dental anxiety. *Appl Cogn Psychol*  
22 2015, **29**, 515-523.  
23  
24  
25 24. SANTIAGO PN, URSANO RJ, GRAY CL, PYNOOS RS, SPIEGEL D, LEWIS-  
26 FERNANDEZ R, FRIEDMAN, MJ, FULLERTON CS. A Systematic Review of PTSD  
27 Prevalence and Trajectories in DSM-5 Defined Trauma Exposed Populations: Intentional and  
28 Non-Intentional Traumatic Events. *PLoS One* 2013; **8**: e59236.  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**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.**

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

---

N	14	75	
SD	2.9	2.2	
<b>Sense of reliving</b>	6.2	5.1	0.22
N	14	75	
SD	3.0	3.1	

---

\*p<0.05

Manuscript Copy