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[ORIGINAL]

## A questionnaire study regarding local anesthesia in dentistry and safety measures in dental clinics among dental students

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### Abstract

This reports the results of a questionnaire study of dental students on the awareness of “local anesthesia” and “use of patient monitoring systems” in dental clinics. Subjects participated in the present study included 96 sixth year dental students (D6) and 93 first year dental students (D1).

The results indicate that the majority of respondents including both D6 and D1 support the notion that a “dentist” is the most suitable person to perform local anesthesia in dental treatment. With respect to education in local anesthesia, 49.0% of D6 respondents consider that education of local anesthesia is essential in post-graduate internships and 92.5% of the D1 group answered that it is essential in undergraduate education. About a third of respondents D6 : 30.2% and D1 : 34.4% were aware of the danger that patients may pass away during dental treatment, prior to enrollment in dental school. Effective measures when attempting to promote safety in dental local anesthesia reported by D6 indicated 50% or higher for painless local anesthesia using an electric-type syringe, allergy tests, topical anesthesia prior to local anesthesia, use of a patient monitoring system, nitrous oxide/oxygen inhalation sedation, intravenous sedation, and quantitative assessments of pain and anxiety. Regarding education in the use of a patient monitoring system and data assessment, 54.2% of D6 responded that it is “essential” for post-graduate internship, and 86.0% of D1 responded that it is “essential” in undergraduate education. Overall the study suggests that there is a need for more education in this area at an early stage to promote safety in dental clinical fields.

**Key words ;** Dental anesthesiology, Local anesthetic injection, Awareness questionnaire, Dental students

### Introduction

The number of systemic accidents among dental patients' ranges from 4 to 7 cases per 100,000 patients, and of these 5 or more cases per year result in death. Eighteen cases of dental anesthesia-related accidents were reported during the period from 1981 through 2000, and of these 15 cases were deaths (Kaku et al., 2004). Most of these dental anesthesia-related accidents occurred due to local anesthetic injections with outpatients. To promote safety measures in dental clinics and improving the quality of dental education, a questionnaire study of dental student awareness of “local anesthesia” and the “use of a patient monitoring system” in dental clinics was conducted.

### Methods

#### 1. Places and Dates

The questionnaire was administered at the University Dental Hospital and at lectures in the Faculty of Dentistry in May and June of 2002.

#### 2. Subjects and Education

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### 1 ) Subjects

Subjects participating in the present study included 96 sixth year dental students (66 males and 30 females, mean 25.8±2.7 years old, referred to as D6 in the following) who were enrolled in lectures and clinical training courses in dental anesthesiology and 93 first year dental students (64 males and 29 females, mean of 20.0±2.8 years old, referred to as D1 below) who were introduced dental anesthesiology clinics. The responses of the two groups, D6 and D1, were compared.

### 2 ) Undergraduate education

The courses offered are visiting the dental anesthesiology clinic in the first semester of the first year, dental anesthesiology lectures (80 min × 30) and basic practice with measurement of blood pressure (120 min × 1) in the fourth year, lectures on dentistry for the handicapped (80 min × 2), a geriatric dentistry lecture (80 min × 1), and dental anesthesiology clinical training (5 days/ a week, twice : total 10 days) in the fifth year. The clinical training covers the following areas : infiltration/conduction of anesthetic injections using a dental local of anesthetic injection training model (Kudo et al., 2002), anesthetic infiltration injections among students, nitrous oxide/oxygen (N<sub>2</sub>O/O<sub>2</sub>) inhalation sedation (Kudo 2003), use of a patient monitoring system and interpretation of data, cardiopulmonary resuscitation using a simulator, and performance of the procedural practices that are needed for BLS (basic life support) and ACLS (advanced cardiac life support) in emergency cardiovascular treatment, and student visits to a pain clinic and observation of dental care under general anesthesia. In addition, a total of 14.1 hours of lectures concerning cardiopulmonary resuscitation and systemic accidents (fourth grade, 80 min × 2, fifth grade ; practice lectures 90 min.) and clinical training (5 hours × 2) are offered at the Faculty of Dentistry. It is thought that the courses offered are typical of dental education.

### 3 . Questionnaire (Items questioned)

The questionnaire used a standard self-recording type questionnaire sheet. Questions included 40 items concerning dental anesthesiology clinics and dental anesthesiology education. Five questions concerning dental clinical accidents, local anesthesia, and the use of a patient monitoring system were tabulated and the percentages were calculated relative to the number of the students that responded. The questionnaire response sheets were collected from the cooperating students who understood the main objective of the study at the facilities where the questionnaire was administered.

#### 1 ) Local anesthesia

##### (1)Optimal administration of local anesthesia in dental clinics

The question was "Select one person who should optimally perform the local anesthesia in dental clinics", and the suggested responses were "dentist", "medical doctor", "both dentist and medical doctor", "do not know" and "other, specify the choice".

##### (2)Education in local anesthesia

The D6 group was asked whether the following education is necessary, "internship in local anesthetics after graduation ;" and D1 were asked about "education in local anesthetics at the Faculty of Dentistry". The answer choices offered were "essential", "only if wanted", "not necessary", and "other, specify the choice".

#### 2 ) Risks in dental clinics and preventive measures

##### (1)Knowledge about the risks of patient death during dental treatment

The question was "were you aware of the fact that patients may accidentally die during dental treatment before you enrolled in dental school?" and the answer choices offered were "yes" or "no".

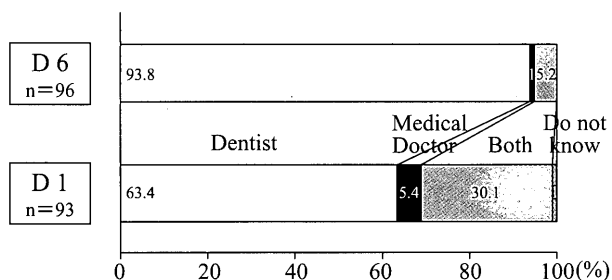
##### (2)Measures to promote safety in local anesthesia

The D6 group was asked "to select measures that would be effective when promoting safety in dental local anesthesia", and answers could be selected from the following : topical anesthesia, painless local anesthesia using an electric-type syringe, use of a patient monitoring system, N<sub>2</sub>O/O<sub>2</sub> inhalation sedation, intravenous sedation, quantitative assessment of pain and anxiety, allergy tests, and other, specify the choice.

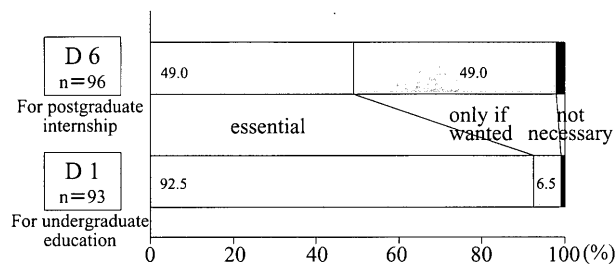
##### (3)Education in the use of a patient monitoring system and data assessment

The question for the D6 group was "is a post-graduate internship in the use of a patient monitoring system and data assessment necessary?", and the question for the D1 group was "is education at the Faculty of Dentistry in the use of a patient

monitoring system and data assessment necessary?" The answer choices were "essential", "only if wanted", "not necessary", and "other, specify the choice".



**Fig.1** Optimal performers for local anesthesia in dental clinics  
 "Dentist" was chosen by D6 : 93.8%/D1 : 63.4%, "medical doctor" was D6 : 1.0/D1 : 5.4%, "both dentist and medical doctor" was D6 : 5.2/D1 : 30.1%



**Fig.2** Education in local anesthesia  
 The answer "essential" was 49.0% from D6 and 92.5% from D1.

### Results

#### 1) Questionnaire return rates

The questionnaire return rate was 100%.

#### 2) Local anesthetics

##### (1) Optimal administration of local anesthesia in dental clinics

"Dentist" was chosen by 93.8% of D6 and 63.4% of D1 (the following results for the D6 and D1 groups are shown as D6/D1), "medical doctor" 1.0/5.4%, "both dentist and medical doctor" 5.2/30.1% (Fig.1).

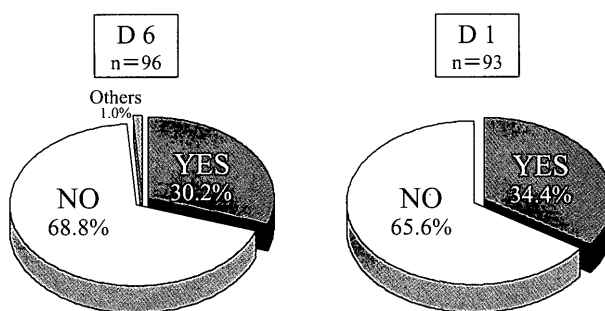
##### (2) Education in local anesthesia

The answers from the D6 group about a post-graduate internship was "essential" 49.0%, "only if wanted" 49.0%, and "not necessary" 2.1%. The answers of the D1 group about undergraduate education was "essential" 92.5%, "only if wanted" 6.5% and "not necessary" 1.1% (Fig.2).

#### 3) Risks in dental clinics and preventive measures

##### (1) Knowledge about the risk of patient deaths during dental treatment (prior to enrollment in dental school)

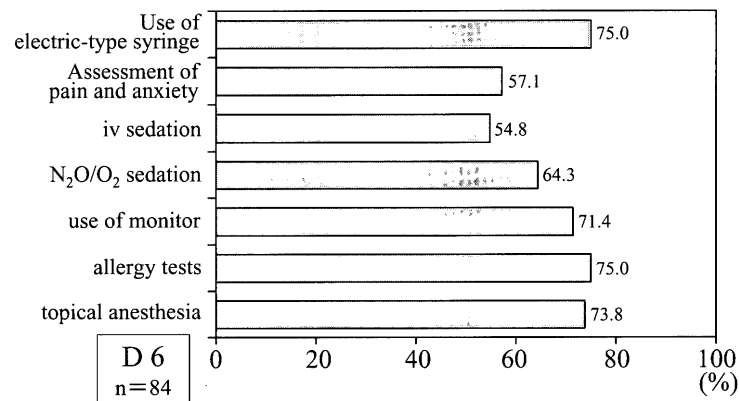
Those aware of this fact were 30.2/34.4% (Fig.3).



**Fig.3** Knowledge about the risks of patients' death among dental patients before enrollment  
 "Those who were aware of the fact" were D6 : 30.2/D1 : 34.4%.

##### (2) Measures to promote safety in local anesthesia

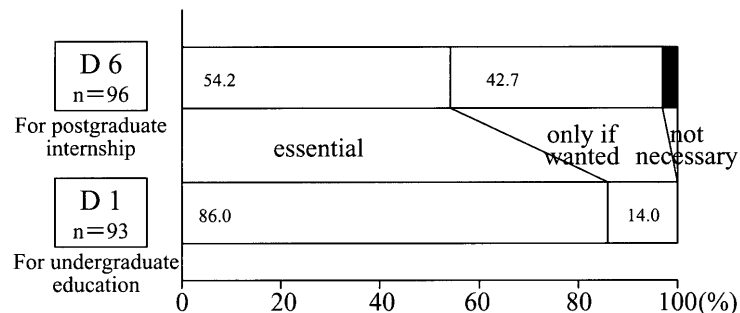
The responses from the D6 group higher than 50% were : 75.0% for both painless local anesthesia using an electric-type syringe and allergy tests ; 73.8% for topical anesthesia prior to local anesthesia ; 71.4% for use of a patient monitoring system ; 64.3% for N<sub>2</sub>O/O<sub>2</sub> inhalation sedation ; 54.8% for intravenous sedation ; and 57.1% for pain and anxiety quantitative assessments (Fig.4).



**Fig.4** Effective measures for promoting safety of dental local anesthesia  
The most popular response from D6 was painless local anesthesia using an electric-type syringe and allergy tests.

### (3) Education in the use of a patient monitoring system and data assessment

The answers from the D6 group about post-graduate internship were : 54.2% “essential” ; 42.7% “only if wanted” ; and 2.1% “not necessary”. The answers from the D1 group about undergraduate education were : 86.0% “essential” ; 14.0% “only if wanted” ; and 0% “not necessary”(Fig.5).



**Fig.5** Education concerning the use of a patient monitoring system and data assessment  
The most popular answer from D6 was 54.2% supporting as “essential”.  
The most popular answer from D1 was 86.0% supporting as “essential”.

## Discussion

Media coverage of clinical accidents has increased. At the time when the questionnaire was administered, a fatal dental outpatient accident due to a local anesthetic injection was widely reported (Asahi news paper, 2002). The 70% of students who, prior to the enrollment in dental school, were not aware that deaths of dental patients may occur would have very little awareness of the necessity for safety measures in dental clinics. According to Sakuki et al., visits to dental anesthetic clinics during the time immediately after enrollment in the first year of dental school results in a higher motivation to promote safety in medical care of dental patients (Sakuki et al., 2004). In addition, Miyamoto et al. reported that very small numbers of fourth and fifth year dental students demonstrated an interest in oral surgery and dental anesthesiology (Miyamoto et al., 2004). Therefore, opportunities to promote awareness and technical education must be given early to promote safety in dental clinics.

Over 90% of the D6 respondents suggested that the optimal person to perform dental local anesthesia is the dentist, leading to the conclusion that interest in local anesthesiology is very high. According to Shimada, accident cases are presently reported in the clinical training of dental students at many universities (Shimada et al., 2005). The School of Dentistry at Health Sciences University of Hokkaido has offered an introduction to technical education in how to conduct anesthesia by injection since 1984 using a dental local anesthetic injection training model (DLAITM) (Kudo et al., 2002) for pre-clinical training. Last year, a DLAITM was developed which introduced the possibility of training in low pressure injection of a solution for infiltration injection. With the introduction of technical education using the DLAITM at an early stage in dental school, we can expect better clinical education in local anesthetic injection beyond the requirements for OSCE (Basic Skills :

infiltration anesthetics).

Regarding education in the use of a patient monitoring system, 54.2% of the D6 group considered it essential in post-graduate internship and 86% of the D1 group in undergraduate education. This education must be introduced with a strong emphasis on case reports. In the field of clinical oral surgery, Sekine et al. have reported clinical examples of treatments with drainage and antibiotics after abnormalities such as pneumothorax and subcutaneous emphysema extensively spreading from the neck to the chest caused by third molar surgery were diagnosed early using a patient monitoring system (Sekine et al., 2000). The authors have previously reported a case where the induction of angina was avoided in an elderly outpatient with hypertension and diabetes during prosthetic treatment by using patient monitoring (Kawai et al., 1996). For the future, education in the use of a patient monitoring system for elderly dental outpatients, will become increasingly important to promote safety in dental clinics.

In the current report, we compared the results of the questionnaire between the two groups : D1 (pre-undergraduate educated) and D6 (post-undergraduate educated) to check the effects of our education and improve the curriculums for the undergraduate educated and the post-graduate internship.

The present study found that it is desirable to provide education in painless local anesthetic injection, N<sub>2</sub>O/O<sub>2</sub> inhalation sedation, and clinical procedures to undergraduates as well as during graduate internship for an effective use of a patient monitoring system in the education to promote safety in dental clinics. There is a clear need to strengthen motives to promote safety in dental clinics at an early stage, ensure technical education in local anesthetic injection using various electric-type syringes, conduct early pre-graduation clinical training including N<sub>2</sub>O/O<sub>2</sub> inhalation sedation and the effective use of a patient monitoring system, and the need to establish a flexible post-graduate internship curriculum. Yamamura has suggested differences in the directions of development of medical anesthesiology and dental anesthesiology (Yamamura, 2002). Therefore, to promote safety, the dental clinics at the Faculty of Dentistry provide local anesthetics (Kudo et al., 2004; Ohke et al., 2002), psychosedation (Kudo, 2003; Ohke et al., 2000), behavioral adjustment, and patient management methods in dental anesthesiology clinics for patients and elderly dental patients with existing complications (Kato et al., 2000; Kudo et al., 1994) as well as mentally handicapped patients (Kato et al., 2000), also oral implant treatments (Ohke et al., 2004), and promotion of safety by providing feedback through reports, publications, and clinical applications without screening out medical accidents (Kudo et al., 2002). Previously the authors have reported on local anesthesia (Kudo et al., 2001), general anesthesia (Kudo et al., 1999; Kudo et al., 1996), psychosedation (Kudo et al., 1997; Kawai et al., 2002), and a method to improve prevention as well as measures for preventing systemic accidents (Sano et al., 1994) to provide painless, safe, and comfortable dental treatment. For the future, we will apply this knowledge to clinical education.

## Conclusion

A questionnaire study on the awareness of "local anesthetics" and "patient monitoring systems" in dental clinics among dental students was conducted. The results indicate that the majority of both the D6 and D1 groups (sixth and first year dental students) agree that a "dentist" is the most suitable person to perform local anesthesia in dental treatment. With respect to education in local anesthetics, 49.0% of the D6 group answered that it is essential in post-graduate internships and 92.5% of the D1 group answered that it is essential in undergraduate education. Those who, prior to the enrollment in dental school, were aware of the risk of patient death during dental treatment were D6 30.2% and D1 34.4%. Regarding education in the use of a patient monitoring system and data assessment, 54.2% of the D6 group considered it "essential" in post-graduate internship, and 86.0% "essential" in undergraduate education.

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