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## Original Article

# Anxiety May Enhance Pain during Dental Treatment

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## Abstract

The purpose of this study was to clarify the effects of anxiety about dental treatment on pain during treatment. Subjects consisted of 57 consenting sixth-grade students at Tokyo Dental College (male: 32, female: 25), all of whom participated in this study during their clinical training program. They knew how third molars were extracted and all had experience of assisting in tooth extraction. Prior to the study, trait anxiety in the subjects was evaluated according to the State-Trait Anxiety Inventory (STAI, Japanese version). The students were asked to read one of two scenarios describing a scene in which a third molar was extracted while imagining themselves to be the patient. Scene 1 is set in an “environment where the patient feels safe and comfortable,” and the Scene 2 is set in an “environment where the patient feels strong anxiety”. The subjects were asked to imagine the anxiety and pain in that scenario and evaluate that pain according to a visual analogue scale (VAS). Two scenarios were randomly shown to the subjects in a crossover manner. No significant correlation between trait anxiety and preoperative anxiety was observed. There was no difference in level of preoperative anxiety for Scene 1 and Scene 2 between the high- and low-trait anxiety groups. This suggests that there was no relationship between sensitivity to anxiety as a characteristic of the subject and amplitude of anxiety immediately prior to treatment. Scene 2 elicited significantly higher anxiety before injection of regional anesthesia, significantly higher pain during insertion of the needle, and significantly higher pain during extraction of the tooth than Scene 1. This difference suggests that patients feel stronger pain if anxiety in the treatment environment is high and that it is, therefore, important to reduce anxiety during treatment to reduce pain.

Key words: Anxiety — Pain — Dental treatment

## Introduction

For most dental patients, dental treatment is “painful and scary”. Anxiety and tension about dental treatment may cause systemic complications. More than half of systemic complications develop during local anesthesia. Most complications are not critical, such

as fainting or hyperventilation syndrome. However, patients sometimes die of acute heart failure or cerebrovascular accident<sup>1,3,5,9,10</sup>.

In general, anxiety and fear are said to enhance pain. According to one report discussing the relationship between amplitude of anxiety as a characteristic of a patient (trait anxiety) or amplitude of anxiety when secur-

Table 1 Script (Scene 1)

The following is a text of a hypothetical dental care situation. Read the text and imagine that you are the patient. You will be asked about your condition several times during the process. Use the tool provided to record your condition each time.

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### Scene 1

Your third molar is to be extracted today. The dentist in charge is your regular dentist. The dentist is well appreciated by his patients, and is known to be skillful at extracting teeth. The dental hygienist is caring, and the dental clinic has a very warm atmosphere.

You are taken to the dentist chair. After a while, your regular dentist comes in with a smile on his face.

“Hello. How are you today?”

You say, “Fine,” nodding.

“Are you a little nervous? It’s going to be fine. Let me know if you start feeling ill.”

The dentist sees that you seem different than usual.

#### Record 1: Record the degree of your anxiety regarding the tooth extraction.

“We will numb the area. Let’s bring the chair down.”

“You will feel a little sting. Breathe slowly through your nose. You can raise your hand if you start feeling ill. Don’t hesitate to let me know.”

#### Record 2: Imagine and record the pain when the needle with the local anesthetic is inserted.

“Are you feeling all right? Shall we start?”

“Does it hurt?”

The anesthetic appears to be working.

“Let me know if it hurts or you start feeling ill.”

“First, I will break the tooth.”

You hear the sound of a turbine and have a painful expression on your face.

“Are you all right? Does it hurt?”

The dentist quickly notices the change in your facial expression.

“I’m all right.”

The turbine is turned off, and breaking of the tooth is finished.

“It’s almost over. You may feel a slight discomfort. Hang in there.”

...A creaking sound... The tooth appears to be coming out.

#### Record 3: You felt a slight pain at this time. Imagine and record the degree of the pain.

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ing a vein (state anxiety) and subjective strength of pain<sup>4)</sup>, subjects with higher trait anxiety showed a stronger state anxiety and realized stronger pain when a vein was punctured and a catheter inserted than a subject with lower trait anxiety. This suggests that patients with a stronger anxiety trait tend to experience stronger anxiety during dental treatment than patients with a weaker anxiety trait and that they are likely to feel more pain. Another study reported that patients with stronger state anxiety experienced stronger pain when having veins punctured<sup>7)</sup>. However, these studies do not directly discuss dental treatment. Therefore, it has yet to be determined whether anxiety about dental treatment affects pain during such treatment.

The purpose of this study was to clarify the

effects of anxiety about dental treatment on pain during treatment. Subjects were asked to read two scenarios describing a scene in which a third molar was extracted. The relationship between anxiety and pain was discussed based on the VAS (Visual Analogue Scale) values of anxiety and pain obtained while the subjects were reading the scenarios.

## Subjects and Method

Subjects consisted of 57 consenting sixth-grade students at Tokyo Dental College (male: 32, female: 25). The specific content of the study was not explained to them to prevent preoccupation from affecting the results. All subjects participated in this study during

Table 1 Script (Scene 2)

The following is the text of a hypothetical dental care situation. Read the text and imagine that you are the patient. You will be asked about your condition several times during the process. Use the tool provided to record your condition each time.

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**Scene 2**

Your third molar is to be extracted today. Your regular dentist referred you to an oral surgeon. An unfriendly dental hygienist calls you. You enter the clinic and see a lot of chairs and doctors. This unfamiliar sight takes you by surprise.

You see a young dentist in the clinic. The dentist asks you about your medical condition.

“Is this the dentist who is going to pull my tooth out?”

The dentist examines the inside of your mouth. He seems inexperienced...

“I wonder if I can trust him...”

After awhile an experienced dentist comes in.

“Hello. My name is \*\*\*\*. I will be working with Dr. \*\*\*\* today.”

You feel relieved, but this setting is not familiar to you...

Record 1: Record the degree of your anxiety regarding the tooth extraction.

“I am going to numb the area. Let’s bring the chair down.”

You are not quite ready for it... But the procedure is about to begin.

“OK, Dr. \*\*\*\*, would you numb the area?”

My god! Is he going to do it?

The needle comes close to your face, and then it goes inside your mouth...

“No, not there.”

“Oh, I’m sorry.”

“It’s going to sting a little. Breathe slowly through your nose.”

Record 2: Imagine and record the pain when needle with the local anesthetic is inserted.

The chair is brought down again. It appears that the procedure is about to begin.

“OK, here we go.”

I wonder if the anesthetic is working... The dentist doesn’t ask at all.

What if I feel the pain? I wonder if I am supposed to put up with it a little...

The young dentist appears to be the one who will extract the tooth. Just as you thought, he doesn’t seem to be experienced with the procedure. He doesn’t work smoothly, and the experienced dentist sometimes takes over.

You hear the sound of the turbine... You unconsciously develop a painful expression on your face. However, the dentist doesn’t stop. He is only looking at the inside of your mouth. You constantly hear the instructions by the experienced dentist.

It feels as if it’s taking too long. You are tired from keeping your mouth open.

A creaking sound... Your chin feels more weight placed on it.

Hold on a little longer. You may feel a discomfort, but the tooth is almost out...

Record 3: You felt a slight pain at this time. Imagine and record the pain.

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their clinical training program. They knew how a third molar was extracted and all had experience of assisting in tooth extraction.

Before the study, the trait anxiety of the subjects was evaluated according to the State-Trait Anxiety Inventory (STAI, Japanese version), which is a self-administered psychological test with no time restriction. The subjects were then asked to read one of two scenarios describing a scene in which a third molar was extracted while imagining themselves to be the patient. They were asked to imagine the

anxiety and pain that scenario would elicit and evaluate that pain according to the visual analogue scale (VAS). They were next asked to read another scenario after an at least two-day interval and repeat the same evaluation in the same manner.

These scenarios consisted of a scene describing the extraction of a third molar. One is set in an “environment where the patient feels safe and comfortable,” and the other is set in an “environment where the patient feels strong anxiety” (Table 1). The timing of the

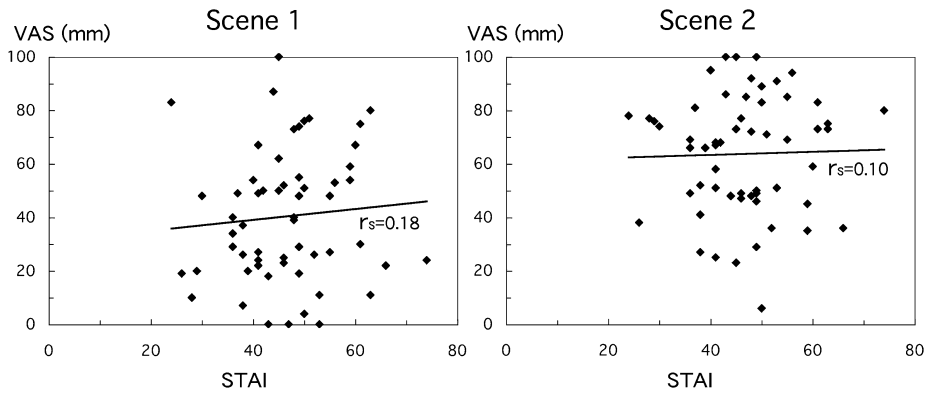


Fig. 1 Relationship between STAI values and preoperative anxiety for total subjects

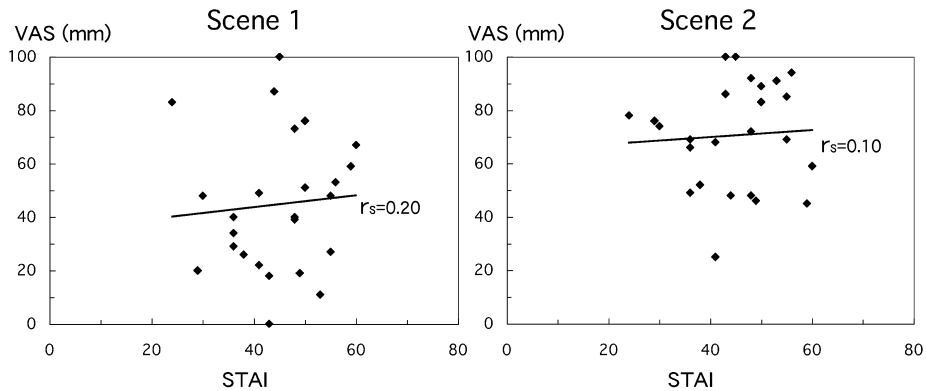


Fig. 2 Relationship between STAI values and preoperative anxiety for female subjects

evaluations were: (1) anxiety before injection of local anesthesia, (2) pain during insertion of a needle, and (3) pain during extraction of the tooth. In VAS evaluation, the left end of the scale (0 mm) indicates “no anxiety or pain,” and the right end (100 mm) indicates “strongest anxiety or pain imaginable”. Subjects were asked to evaluate the degree of their own anxiety and pain on the scale.

The data were expressed as an average value  $\pm$  the standard deviation. The Spearman rank correlation and Wilcoxon signed-rank-sum test were used for statistical analyses. A significance level of  $p < 0.05$  was considered to be significant.

## Results

### 1. Relationship between STAI values and preoperative anxiety (VAS)

There was no significant correlation between STAI values and preoperative anxiety (VAS) for any subject (Scene 1:  $r_s = 0.18$ , Scene 2:  $r_s = 0.10$ ; Fig. 1); in female subjects (Scene 1:  $r_s = 0.20$ , Scene 2:  $r_s = 0.10$ ; Fig. 2); and in male subjects (Scene 1:  $r_s = 0.18$ , Scene 2:  $r_s = 0.11$ ; Fig. 3).

Values of STAI were divided into two groups including less than average ( $24-46$ ,  $38.8 \pm 6.2$ ) and more than average ( $47-74$ ,  $54.5 \pm 6.8$ ) and the preoperative anxiety levels of Scene 1 and Scene 2 were compared. There was no significant difference in Scene 1

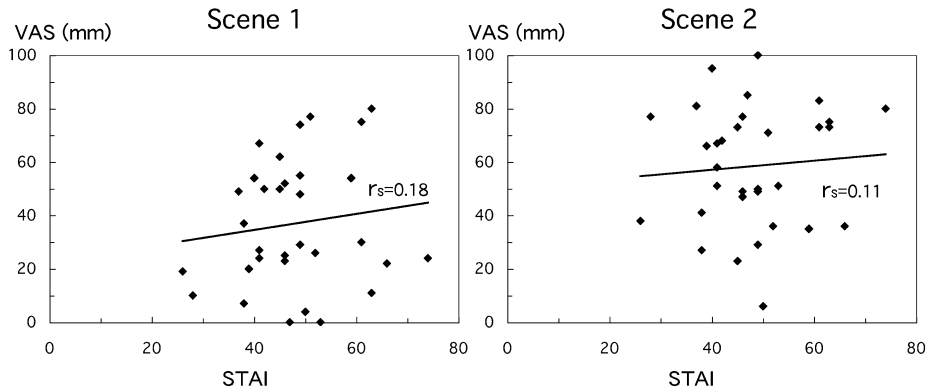


Fig. 3 Relationship between STAI values and preoperative anxiety for male subjects

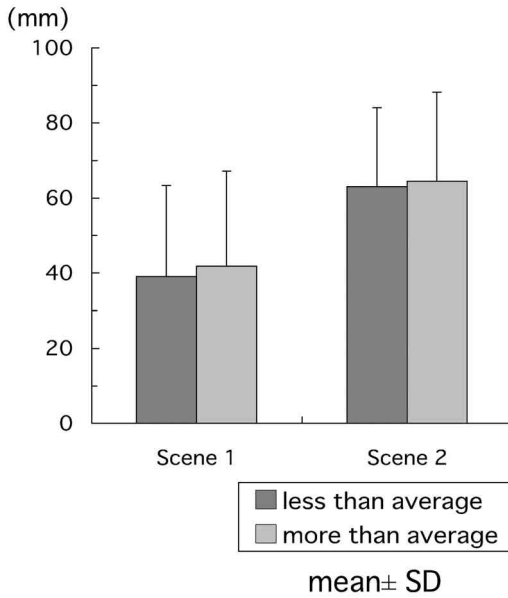


Fig. 4 Relationship between STAI values and preoperative anxiety

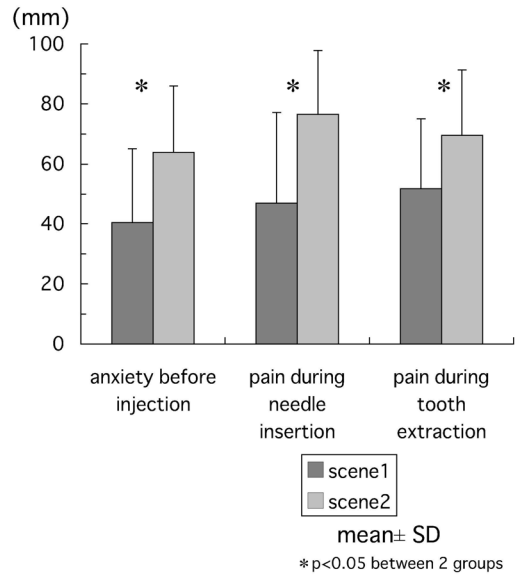


Fig. 5 Comparison between Scene 1 and Scene 2 for total subjects

(less than average:  $39.0 \pm 24.3$ , more than average:  $41.9 \pm 25.4$ ), or in Scene 2 (less than:  $63.1 \pm 21.0$ , more than average:  $64.5 \pm 23.7$ ; Fig. 4).

## 2. Comparison between Scene 1 and Scene 2

When comparing Scene 1 and Scene 2, the anxiety of subjects before injection of local

anesthesia was  $40.4 \pm 24.6$  and  $63.8 \pm 22.2$  for Scene 1 and Scene 2, respectively. The pain during insertion of the needle was  $46.9 \pm 30.2$  and  $76.5 \pm 21.3$  for Scene 1 and Scene 2, respectively. The pain during extraction of the tooth was  $51.7 \pm 23.2$  and  $69.5 \pm 21.9$  for Scene 1 and Scene 2, respectively. In all cases, Scene 2 showed significantly higher values than Scene 1 (Fig. 5).

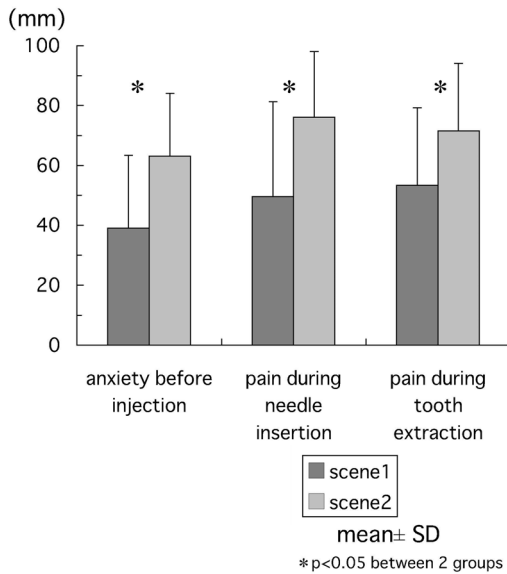


Fig. 6 Comparison between Scene 1 and Scene 2 for female subjects

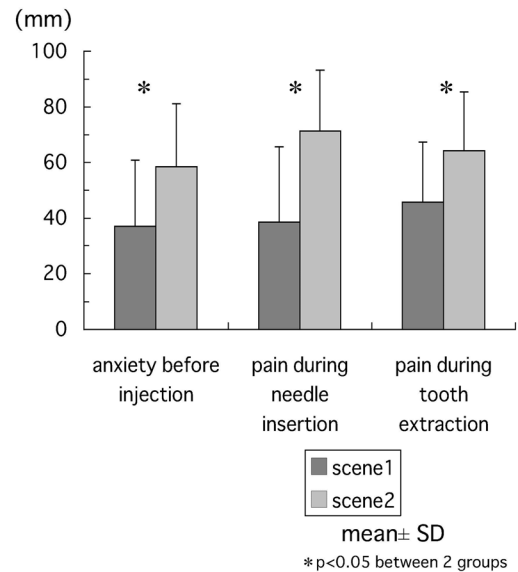


Fig. 7 Comparison between Scene 1 and Scene 2 for male subjects

In females, anxiety before injection of regional anesthesia was  $39.0 \pm 24.3$  and  $63.1 \pm 21.6$  for Scene 1 and Scene 2, respectively. The pain during insertion of the needle was  $49.6 \pm 31.7$  and  $76.1 \pm 22.0$  for Scene 1 and Scene 2, respectively. The pain during extraction of the tooth was  $53.4 \pm 25.8$  and  $71.5 \pm 22.6$  for Scene 1 and Scene 2, respectively. In all cases, Scene 2 showed significantly higher values than Scene 1 (Fig. 6).

In males, the anxiety before injection of regional anesthesia was  $37.0 \pm 23.8$  and  $58.4 \pm 22.7$  for Scene 1 and Scene 2, respectively. The pain during insertion of the needle was  $38.5 \pm 27.2$  and  $71.3 \pm 21.9$  for Scene 1 and Scene 2, respectively. The pain during extraction of the tooth was  $45.7 \pm 21.6$  and  $64.2 \pm 21.2$  for Scene 1 and Scene 2, respectively. In all cases, Scene 2 showed significantly higher values than Scene 1 (Fig. 7).

In all conditions, females showed higher values than males. However, there was no statistically significant difference.

## Discussion

No significant correlation was found between trait anxiety and preoperative anxiety in this study. Furthermore, there was no difference in the preoperative anxiety of Scene 1 and Scene 2 between the high- and low-trait anxiety groups. This suggests that there was no relationship between sensitivity to anxiety as a characteristic of a patient and amplitude of anxiety immediately before treatment. Scene 2 elicited significantly higher anxiety before injection of the regional anesthesia, significantly higher pain during insertion of the needle, and significantly higher pain during extraction of the tooth than Scene 1. This suggests that subjects feel stronger pain if anxiety in therapeutic environment is high.

### 1. Subjects

The subjects consisted of sixth-grader dental students. It was assumed that they well understood the flow of tooth extraction, including local anesthesia, as they all had experience of clinical training. In addition, they all had

training in infiltration anesthesia and infra-alveolar nerve block. Therefore, it was supposed that they would be able to imagine the pain that would occur during the insertion of a needle based on their experience.

Less than half of the students (male: 15/32, female: 11/25), however, had experienced a third molar extraction. Therefore, it was difficult for most of the subjects to imagine the pain and discomfort of tooth extraction based on personal experiences. However, in this study, lack of personal experience of tooth extraction had only a small effect on the difference between Scene 1 and Scene 2, as each subject evaluated both scenarios in a crossover manner.

Since all the subjects in this study were dental students, this specialized experimental condition may have affected the results. Further study should use subjects who are not specialists in medicine or dentistry.

## 2. Method

In this study, anxiety and pain were evaluated according to VAS, using two scenarios of third molar extraction, including one with an “environment where the patient feels strong anxiety” and one with an “environment where the patient feels safe and comfortable”.

The best way to evaluate anxiety and pain during dental treatment is to evaluate patients in the actual environment of tooth extraction. However, it is ethically unacceptable to artificially create an environment where a patient feels strong anxiety. Therefore, in this study, we used a method where the subjects were made to imagine anxiety and pain by using scenarios.

There are several methods of evaluating anxiety. Among them, STAI is the standard method<sup>8)</sup>. STAI can evaluate both trait anxiety, which indicates strength of anxiety based on the character of a subject, and state anxiety, which indicates strength of anxiety within a particular environment. However, it takes 15–20 minutes to fill in the STAI questionnaire. Therefore, it is difficult to evaluate state anxiety by STAI while reading a scenario, as was done in this study. Therefore, VAS was

used to evaluate state anxiety in this study. It has been reported that there is a good correlation between STAI and VAS when used to evaluate state anxiety<sup>9)</sup>.

## 3. Relationship between trait anxiety and state anxiety of subjects before extraction of tooth

This study found no relationship between trait anxiety in the subjects and state anxiety before extraction of a tooth. In other words, a person who hardly feels anxiety under normal circumstances may feel strong anxiety if the environment for treatment is bad and vice versa.

According to one report discussing the relationship between trait anxiety and state anxiety when securing a subject's vein<sup>6)</sup>, subjects with strong trait anxiety showed a greater increase in state anxiety when puncturing a vein and inserting a catheter than subjects who did not have strong trait anxiety. However, in this study, there was no difference in anxiety levels on entering the examination room between the subjects.

Therefore, it is necessary to create a clinical environment that does not promote patient anxiety.

## 4. Relationship between state anxiety before extraction of tooth and pain during insertion of needle and extraction of tooth

The results of this study suggest that a patient feels stronger pain if the state anxiety is strong in the therapeutic environment, and anxiety enhances pain irrespective of personal sensitivity to anxiety. Therefore, the same as previous reports on the relationship between state anxiety and pain when securing a vein<sup>4,7)</sup>, this study found that there was a relationship between state anxiety and pain in dental treatment. In a recent study<sup>2)</sup>, expectation of decreased pain reduced subjective experience of pain in healthy volunteers. Our results agree with that finding. We believe, therefore, that we may extrapolate our current results to generalized subjects who are not engaged in medical fields.

In this study, there was no difference in degree of anxiety before extraction of a tooth between female and male subjects. The same result was reported in a paper on preoperative state anxiety in patients with jaw deformities<sup>10)</sup>. Furthermore, it was supposed that there was no difference in the effect of state anxiety on pain between male and female subjects, as there was no difference in state anxiety and degree of pain during insertion of a needle and extraction of a tooth between male and female subjects. Therefore, these results suggest that it is important to establish a therapeutic environment that gives minimum anxiety to patients in order to reduce pain during treatment.

In conclusion, in this study, we discussed the effects of level of anxiety about dental treatment on pain during treatment. We found no relationship between trait anxiety in a subject and state anxiety before extraction of a tooth. In contrast, patients felt strong pain if state anxiety in the treatment environment was strong. As shown above, it is important to reduce anxiety during treatment to reduce pain during treatment.

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