

## A questionnaire survey on the effect of the sound of dental drills on the feeling of patients in dental clinics

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(Received 29 March 2006, Accepted for publication 18 May 2006)

**Keywords:** Sound of dental drills, Dental anxiety, Fear, Questionnaire survey

**PACS number:** 43.50.Qp [doi:10.1250/ast.27.305]

### 1. Introduction

The Japan Dental Association and the Ministry of Health, Labor and Welfare are currently promoting regular dental check-up to improve the current status of 80-year-old Japanese elderly who have only an average of 8 teeth remaining in their oral cavity [1]. Fear and stress frequently prevent people from visiting dental clinics for preventive and therapeutic treatments [2–5]. There are several reports concerning “pain” as a factor causing dental anxiety. On the other hand, little information is available regarding the psychological influence of the sound of a dental drill in dental treatment. The dental high-speed air turbine (drill) is an indispensable apparatus in dental treatment. However, the sound of a dental drill seems to make patients fearful. The aim of this study is to examine the effects of the sound of a dental high-speed air turbine on patients’ feeling and to assess the relationship between the dental air turbine sound and dental anxiety level by conducting a questionnaire survey.

### 2. Questionnaire survey

#### 2.1. Respondents

The respondents were 161 males and 398 females. They were ordinary people, outpatients, university students, dental hygienist students and dental clinical students as shown in Table 1. They were requested to answer a questionnaire.

#### 2.2. Questionnaires

The contents of the questionnaire were as follows:

(1) *Dental anxiety*: Dental anxiety level was measured using two kinds of scale. One is a 5-step category scale (Dental Anxiety Question (DAQ) [6]; cf. Fig. 1) and the other is based

on Corah’s Dental Anxiety Scale (DAS), which consists of four questions, each with 5-step categories [7]. The respondents were also requested to answer 11 questions regarding situations that might make them fearful when visiting a dental clinic (cf. Fig. 5).

(2) *Unpleasant feeling at a dental clinic*: The respondents were asked for the reasons of their unpleasant feeling at a dental clinic (cf. Fig. 3).

(3) *Experience of avoiding dental treatment*: The respondents were asked whether they had postponed or canceled their dental appointments because of dental fear.

(4) *Habituation to noise*: The respondents were asked whether they were easily habituated to environmental noise.

(5) *Face sheet*: The gender, age and dental experience of the respondents in the previous year were asked.

### 3. Results and discussion

#### 3.1. Dental anxiety

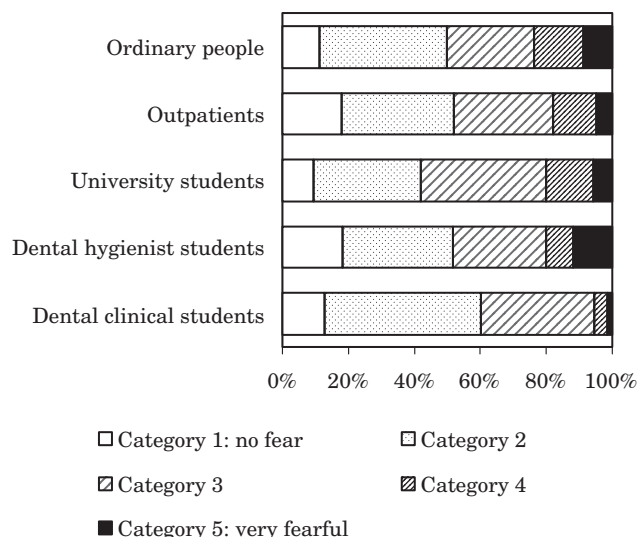
Dental anxiety constitutes one of the major problems of dental patients. The results of DAQ survey are shown in Fig. 1. The respondents who were not afraid of visiting a dentist were only 11–18%, that is, most of the respondents had some degree of fear. There was a significant correlation for dental anxiety between the score of Corah’s Dental Anxiety Scale and the score of DAQ (Spearman’s rank correlation; correlation coefficient  $r = 0.7$ , significant level  $p < 0.001$ ).

The percentage of the respondents who had postponed or cancelled an appointment with a dental clinic because of dental fear was 16.5%. The ratios of having these experiences increase as dental anxiety level increases are shown in Fig. 2. In particular, half of those who answered that they were very fearful had the experience of escaping a dental treatment at least once.

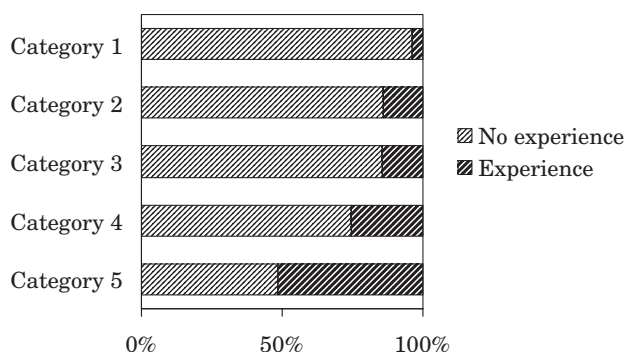
It is reported that the reasons for not regularly visiting a dental clinic were “lack of time” (36%), “no need for treatment” (34.1%), “fear of dentist” (13.3%) and “cost” (16.6%) [3]. However, little information is available regarding the reasons for intentional postponement or cancellation of a dental appointment. It is difficult for dentists to think of other reasons except for illness, other commitments and forgetfulness. Patients generally rarely cite fear as their reason for cancelling treatment appointments. Dentists need to consider patient’s fear more carefully.

**Table 1** Respondents.

Group	Female	Male	Total	Average age
Ordinary people	75	39	114	35.8
Outpatients	73	31	104	53.4
University students	80	25	105	19.4
Dental hygienist students	110	0	110	19.2
Dental clinical students	60	66	126	24.6
Total	398	161	559	30.2



**Fig. 1** Results of dental anxiety question (DAQ). Percentages of each group of respondents who answered using 5-step category scale to the question, “Are you afraid of undergoing dental treatment?”

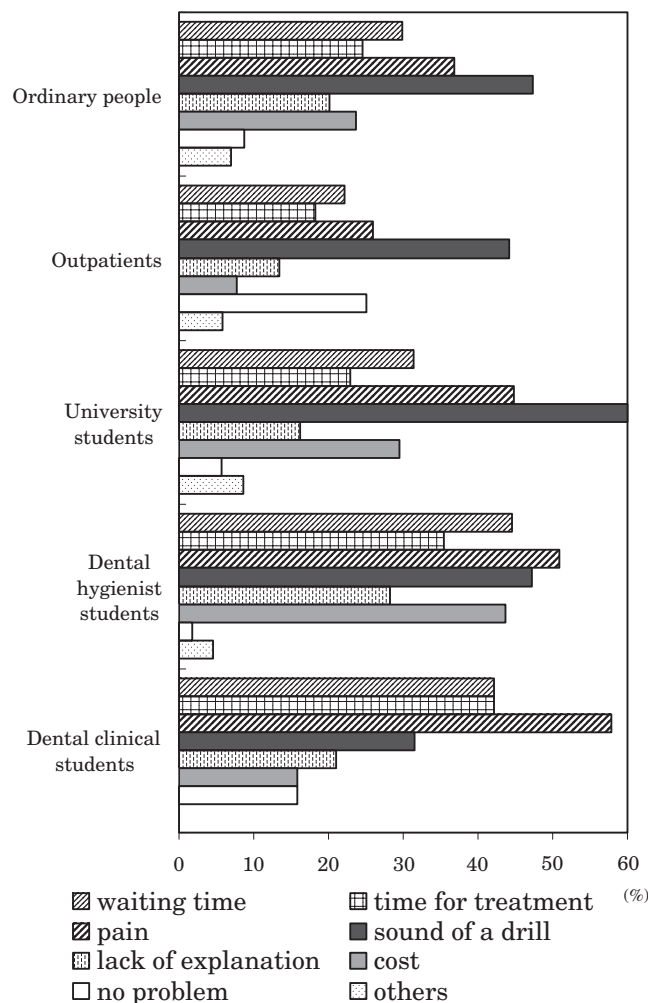


**Fig. 2** Results of cross analysis of experience to postpone or cancel a dental appointment using dental anxiety as a key item. The keys are as follows: Category 1: no fear, Category 5: very fearful.

### 3.2. Unpleasant feeling

The results of our survey on unpleasant feeling at a dental clinic are shown in Fig. 3. Almost half of the respondents of each group, except for the dental clinical students, answered that the sound of a dental drill made them feel unpleasant. In particular, the sound of a dental drill was chosen with the highest percentage among the items that cause unpleasant feeling in the three groups of the respondents.

Because dental anxiety may differ depending on the feeling of the respondents, cross analysis was conducted using unpleasant feeling to the sound of a dental drill as a key item. Respondents who answered that they experienced unpleasant feeling with the sound of a dental drill were classified as group “Y” and respondents who answered that they did not experience any unpleasant feeling with the sound of a dental drill were classified as group “N.” The results are shown in Fig. 4. There was a significant difference in dental anxiety level between groups “Y” and “N” (Mann-Whitney’s *U* test;



**Fig. 3** Percentages of each group of respondents who answered that they felt unpleasant at a dental clinic.

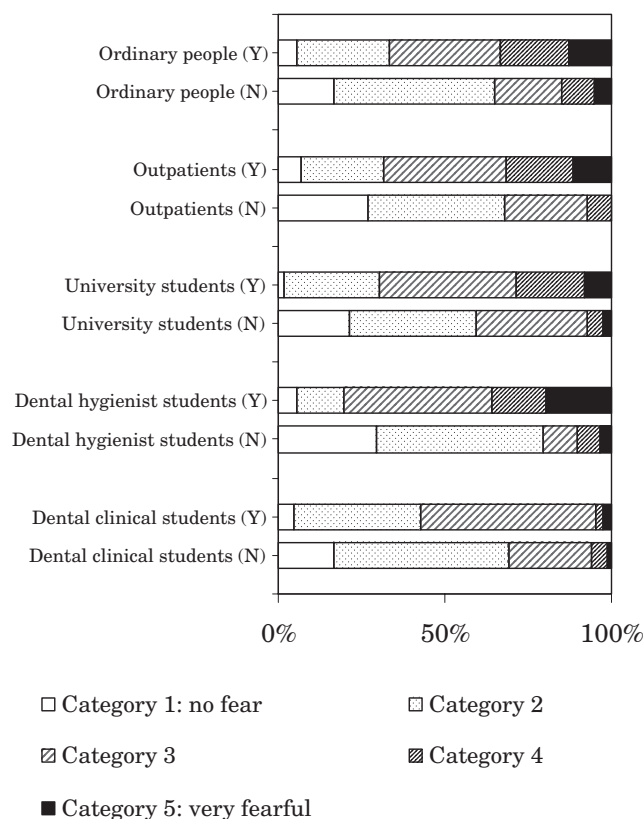
$p < 0.001$ ). Those who experienced unpleasant feeling with the sound of a dental drill tended to be more fearful of dental treatment than those who did not experience such unpleasant feeling. This suggests that the sound of a dental drill creates a psychological effect on dental patients and it would be important to improve the sound.

### 3.3. Fearful feeling

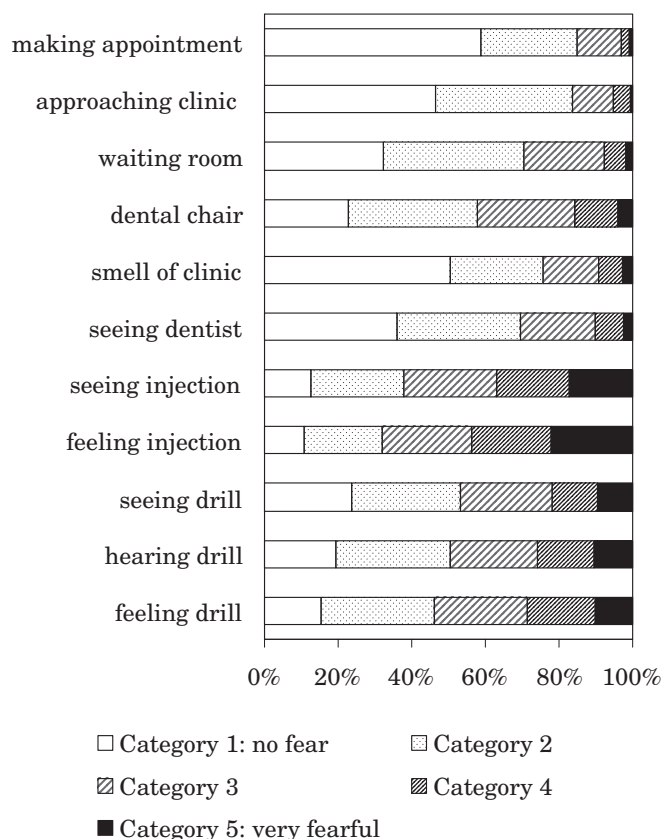
Eleven situations often encountered during a dental treatment were listed and the respondents were asked to rate each situation selecting from 5-step categories in terms of how much each situation made them fearful. Category 1 indicated no fear and category 5 indicated very fearful. The results are shown in Fig. 5.

Making an appointment with a dental clinic is the first step in receiving dental treatment and even at this first step, approximately 42% of the respondents answered that they were afraid of making such appointments. There seems to be something that makes them hesitate to make an appointment although they know that it is important to visit a dental clinic.

Most of the respondents were scared of seeing a needle and feeling needle injection. Because it is well known that people are very sensitive to needle injection, dentists are taking care to prevent patients from seeing the needle to



**Fig. 4** Results of cross analysis of dental anxiety showing whether the sound of a dental drill is unpleasant (Y) or not (N) as a key item.



**Fig. 5** Answers to the question, "How fearful are you of each situation?"

relieve their stress, to spread surface anesthesia and to slow down injection speed for the relief of pain.

Next to needle injection, there are many respondents who answered that they feared a dental drill. The numbers of respondents who feared hearing the sound of a dental drill and feeling a drill were almost equal. This suggests that uneasiness is intensified when patients hear the sound of a dental drill even before the actual drilling treatment. However, little attention has been given to the sound of a dental drill, because it is thought that drilling is not painful when anesthesia is effective.

### 3.4. Regression analysis

To examine the relative influence of a number of variables experienced in ordinary dental situations on dental anxiety, multiple regression analysis was carried out. Data were analyzed using the initial factor method with Varimax rotation. The results of the factor analysis are shown in Table 2. Three factors were extracted from 11 items and the total variance explained was 68.6%. The representative items that loaded most strongly on each factor were "approaching a dental clinic" (loading = 0.843), "seeing an injection needle" (0.853) and "hearing the sound of a dental drill" (0.884). On the basis of the results of the factor analysis, "hearing the sound of a dental drill," "seeing an injection needle" and "approaching a dental clinic" were selected as independent variables for the multiple regression analysis. Moreover, "habituation to noise" was used as an independent variable as a general attitude to sound. The dental anxiety score in the 5

**Table 2** Results of factor analysis. The rotated factor loadings are the correlations between the variable and the factor.

Variable	Factor		
	1	2	3
Making appointment	0.505	0.047	0.115
Approaching clinic	0.843	0.131	0.210
Waiting room	0.837	0.165	0.255
Dental chair	0.751	0.241	0.360
Smell of clinic	0.500	0.238	0.421
Seeing dentist	0.517	0.363	0.442
Seeing injection	0.175	0.853	0.209
Feeling injection	0.158	0.646	0.425
Seeing drill	0.320	0.343	0.768
Hearing drill	0.310	0.218	0.884
Feeling drill	0.275	0.246	0.767

steps (DAQ) was used as a dependent variable. SPSS was used for statistical analysis. The results of the multiple regression analysis are shown in Table 3. Dental anxiety had a significant positive association with uneasiness due to "hearing the sound of a dental drill," "seeing an injection needle," "approaching a dental clinic" and "habituation to noise." The adjusted  $R^2$  value in this model is 0.612, which is the overall strength of the regression analysis. Beta weight is calculated for each independent variable, and is a measure of the degree

**Table 3** Results of the multiple regression analysis. The regression model for dental anxiety with uneasiness due to “approaching a dental clinic,” “seeing an injection needle,” “hearing the sound of a dental drill” and “habituation to noise.”

Model	Beta	t-value	Significance
Hearing drill	0.381	11.054	$p < 0.001$
Approaching clinic	0.329	10.428	$p < 0.001$
Seeing injection	0.213	6.907	$p < 0.001$
Habituation to noise	0.104	3.396	$p < 0.01$

of influence on the dependent variable. The highest Beta standardization coefficient value was obtained for the variable “hearing the sound of a dental drill” in this model. This suggests that the fear of the sound of a dental drill has the greatest influence on dental anxiety among the four independent variables used.

### 3.5. Difference among groups

Dental hygienist students and dental clinical students who will be engaged in dental clinics in the future were included as respondents in this survey. There was a statistically significant difference between the dental clinical students and the other respondents in terms of dental anxiety level (Kruskal-Wallis test;  $p < 0.05$ ) (cf. Fig. 1).

The percentage of dental experience in the previous year was 44.4% for the ordinary people and 42.9% for the university students. These results are almost the same as 41% for adults in Japan [1]. It is needless to say that it was 100% for the patients’ group. On the other hand, it was 73.3% for the dental hygienist students and 70.6% for the dental clinical students. This may be because dental hygienist students and dental clinical students are more concerned with teeth health than the other groups.

As for the trigger of unpleasant feeling, many of the dental hygienist students and dental clinical students selected pain more often than hearing the sound of a dental drill. However, the hygienist students answered that the sound of a dental drill was almost equally unpleasant to the ordinary people. This is because the dental hygienist students included in this survey were still freshmen and their experience as hygienist is limited. On the other hand, the dental clinical students in this study have already been trained with the use of the dental high-speed air turbine, thus, they tended to tolerate better the sound of a dental drill than the other groups.

## 4. Summary

A questionnaire survey was conducted with 559 people and the relationship between the sound of a dental drill and dental anxiety level was examined. The following results were found.

- (1) There were individual differences in terms of unpleasant feeling to the sound of a drill and approximately half of the respondents felt the sound of a dental drill as unpleasant.
- (2) Those who answered that the sound of a dental drill was unpleasant tended to be more fearful of dental treatment than the other respondents.
- (3) The fear of the sound of a dental drill had a strong influence on dental anxiety level.
- (4) There were differences in unpleasant feeling for the sound of a dental drill between dental clinical students who were already trained to use the dental air turbine compared with the other respondents.

These results suggest that it is necessary to take care of the sound of dental drills to reduce the fear of patients from visiting a dental clinic. The frequency spectra of air-conducted sound and bone-conducted sound under dental treatment were previously measured and analyzed [8]. It was found that each sound included audible and ultrasonic frequencies. Ultrasound can be perceived through bone conduction [9]. Further research on the sound characteristics and quality of dental drills is being conducted.

## Acknowledgements

The authors are grateful to Prof. Yutaka Kano of Osaka University for his kind advice regarding the statistical analysis.

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