A study of the effect of the sound of dental equipment on dental anxiety

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ABSTRACT

Dental anxiety is considered to be a serious public health problem in spite of the technological development achieved in modern dentistry. It is known that the psychological influence of the sound of dental equipment is unclear. This paper reports a study conducted by the authors to investigate the effects of the sound of dental equipment on people's perceptions and dental anxiety levels. The study used a questionnaire survey. The convenience sample for the survey comprised 230 dental students and 230 gender and age matched non-dental university students. The subjects were requested to answer the questionnaires themselves. It is found that among the five anxiety-provoking factors examined (sound, smell, taste, sight, and feeling), the sound of dental equipment has a great influence on dental anxiety among non-dental students.

INTRODUCTION

It is known that the health of our teeth and mouth are linked to overall health and well-being of a person in a number of ways including chewing and swallowing of food, speech communication, self-esteem and so forth. Dental treatment and oral health are therefore of paramount importance. However, studies have suggested that as many as 75% of US adults experience some degree of dental fear from mild to severe (Kleinknecht et al. 1984; Getka & Glass 1992; Milgrom et al. 1995). The fear/anxiety of dentistry and of receiving dental care has significant impact on daily oral health. This is a serious problem to both patients and dental care provided. This also raises questions on what aspects of the dental setting may have the potential to cause dental anxiety or fear. Considerably a large number of investigations have been sought to find out the potential anxiety-provoking stimuli present in the dental setting. These stimuli include receiving an injection (Corah et al. 1985; Scott et al. 1984), having dental X-rays taken (Doebling & Rowe 2000), the sight of the needle (Gale 1972), various aspects of the drill such as its appearance, sound, and feeling (De Jongh et al. 2003), improper behaviour on the part of the dentist (Abrahamsson et al 2002), pain sensations (Mellor 1992), and several other potentially fear-evoking aspects of the dental practice environment including its smell, dental personnel, and the chair (Domoto et al. 1988). There are a lot of investigations on potential dental anxiety-provoking stimuli. However, few have concentrated on the anxiety-provoking impact of dental equipment, including the high-speed air-turbine (dental drill) and the ultrasonic dental scaler shown in Figure 1 and Figure 2 respectively. The

psychological influence of the sound of dental equipment remains unclear, especially in terms of the effect of the dental drill on willingness to seek dental treatment.

There is increasing concern about noise and vibration problems in the indoor environment, as they relate to public health (Wong et al 2011). As a result of these concerns, a large number of investigations have been sought to study such problems (Mak 2005; Mak & Lui 2012; Mak & Su 2002; Mak et al. 2009; Ou & Mak 2011; Sorainen & Rytkonen 2005). The effect of the sound of dental equipment on dental anxiety is of importance as it affects oral health, which in turn has an impact on public health. Since dental anxiety is closely related to one's past experience in dental clinics, the purpose of this study was therefore to investigate the effects of the sound of dental equipment on people's perceptions and dental anxiety levels using a questionnaire survey.

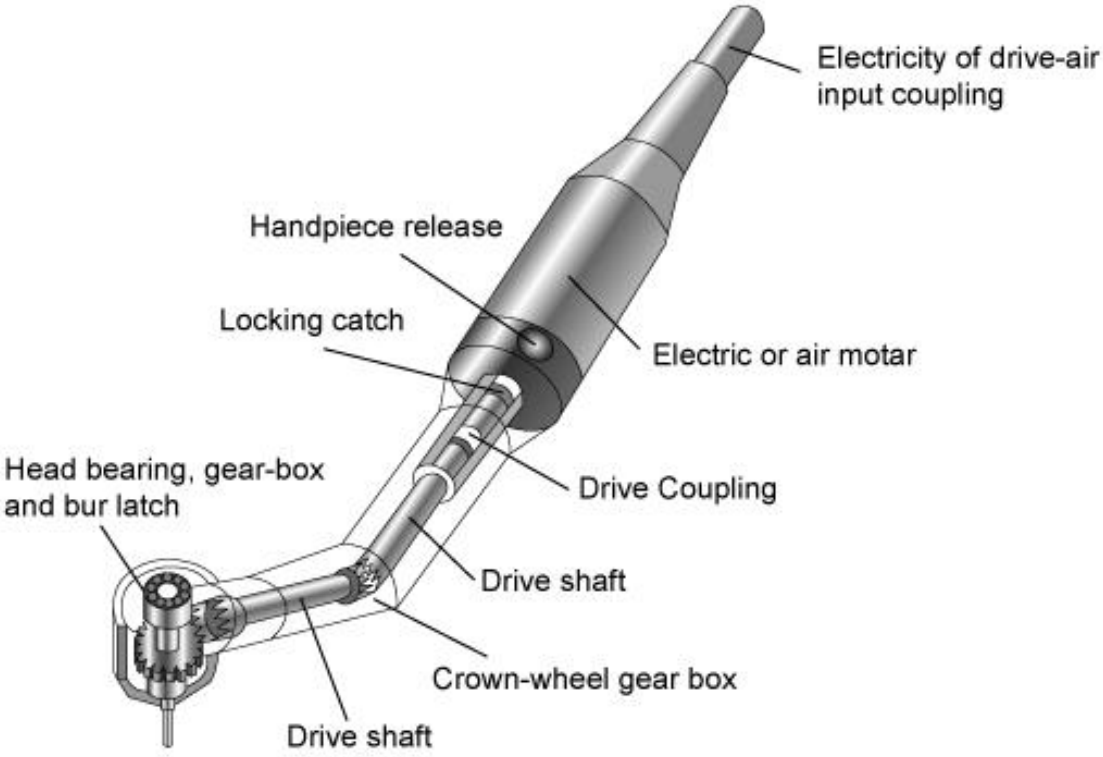

Figure 1: An example of a dental drill

Figure 2: An example of an ultrasonic dental scaler

METHODS

Questionnaire survey

A convenience sample was selected for this survey. Two hundred and thirty dental students at the University of Hong Kong were invited to participate, and 230 gender and age-matched non-dental students were recruited from other universities in Hong Kong. The students completed a four-part questionnaire themselves. The questionnaire was used to examine the effects of the sound of a dental drill on people's perceptions and assess the relationship between that sound and dental anxiety. The first part of the questionnaire (Wong et al 2011) contained 73 potentially anxiety-provoking stimuli present in the dental setting. Each stimulus was scored on a 4-point scale ranging from 1 (not anxiety-provoking at all) to 4 (extremely anxiety-provoking). The second part of the questionnaire comprised the Dental Anxiety Scale (DAS) and the Dental Anxiety Question (DAQ). The DAS is a 4-item dental trait anxiety measuring scale that is the most widely used scale in dental anxiety studies. The four items in the scale are "If you had to go to dentist tomorrow, how would you feel about it?", "When you are waiting in the dentist's office for your turn in the chair, how do you feel?", "When you are in the dentist's chair waiting while the dentist gets the drill ready to begin working on your teeth, how do you feel?", and "You are in the dentist's or hygienist's chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he or she will use to scrape your teeth around the gums, how do you feel?" Responses are scored from 1 to 5, giving total scores ranging from 4 (not anxious at all) to 20 (extremely anxious). The DAQ is a single-item dental anxiety question. Respondents were asked the question and were scored from 1 to 4 to measure their degree of fear toward dental treatment. The third part of the questionnaire was about the perceived unpleasantness of the sound of the dental drill. Respondents were asked three questions focusing on their degree of perceived unpleasantness towards noise and their experience of hearing the sound of the dental drill. The three questions were "Are you easily habituated to

environmental noise?", "Would you feel more comfortable during dental treatment if the sound of the dental drill were lower?" and "What is the grade of perceived unpleasantness brought by the sound of the dental drill?" In the first question, environmental noise referred to general environmental noise including indoor environmental noise, construction site noise, neighborhood noise, and traffic noise. This question was intended to investigate the general attitude of dental and non-dental students to sound. In the third question, the grades included "no perceived unpleasantness", "slight perceived unpleasantness", "moderate perceived unpleasantness", and "extreme perceived unpleasantness". The fourth part of the questionnaire consisted of items pertaining to demographic variables such as university attendance, age, and gender.

Statistical analysis

Data were coded and analysed using the software package SPSS for Windows 17.0 (SPSS Inc., Chicago, IL, USA). The SPSS is a widely used program for statistical analysis in social science. It is also used by researchers in the fields of health, engineering, built environments and other fields.

RESULTS

Fifty percent of both the dental and non-dental students were male, and the age range was from 17 to 24 years. There was no statistically difference for gender and age between the dental and non-dental students ($P>0.05$). Based on the hierarchy of the mean capacities and standard deviations for the 73 anxiety-provoking stimuli and the percentage of participants who rated each stimulus as extremely anxiety provoking (capacity 4) for the non-dental students and the dental students, it was found that among the total of 73 stimuli examined, the sound of these two items of dental equipment (dental drill and dental scaler) provoked a relatively high level of dental anxiety. In addition, the non-dental students regarded the sound of dental equipment as more anxiety-provoking than did the dental students and that a higher percentage of non-dental students rated the sound of dental equipment as extremely anxiety-provoking. The details can be found in the published papers of the authors (Wong et al 2011).

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Dental anxiety and the dental anxiety-provoking factors

Table 1 shows the differences between dental and non-dental students in the scores for the five dental anxiety-provoking factors (sound, smell, taste, sight and feeling), the Dental Anxiety Question (DAQ) (Neverlien 1990), and the Dental Anxiety Scale (DAS) (Corah 1969). The mean capacities of the five anxiety-provoking factors among the non-dental students were all significantly higher than those among the dental students ($P< 0.001$). Significant differences in DAQ ($P< 0.01$) and DAS (P<

0.001) scores were also found between the dental and non-dental students. These results show that the non-dental students had a statistically higher level of dental anxiety when measured by the DAQ and the DAS and a greater capacity to become anxious on hearing the sound of dental equipment in comparison with the dental students. A stepwise regression analysis was adopted to evaluate the relative influence of the anxiety-provoking factors on dental and non-dental students. The DAS score was selected as the dependent variable and the five anxiety-provoking factors were chosen as the independent variables. The results of the stepwise regression analysis are shown in Tables 2 and 3. A statistically significant model was obtained, and when "feeling" and "sound" were input into the model, significant P-values (P< 0.001) were obtained for non-dental students. The standardized betas showed that the "feeling" factor contributed principally to dental trait anxiety and that the "sound" factor had a secondary influence on dental trait anxiety. In addition, dental trait anxiety was also affected by the "dental/non-dental" property. The value of R^2 indicated that 94.0% of the variance in the DAS score was explained by the regression model. However, for dental students, only "feeling" entered the statistically significant model (P< 0.001). This means that the fear of the sound of dental equipment has a significant influence on dental anxiety among non-dental students, but not on dental students.

Table 1: Mean (SD) scores for dental anxiety-provoking factors, DAQ, and DAS between the dental and non-dental students

	Non-dental students	Dental students
Sound***	2.57 (0.94)	2.07 (0.86)
Smell***	2.22 (0.97)	1.70 (0.78)
Taste***	2.24 (0.91)	1.88 (0.85)
Sight***	2.03 (0.71)	1.70 (0.80)
Feeling***	2.58 (0.97)	2.18 (0.91)
DAQ**	2.14 (0.86)	1.87 (0.72)
DAS***	9.74 (3.79)	8.04 (2.43)

Mann-Whitney test
** *P*< 0.01, *** *P*< 0.001

Table 2: Results of stepwise regression analysis with DAS as the dependent variable for the non-dental students

Variable	β	Standardized-β	*P*
Feeling	3.431	0.693	0.000
Sound	1.122	0.284	0.000

R^2 = 0.940, *F* = 1700.854 (*P*< 0.001)
Excluded independent variables: smell, sight, taste

Table 3: Results of stepwise regression analysis with DAS as the dependent variable for the dental students

Variable	β	Standardized-β	*P*
Feeling	4.451	0.963	0.000

R^2 = 0.927, *F* = 2918.780 (*P*< 0.001)
Excluded independent variables: smell, sight, taste, sound

CONCLUSIONS

A questionnaire survey was conducted. The convenience sample for the survey comprised 230 dental students and 230 gender and age matched non-dental university students. It was found that among the five anxiety-provoking factors examined (sound, smell, taste, sight, and feeling), the sound of dental equipment has a great influence on dental anxiety among non-dental students.

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