

## The denying of patient's appeal for additional local anesthesia is related to post-traumatic stress disorder symptoms about dental treatment.

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The aim of this study was to identify traumatic dental events that are related to post-traumatic stress disorder (PTSD) symptoms. At a dental clinic, first-time visitors were given a questionnaire that asked patients to indicate whether they felt fear in different dental situations. Patients' dental anxiety was assessed using the short version of the Dental Anxiety Inventory (S-DAI). Patients' trauma from dental treatments was assessed using the Impact of Event Scale-Revised (IES-R). Scores indicated that 16.5% of patients suffered from PTSD symptoms. A weak positive correlation was observed between S-DAI scores and IES-R scores. In a logistic regression analysis, "Not being able to get an anesthetic injection despite reporting pain during treatment" had independent effects on the PTSD symptom group. Our results suggest that a past experience with a dentist who denied a patient's appeal for additional local anesthesia is related to the patient's PTSD symptoms about dental treatment.

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**Key words:** Dental treatment, Post-traumatic stress disorder (PTSD), Local anesthesia, Dental Anxiety, S-DAI, IES-R

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### Introduction

A majority of dental patients fear dental treatment. Some papers say that as much as 3% to 7% of the population suffer from high levels of dental anxiety, which leads to avoidance of dental treatment<sup>1-4</sup>. Previous studies suggest that dental anxiety often leads to avoidance of dental treatment, deterioration of the patient's oral condition, elevation of the severity of dental treatment phobia. This threatens the patient's mental and general health in addition harming the patient's quality of life<sup>5-8</sup>. Furthermore, previous studies have reported some dental situations act as a trigger to induce dental anxiety, such as pain<sup>5,7-9</sup>, a root canal treatment or injections<sup>5,7-10</sup>, distress caused by the dentist's behavior<sup>5,10-13</sup>, distress caused by emotional responses from dental treatment<sup>7,12,14</sup>, and distress caused by hearing stories about dental episodes from informants<sup>11</sup>. However, this previous literature did not rely

on the criteria of post-traumatic stress disorder (PTSD) to identify the relationship between dental treatments and dental anxiety. PTSD is a psychiatric disorder that is caused by the experience or witnessing of traumatic or life-threatening events<sup>15,16</sup>. PTSD carries the risk of chronic morbidity, mortality, increased physical problems, psychiatric disturbances or impairment of interpersonal-professional functioning. Although dental treatments are not life-threatening events, Mol et al. reported that both life-threatening events and traumatic events could generate PTSD symptoms (re-experience of trauma, avoidance, loss of interest or insomnia)<sup>17</sup>. De Jongh et al. suggested about half of severe dental anxiety patients suffered from symptoms that are typically reported by patients with PTSD<sup>14</sup>. De Jongh et al. also suggested that patient's expectations of repeating a negative experience during dental treatment caused them to feel apprehension and anxiety<sup>14</sup>. Moreover of patients with a high level of dental

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anxiety, 46.1% indicated suffering from one or more PTSD symptoms; in contrast, this percentage was 6% in the reference group<sup>18</sup>. Again, these reports did not utilize PTSD criteria to investigate a causal relationship between dental treatment and dental anxiety. Utilization of PTSD criteria is an effective approach to determine if dental anxiety is caused by dental treatment. As Davidson et al. suggest, traumatic event exposure is the presumptive primary factor for PTSD<sup>19</sup>.

To research this concept, we evaluated the relationship between dental treatment and PTSD symptoms in general dental patients on their first visit to a new dental hospital. The reason for studying new patients was that, new patients provide the best opportunity to evaluate PTSD symptoms. In the time between scheduling an appointment and receiving treatment, patients feel anxiety and concern about visiting the dentist.

## METHODS

### *Participants*

At a dental clinic affiliated with Nagasaki University Hospital, first-time visitors of adult patients (20 to 74 years old) between September 21, 2010 and January 21, 2011 were randomly recruited before dental treatment. Patients who were too young or who had mental retardation were excluded because they could not understand the aims of the study and were unable to explain their feelings. This study was done soon after patients arrived to the hospital. Patients were given a questionnaire to complete on their own. We first inquired about age, gender and dental treatment experience. If they had no previous experience of dental treatment, we removed them from our study. Patients were adequately informed of the aim of this study by an accompanying letter. The letter explained that patients were free to participate or not with the study, and the decision to participate had no effect on their treatment. Patients filled out the questionnaire in the waiting room of the outpatient center of Nagasaki University Hospital. They also signed a letter of consent for this study. The experiment protocol was approved by the Human Investigation Committee of the Nagasaki University Graduate School of Biomedical Sciences.

### *Measures*

This research was carried out using a questionnaire that patient's completed on their own. The questionnaire investigated data such as age, gender, previous dental contact and history of previous psychiatric consultations. Dental anxiety

was assessed using the 9-item short version of the Dental Anxiety Inventory (S-DAI)<sup>20</sup>. Responses to the S-DAI are scored from 1-5; as a result, total scores could range from 9 (not anxious at all) to 45 (extremely anxious)<sup>21,22</sup>. The list of 45 traumatic dental situations in a dental office was created<sup>23</sup> specifically for this study based on other studies<sup>8,12</sup>. Patients could select multiple events that they had experienced and still feared. PTSD symptoms were assessed using the Japanese language version of the Impact of Event Scale-Revised (IES-R)<sup>24</sup>. When scoring the IES-R, subjects were asked to indicate the frequency of their symptoms during the past 7 days. Patients were requested to keep in mind "the most awful dental situation" during screening with the IES-R. The frequencies of each symptom were scored using a 5-point (0-4) response format with equal intervals, ranging from 'not at all' (0) to 'very much' (4). These scores were added to produce the total IES-R score (range, 0-88), with a higher score indicating a greater level of post-traumatic stress symptoms. For clinical purposes, a score of 25 is the suggested cut-off point for a clinically relevant level of PTSD<sup>25</sup>. Cronbach's alpha for the IES-R in the present study was 0.953. We used the suggested cut-off point (25) in IES-R scores<sup>24,25</sup> in order to divide the patients into two groups, those with groups of clinical PTSD symptoms and those without, in order to screen the PTSD symptom group or not based on the patients own specific distressing dental experiences. For the purpose of this study, patients with IES-R scores  $\geq 25$  were considered to be in the PTSD symptoms group, and patients with IES-R scores  $< 25$  were in the non-PTSD symptoms group.

### *Statistical analysis*

Statistical analyses were performed using SPSS Statistics version 20.0.0 software (SPSS, IBM Japan, Tokyo, Japan). Cronbach's alpha was used to analyze internal consistency of S-DAI and IES-R. Welch's t-tests or Fisher's exact test were used to identify differences in the level of dental anxiety and PTSD symptoms in relation to age, gender and previous history of psychiatric consultations. Pearson's correlation was applied to determine the nature and degree of the relationship between age and S-DAI scores or IES-R scores, and between S-DAI scores and IES-R scores. Multivariable logistic regression analyses were used to analyze whether or not specific conditions correlated with the PTSD symptom group after controlling simultaneously for potential confounders. We initially wanted to establish the correlation between PTSD and independent variables, about age, gender, psychiatric consultation history, S-DAI scores, and selected

dental situations that the patients had experienced and still feared. Age, gender, psychiatric consultation history and S-DAI scores were considered as the baseline data set. However, to apply 45 dental situations to the data set in logistic regression analyses was too many to calculate, so that we selected the variables by using Chi-square tests, to determine the significance between the PTSD symptom group and patient-selected dental situations. Adjustment for multicollinearity was not done because this research is an exploratory research. For each of the independent variables, it was assessed whether or not the variable added significantly to the explained logistic regression analysis of the PTSD symptom group. The Hosmer-Lemeshow goodness of fit Chi-square test was used to calculate how well the data fit the models. P-values of  $< 0.05$  or  $< 0.01$  were taken to denote statistical significance.

## RESULTS

The questionnaire was given to 332 patients who attended the Nagasaki University Hospital outpatient dental clinic for the first time, after obtaining their informed consent. Four female patients were excluded from the study, because they had never experienced dental treatment.

Table 1 compares the two groups in terms of age, gender, psychological consultation record, S-DAI scores and IES-R scores. The two groups were consists by a PTSD symptom group or not. Of the 328 patients, 230 patients (70.1%), including 155 women (67.4%) and 75 men (32.6%), completed all parts of the questionnaire. Mean patient age ( $\pm$  standard deviation) was  $43.4 \pm 15.1$  years (range, 20-74 years). No significant difference in age was apparent between women and men [Mean Different (MD) = 2.710, 95% Confidence intervals (CI) -6.875 ~ 1.455,  $p = 0.201$ ]. The 13 of them in

patients (5.7%) answered 'yes' about history of previous psychiatric consultation, while 217 of them (94.3%) had no such past history. Mean S-DAI score was  $24.7 \pm 9.0$  (range, 9-45). S-DAI scores differed by gender, with women showing higher scores than men [MD=4.724, 95%CI 2.405 ~ 7.039,  $p < 0.001$ ]. S-DAI scores differed by psychiatric consultation history, with patients with a history of psychiatric consultation showing higher scores than those with no records [MD = 5.082, 95%CI -9.826 ~ -0.339,  $p = 0.037$ ]. There was no significant correlation between S-DAI scores and age ( $r = -0.038$ ,  $p = 0.565$ ). Mean IES-R score was  $11.5 \pm 14.6$  (range, 0-88), with 38 participants (16.5%) showing IES-R scores  $\geq 25$  (the PTSD symptom group). IES-R scores did not differ by gender [MD = 1.416, 95%CI -2.640 ~ 5.473,  $p = 0.491$ ] and psychiatric consultation record [MD = 8.086, 95%CI -19.837 ~ 3.665,  $p = 0.161$ ]. There was no significant correlation between IES-R scores and age ( $r = 0.046$ ,  $p = 0.565$ ). A weak positive correlation was observed between S-DAI scores and IES-R scores ( $r = 0.378$ ,  $p < 0.001$ ). The patients with past psychiatric consultation history showing higher S-DAI scores than those with no records [MD = 5.082, 95%CI -9.826 ~ -0.339,  $p = 0.037$ ], however, we did not find significant, between past psychiatric consultation history factor and any other factor, i.e., age [MD = 7.340, 95%CI -1.287 ~ 15.967,  $p = 0.089$ ], gender [Relative Risk = 0.974, 95%CI 0.916 ~ 1.037,  $p = 0.555$ ] and IES-R scores [MD = 8.086, 95%CI -19.837 ~ 3.665,  $p = 0.161$ ].

Table 2 presents frequency of anxiety-causing events in dental situations that were indicated by patients' experiences, and analysis between each events and "the PTSD symptom group or not" using Chi-square tests. On the basis of Chi-square tests ( $p < 0.01$ ), we identified four dental situations, namely, dental situation number 2: "Waiting in the waiting room of a dental clinic", number 12: "Seeing dental instruments", number 18: "Not being able to get an anesthetic in-

**Table 1.** Demographic and clinical characteristics, total and PTSD symptom group or not (n=230)

	Total (n=230)	PTSD symptom group (IES-R $\geq$ 25) (n=38)	non-PTSD symptom group (IES-R < 25) (n=192)	p-value	Mean difference (95% Confidence)
Gender(Male/Female) †	75/155	12/26	63/129	0.882	
Psychiatric consultaion record (Yes/No) †	13/217	4/34	9/183	0.154	
age (Mean $\pm$ SD) *	$43.4 \pm 15.1$	$44.2 \pm 14.6$	$43.2 \pm 15.2$	0.772	-0.955 (-6.235, 4.325)
S-DAI scores (Mean $\pm$ SD) *	$24.7 \pm 9.0$	$31.1 \pm 8.8$	$23.5 \pm 8.5$	$< 0.001$	-7.621 (-10.623, -4.618)
IES-R scores (Mean $\pm$ SD) *	$11.5 \pm 14.6$	$39.3 \pm 11.9$	$5.9 \pm 6.7$	$< 0.001$	-33.32 (-36.338, -29.303)

† Fisher's exact test

\* Welch's t-test

**Table 2.** Frequency of experience dental situations, causing fearful to the patients, and comparing PTSD symptom group or not (n=230)

No.	Dental situations	total selected number	PTSD symptom group (IES-R $\geq$ 25) (n=38)	non-PTSD symptom group (IES-R < 25) (n=192)	p-value
1	Entering a dental clinic	25	10	15	0.027
2	Waiting in the waiting room of a dental clinic	35	14	21	< 0.01
3	Sitting in the dentist's chair	40	13	27	0.012
4	Not being able to move freely from the time I sit down in the dentist's chair until the time the treatment is finished	26	8	18	0.129
5	Opening my mouth while lying in a reclined position	31	5	26	0.560
6	Having water pool in my mouth	55	11	44	0.971
7	Having tooth pulled	103	20	83	0.287
8	Having a facial swelling after having a tooth pulled	53	8	45	0.918
9	Having a tooth drilled	83	18	65	0.398
10	Hearing the sound of a dental drill	78	18	60	0.123
11	Feeling the vibration of a dental drill	62	15	47	0.057
12	Seeing dental instruments	21	9	12	< 0.01
13	Feeling tooth smarting (sharp pain) during treatment	47	9	38	0.587
14	Feeling pain during treatment	122	24	98	0.085
15	Not knowing when something is going to hurt during treatment	69	18	51	0.030
16	Receiving an injection of anesthesia in the mouth	88	16	72	0.866
17	The sensation of the anesthetic being injected	48	11	37	0.180
18	Not being able to get an anesthetic injection despite reporting pain during treatment	12	6	6	< 0.01
19	Feeling mouth numbness after an injection of anesthesia	41	9	32	0.302
20	Treatment on the root of a tooth	59	9	50	0.918
21	Having tartar removed with a metal tool	34	7	27	0.757
22	Having tartar removed with an ultrasonic tool (a device that squirts water and emits a high-pitched sound)	24	6	18	0.548
23	Bleeding during dental treatment	32	11	21	0.016
24	Tasting blood in my mouth	25	7	18	0.286
25	Having a bitter taste in my mouth, such as that from medicine	23	4	19	0.906
26	Finding it hard to breathe when having a tooth mold made	42	9	33	0.978
27	Feeling nauseous when having a tooth mold made	26	5	21	0.693
28	Feeling nauseous when a dental instrument enters the back of my mouth	26	4	22	0.868
29	Having a bright light shining in my eyes during dental treatment	11	0	11	0.496
30	The unique smell of a dental clinic	17	7	10	< 0.01
31	The uniforms worn by the dentist or staff	1	0	1	0.656
32	Not knowing how long a particular treatment will take when being treated	59	11	48	0.918
33	Not knowing what is being done in my mouth	38	7	31	0.730
34	Receiving an excessively detailed explanation during treatment	1	0	1	0.656
35	Not getting a concise explanation from the dentist	59	10	49	0.611
36	Not getting the dentist to perform the treatment according to my wishes	13	4	9	0.512
37	Being reprimanded by the dentist	12	3	9	0.417
38	Being laughed at by the dentist	3	2	1	0.019
39	Being sexually harassed by the dentist	1	0	1	0.656
40	The cold/unfriendly attitude of staff members other than the dentist	15	3	12	0.708
41	Seeing someone else experience pain while they are receiving dental treatment	13	5	8	0.028
42	Being rejected for dental treatment	5	2	3	0.153
43	Experiencing prolonged pain after a dental treatment	34	10	24	0.028
44	Receiving dental treatment while being physically restrained	3	1	2	0.430
45	Others	11	3	8	0.325

jection despite reporting pain during treatment” and dental situation number 30: “The unique smell of a dental clinic”, that were likely to be independent variables for logistic regression analyses. Table 3 displays the results of multivariate logistic regression analyses that were used to predict the positive diagnostic ability for the PTSD symptom group, using the four baseline data sets and four dental situations as independent variables [goodness of fit Chi-square = 35.293, d.f. = 7,  $p < 0.001$ ] [Hosmer-Lemeshow test = 4.258;  $p = 0.833$ ]. Dental anxiety level (S-DAI scores) (OR = 1.073,  $p < 0.05$ ), and event number 18, i.e. “not being able to get an anesthetic injection despite reporting pain during treatment” (OR = 4.667,  $p < 0.05$ ) correlated significantly with the PTSD symptom group. The other variables did not show a significant correlation ( $p < 0.05$ ).

## DISCUSSION

Dental literature reported that several dental situations are related to the risk of dental anxiety<sup>5,7-14</sup>. However, an interesting aspect of our research was that by using criteria for PTSD, we could confirm only one dental situation that may be associated with dental anxiety, namely, “Not being able to get an anesthetic injection despite reporting pain during treatment”. De Jongh et al. found that just a small proportion of respondents reported a significant increase in S-DAI scores or IES-R scores (4.3%) at a 1-month follow up after third molar surgery<sup>23</sup>. Their research results suggested that comparatively massive dental treatment, such as surgical removal of a third molar under local anesthesia, have minimal impact on dental anxiety or symptoms of psychological trauma. Hence, it is difficult to say that major invasive treatment, such as third molar surgery, is a cause of dental anxiety or PTSD symptoms. Armfield et al reported that the development of specific fears requires a perception of the stimulus as dangerous, disgusting, uncontrollable and unpredictable<sup>26</sup>. Our research results suggest that “Not being able to get an anesthetic injection despite reporting pain during treatment” could produce a patient’s feeling of danger, disgust, helplessness and uncontrollability that results in the generation of fear<sup>26</sup>. In support of this opinion, Oosterink reported that retrospective accounts of dental experiences involving helplessness were most strongly associated with dental phobia<sup>12</sup>.

Adequate local anesthesia to avert the feeling of pain can significantly mitigate the feeling of helplessness and give the patient a sense of being in control, thus potentially minimizing dental anxiety. Some studies reported local anesthetic failure rates of 5-15%<sup>27,28</sup>. These failures are probably due to

anatomic variations or the presence of infection; in addition, some studies said psychological factors cause local anesthetic failure<sup>27,29</sup>. Although local anesthetic failure is sometimes unavoidable, we should not neglect the patient’s appeal for local anesthesia during dental treatment. Maggiri et al. reported that patients should be encouraged to express their worries about pain, and dentists should be encouraged to respond to those patients’ concerns and modify their procedures accordingly<sup>30</sup>. In addition, Woda & Hennequin suggested that in persons showing a certain level of anxiety, exposure to dental treatment, particularly when repeated, constitutes an acute stress stimulus that may aggravate anxiety and render analgesic procedures more difficult<sup>31</sup>. In accordance with their suggestion, our results suggest that PTSD symptoms are related to nociceptive dental treatment performed without sufficient analgesia and to the dentist’s neglect of the patient’s pain and appeal for local anesthesia. In our study, we found that 16.5% patients showed IES-R scores  $\geq 25$ , indicating the possible occurrence of PTSD symptoms based on the questionnaire. This result was not far from the other literature; one report showed that 20.8% of regular patients had IES scores above the cut-off point of 27 for diagnosis of the PTSD symptom group<sup>14</sup>, while another study reported that the low-anxiety patients group had scores suggestive of the PTSD symptoms was 6% according to the NADSD (National Anxiety Disorder Screening Day 1997)<sup>18</sup>. In addition, another study reports 14.3% of general patients scheduled for surgical removal of the mandibular third molar reported higher scores of PTSD symptoms using IES-R at a 1-month follow-up<sup>23</sup>. However, when IES-R scores indicate PTSD symptoms, we must remember the important difference between “PTSD symptoms” and “post-traumatic stress disorder”. Exhibiting “PTSD symptoms” does not mean suffering “post-traumatic stress disorder”. Nemiah clearly emphasized this difference<sup>32</sup>. Even if measuring symptoms by using questionnaire may have useful applications, a questionnaire cannot substitute for complete diagnosis of PTSD using a step-by-step diagnostic procedure. In our study, although we estimated PTSD symptoms by IES-R scores without using definitive diagnostic methods, such as the Clinician-Administered PTSD scale (CAPS)<sup>33</sup> or Mini-International Neuropsychiatric Interview (MINI)<sup>34</sup>, our results showed relatively higher occurrence of PTSD symptoms.

Age was not an independent variable for the PTSD symptom group in our study. This result was similar to the other literature, that suggested that in predicting dental anxiety, the nature of these unpleasant experiences was more important than the age when they occurred<sup>35</sup>. Several important



issues must be considered in validating this study.

First, the selection process for participants in this study must be mentioned. We only recruited adult patients (20-74 years old) who were new to our university hospital, and who had already been exposed to dental treatment in the past. Approximately 47% of patients visiting the outpatient dental division of Nagasaki University Hospital are referrals from ordinary dental clinics. Patients' reasons for referral from ordinary dental clinics to university hospitals may vary widely, but it is reasonable to assume that these patients have already been categorized as needing special dental treatment such as more serious dental surgery. Thus, we cannot apply the results to a population that attends ordinary dental clinics. We assume that a frequency of PTSD symptoms in patients in ordinary dental clinics is likely to be lower than at a dental clinic in university hospital.

Secondly, we should have checked the influence of general PTSD. The chance to check the influence of general PTSD existed when we did the questionnaire research. In our study, four female patients (1.2% of the total number of participants) were excluded because they did not have any prior experience with dental treatment. We suppose that we should consider an alternate protocol for further screening of patients without any past dental treatment, in order to investigate an influence of general PTSD. If we had asked these patients about general IES-R scores, it could have been a good reference for our research.

Thirdly, the accuracy of PTSD diagnosis must be mentioned. The diagnosis of PTSD consists of several core assumptions, particularly a premise that a distinct class of trau-

matic events is linked to a distinct clinical syndrome. With regard to the central role of trauma exposure as the presumptive primary etiological factor for PTSD, the stressor criterion for PTSD, i.e., Criterion A<sup>36</sup>, should be considered. Criterion A consists of several factors regarding the nature of trauma and its link to PTSD: (1) how broadly or narrowly should trauma be defined? ; (2) can trauma be measured reliably and with validity? ; (3) what is the relationship between trauma and PTSD? Given the limited ability of a questionnaire to complete on respondents own, as was used in this study, we could not appropriately test these three questions for Criterion A. Thus reaching a definitive diagnosis of PTSD in this study was difficult. Further studies need to clarify the pathogenesis of PTSD symptoms in dentistry.

Fourth, we should examine the influence of the patient's past psychiatric consultation records because mental disease was adequately considered to influence the patient's mentality about dental treatment. Our study indicates a significant correlation between past psychiatric factors and S-DAI scores [MD = 5.082, 95%CI -9.826 ~ -0.339, p = 0.037]. However, we did not find significant correlations between past psychiatric factors and any other factor, i.e., IES-R scores [MD = 8.086, 95%CI -19.837 ~ 3.665, p = 0.161] or logistic regression analysis (p=0.165) (table 3). Moreover, Abrahamsson et al. suggested that no significant differences exist in dental anxiety level between individuals with low versus high general fear<sup>37</sup>. Therefore, it is difficult to predict the relationship between general psychiatric factors and dental anxiety at the current moment.

**Table 3.** Result of the multivariable logistic regression analyses. Dependent variable: PTSD symptom group or not (n=230)

Variables	Odds ratio	95% Confidence interval	p-value
Gender (reference : female)	1.609	0.680-3.805	0.279
Age (reference ; per year)	1.017	0.989-1.046	0.228
Psychiatric consultation record (reference : No record)	2.635	0.671-10.348	0.165
S-DAI scores (reference : per scores)	1.073	1.015-1.136	0.014
[No.2] Waiting in the waiting room of a dental clinic (reference : No)	2.534	0.953-6.740	0.062
[No.12] Seeing dental instruments (reference : No)	1.134	0.337-0.382	0.839
[No.18] Not being able to get an anesthetic injection despite reporting pain during treatment (reference : No)	4.667	1.175-18.530	0.029
[No.30] The unique smell of a dental clinic (reference : No)	2.032	0.576-7.163	0.270
Constant			0.000

Model chi-square = 35.293; p < 0.001

Hosmer-Lemeshow test = 4.258; p = 0.833

Discrimination predictive value 86.1%

## Conclusion

Our results suggest that a past experience with a dentist who denied a patient's appeal for an additional local anesthesia is related to the patient's PTSD symptoms about dental treatment. Therefore, when providing dental therapy, we must pay attention to the adequacy of analgesia and heed patient's reported pain and appeal for local anesthesia.

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