Effect of a Training Model in Local Anesthesia Teaching


Abstract: The aim of this study was to evaluate the preclinical use of a training model in local anesthesia teaching on the subsequent clinical administration of a local anesthetic. Sixty-five dental students gave their first injection to a fellow dental student: twenty-two students after previous experience on a training model and forty-three without this training. After the injection, the opinions of both the student who performed the injection and the recipient were explored by questionnaires. Use of a training model did not affect the self-reported opinion of the students who performed the injection. However, the recipients of the injection considered students who exercised on the training model significantly more confident and calm, and reported a near-significant decrease in level of pain during insertion of the needle and feeling of a tingling lip. These results suggest that use of preclinical training models in local anesthesia teaching may have beneficial effects.

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Local anesthesia is frequently used during dental treatment. It facilitates a painless treatment, so that the patient’s comfort is maximal during the treatment and the dentist is able to work calmly with concentration and precision. Therefore, gaining an understanding of the background of anesthetics and the ability to deliver anesthetic injection techniques correctly is an important aspect of the dental curriculum. However, learning the techniques for the administration of local anesthetics is a complex process, and transition to the first injection of a patient is often difficult for dental students.

Many dental students feel insufficiently prepared for their first injection in a human. Knowledge of anatomy and complications of anesthetics have been mentioned frequently as areas in which students feel insufficiently prepared. This feeling may still be present after graduation as a dentist. Recently graduated dentists indicate that local anesthesia courses do not provide adequate preparation for the initial demands of a general practice. Nineteen percent of dentists in the United States reported that administration of local anesthesia caused them distress; 6 percent considered this problem serious. A recent study indicates that didactic courses may decrease the anxiety of dental students in relation to administration of a local anesthetic injection.

Electronic training models that indicate the accurate site of injection have been available for three decades. Currently, only a minority of dental schools use these models before students’ initial injections on humans, but several additional schools have reported plans to introduce them into their curricula. Those students who used a preclinical training model considered it a useful preparation for their first injection in a human, and many students proposed the introduction in the dental curriculum.

As far as we know, no studies have been published that evaluate the effects of preclinical training models on subsequent clinical teaching. Therefore, the objectives of the present investigation were twofold. The first objective was to determine if previous experience with a preclinical training model affected the opinion of dental students about their first injection of a local anesthetic in a human. The second objective was to determine whether the preclinical training affected the experiences of the recipient of this injection.
Methods

This study was designed to explore the possible effect of experience with a preclinical training model on students’ attitudes about the administration and receipt of a local anesthetic injection. A training model was constructed based on the Frasaco working model AG-3 (Frasaco Company, Tettning, Germany) (Figure 1). The base of this model was extended in a dorsocranial direction to represent the ascending ramus of the mandible. The location where the anesthetic should be applied contained metal strips connected to a buzzer, which made a sound when the needle was inserted at the correct position. The metal strips were placed at various locations enabling the student to practice the following injection techniques: mandibular block, mental nerve block, and infiltration anesthesia in the upper jaw and in the palatine area.

Sixty-five second-year dental students participated in this study, which was approved by the Medical Ethical Committee of the Free University Medical Center, The Netherlands. All students attended the same dental school and had never administered a local anesthetic injection before. All students followed the regular lecture program (four forty-five-minute sessions) that covered medical, pharmacological, and practical aspects of delivering local anesthetic injections. Subsequently, twenty-two randomly selected students were allowed to practice individually with the preclinical training model described above. On the next day, all students administered and received mandibular block anesthesia. The injection was 1.8 ml of Articaine with 1:100,000 epinephrine (Septanest SP, Septodont, France). When a student received an injection, the recipient was unaware of whether the student who administered the injection had practiced on the training model or not.

After the administration of the local anesthetic, the dental students who performed the injection were asked to indicate their level of agreement on five items (see Table 1). Each item was quantified with a five-point Likert scale (1=totally disagree, 2=partially disagree, 3=don’t agree/don’t disagree, 4=partially agree, 5=totally agree). The student who received the injection filled out a similar questionnaire (see Table 2). Data were collected immediately after the administration of the local anesthetic, and the two students filled out their questionnaires independently of each other.

Data were entered into an Excel spreadsheet, and for each item the means were calculated. Differences between the experimental groups were statistically analyzed with Mann-Whitney tests using the statistical software package SPSS version 15.0 for Windows (SPSS Inc., Chicago, IL, USA). All levels of significance were set at p<0.05.

Results

The mean scores of the students who performed the injections are presented in Table 1. For each of the five items, the scores of the students who exercised on the preclinical training model did not differ significantly from the students without this experience.

Dental students who received their injection from a fellow student who was trained on the training model gave significantly higher scores with regard to “the dentist was confident” than the individuals who were treated by students without this training (Table 2). No differences were observed for the statement “the dentist was reassuring.”

The exercise on the preclinical training model also induced a near-significant decrease in the pain of the recipient during the insertion of the needle (p=0.080) and of the feeling of a tingling lip.
The training model had no effect on the pain of the recipient during the injection of the anesthetic or the feeling of a tingling tongue.

Discussion

This study found that use of a preclinical training model did not affect the self-reported confidence level of dental students about their injection in a human (Table 1). However, the recipients of the injections rated students who had exercised on the training model more confident and calm, and reported near-significant decreases in adverse events of the injection (Table 2).

In observational studies, painful sensations during insertion of the needle for mandibular block anesthesia were reported by 0.9–6.3 percent of the patients. These reactions may occur when the needle touches the periosteal layer of the ascending ramus, a nerve, or the artery wall. The observed near-significant reduction in level of pain during the insertion of the needle (Table 2) suggests that use of preclinical training may reduce the risk of these adverse events. This improvement was observed despite the anatomical limitations of the training model.

The major limitation of the preclinical training model is the poor representation of the oral mucosa in the area of the ascending ramus of the mandible. The pterygomandibular plica, which runs from the palate to the retromolar pad, is missing. This plica is an important landmark for the correct insertion of the needle in mandibular block anesthesia. To avoid anatomical limitations, preclinical use of human cadavers has been suggested as a teaching aid for local anesthesia injection techniques. However, in a recent survey of dental schools in Europe, no school reported the use of human cadavers for local anesthesia education. It is expected that virtual reality may play a role in the teaching of landmarks and insertion points in the near future.

Another limitation of the present study is that the students who practiced with the training model could have discussed this additional training with fellow students. If this indeed has happened, some recipients may have been aware that their fellow student who performed the injection had received

### Table 1. Dental students’ opinions about the first injection with or without exercise on a preclinical training model

<table>
<thead>
<tr>
<th></th>
<th>Preclinical training:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>with (n=22)</td>
<td>without (n=43)</td>
<td>p</td>
</tr>
<tr>
<td>The patient was put at ease.</td>
<td>4.41</td>
<td>4.08</td>
<td>0.360</td>
</tr>
<tr>
<td>My hand did not tremble.</td>
<td>4.00</td>
<td>3.63</td>
<td>0.501</td>
</tr>
<tr>
<td>It was difficult to determine the insertion point.</td>
<td>3.18</td>
<td>2.92</td>
<td>0.389</td>
</tr>
<tr>
<td>I felt bone contact with the mandibular ramus.</td>
<td>3.90</td>
<td>4.50</td>
<td>0.155</td>
</tr>
<tr>
<td>I do not expect to need supervision next time.</td>
<td>2.77</td>
<td>2.95</td>
<td>0.710</td>
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</tbody>
</table>

**Note:** Each of the five items was measured on a five-point Likert scale ranging from 1=totally disagree to 5=totally agree. Data are presented as mean scores.

### Table 2. Dental students’ opinions about receiving the first injection from a fellow dental student with or without exercise on a preclinical training model

<table>
<thead>
<tr>
<th></th>
<th>Preclinical training:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with (n=22)</td>
<td>without (n=43)</td>
<td>p</td>
</tr>
<tr>
<td>The dentist was confident.</td>
<td>4.90</td>
<td>3.98</td>
<td>0.021</td>
</tr>
<tr>
<td>The dentist was reassuring.</td>
<td>4.45</td>
<td>4.08</td>
<td>0.198</td>
</tr>
<tr>
<td>The insertion of the needle was painful.</td>
<td>2.36</td>
<td>2.95</td>
<td>0.080</td>
</tr>
<tr>
<td>The injection of the anesthetic was painful.</td>
<td>2.05</td>
<td>2.54</td>
<td>0.277</td>
</tr>
<tr>
<td>I have a tingling lip.</td>
<td>4.59</td>
<td>3.82</td>
<td>0.089</td>
</tr>
<tr>
<td>I have a tingling tongue.</td>
<td>4.05</td>
<td>3.64</td>
<td>0.651</td>
</tr>
</tbody>
</table>

**Note:** Each of the six items was measured on a five-point Likert scale ranging from 1=totally disagree to 5=totally agree. Data are presented as mean scores.
additional training that could have influenced the opinion of the recipient.

In a previous study, dental students who used a preclinical training model considered it a useful preparation for their first injection in a human. However, only a minority of European dental schools use these models in their regular local anesthesia teaching program. Our data seem to support the suggestions to introduce such training models in the dental curriculum. Introduction may have small but positive effects on the administration of local anesthetics by dental students and may help to prepare them for the demands in the general practice.

Therefore, further research on the effect of this training model is warranted. In these studies, it can be investigated whether integration of the training model in small-group teaching improves the outcomes. Also, the effects of this type of learning tool on patients’ experience in the clinic and the incidence of adverse events during anesthetic administration should be explored.

REFERENCES