The anesthesia efficacy of intraosseous injection with QuickSleeper® and conventional injection in the lower third molar surgery

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Abstract

Objective: This study aimed to compare the efficacy of anesthesia between QuickSleeper® and conventional injection in the lower third molar surgery.

Materials and methods: The study with a simple blind prospective study was comprised 12 females and 14 males with age range 20-25 years (mean age of 21 years). The subjects underwent a total of 52 anesthetic procedures. Each patient was subjected to two anesthetic techniques : conventional injection and intraosseous injection using the QuickSleeper® system. A split-mouth design with a month washout period was adopted in which each patient underwent treatment of lower third molar surgery.

Results: The profoundness of anesthesia by QuickSleeper® and conventional technique are 30.7% and 92.3%, respectively. Pain assessment during injection was 2.7±2.2 for QuickSleeper® and 2.8±2.5 for conventional technique, the difference being not statistically significant. Pain assessment during surgery was 5.2±3.0 for QuickSleeper® and 2.5±2.7 for conventional technique, the difference being statistically significant. Pain assessment after surgery was 1.8±2.4 for QuickSleeper® and 1.8±2.2 for conventional technique, the difference being not statistically significant.

Conclusion: The efficacy of anesthesia from QuickSleeper® is lower than conventional injection in the lower third molar surgery.

Keywords: QuickSleeper® injection, inferior alveolar nerve block, local anesthesia, conventional nerve block, intraosseous injection, lower third molar surgery, onset & duration, profoundness, electric pulp tester, intraoral pain assessment device

Introduction

Dental injection makes patients fear and anxious, because of pain and soft tissue swelling from the local anesthetic volume in that area.1,2 The computerized technology was developed to reduce the patient’s discomfort by controlling the speed of local anesthetic injection.3 In 1998 the previous study of Villette A. studied about the efficacy of intraosseous technique, nerve block and infiltrate technique.4 In 2007 E. Mouliset al. and 2008 SixouJL et. al. studied about transcortical anesthesia by QuickSleeper® for dental procedures in children.5,6 Villette A. et. al. in 2008 and Collier T. in 2006 studied about transcortical anesthesia by Quick Sleeper® for dental procedures in pulpitis.7,8 These studies showed the successful of QuickSleeper® for dental anesthesia in children.

However there has not been previous study mentioned about efficacy of computerized intraosseous injection in lower third molar surgery. So this study, we aim to compare the efficacy of computerized intraosseous injection by QuickSleeper® to conventional injection technique for lower third molar surgery.

Materials and methods

Twenty six patients from faculty of Dentistry, Mahidol University who accepted to participate in this study comprising 12 females and 14 males with a mean age of 21 years (range 20-25). The following inclusion criteria were established: healthy over 20 years with noninfected lower third molar impacted tooth. Patients with antecedent of complications associated with local anesthetic, problem with pain perception, systemic disease or pregnancy were excluded from the study.

This study was approved by the Committee in the Ethics of Research in Human Being of Dentistry and Pharmacy Mahidol University Institutional Review Board with Protocol No. MUDT/PY-IRB 2012/056.1312 and the consent was obtained from each patient.

Each patient was subjected to two anesthetic techniques: conventional inferior alveolar nerve block and intraosseous injection using the device (Quick Sleeper® system). (figure 1) The local anesthetics was 4% articaine with epinephrine 1:100000 in both groups.10-12 The anesthesia and third molar surgery were always carried out by the same surgeon.

A simple-blind prospective study was made between Dec 2012 and Feb 2013. A simple randomized sample was used to random the technique and side of mandible that would be performed first. A month washout period was left between one procedure and another to prepare patient for next surgery and decrease a bias in first anesthetic technique. Moreover when we used conventional technique, we would switch on the device to make the same sound like using the device. The injection point of intraosseous technique was alveolar bone between first and second molar. (figure 2)
The patients were instructed to score their discomfort at 3 moments: during anesthetic drug injection, during surgery and after surgery by a visual analog scale that was a scale line comprising between 0 and 10 (from no pain to intense pain).

After injection, on the anesthetized area of soft tissue numbness was tested at gingival soft tissue of buccal site of lower canine and lingual site of lower molar by the intraoral pain assessment device (figure 3) and tooth numbness was tested by EPT (Electric pulp tester) at lower canine and 2nd molar. After subjective and objective onset from the patient were identified, the lower third molar surgery was conducted. Profoundness was also be evaluated by the necessity of increasing anesthetics during surgery. The determination of the duration of the anesthetic feeling was conducted.

The SPSS version 17 statistical package for Microsoft Windows was used for the statistical analysis. The efficacy of anesthesia from conventional injection and QuickSleeper® system was analyzed by using percentage. The Wilcoxon test was used to assess patient discomfort with the anesthetic techniques in 3 moments, subjective onset, objective onset and duration of the anesthetic feeling between conventional injection and the QuickSleeper® system.

Results

The total of 52 side of the 26 subjects underwent anesthesia. Each side was anesthesized with different technique, and then proceeding the lower third molar surgery. The profoundness of QuickSleeper® and conventional technique were 30.7% and 92.3%, respectively (Table 1).

Figure 3 showed the pain assessment by visual analog scale from the intraoral pain assessment device. Pain assessment during injection was 2.7±2.2 mm. with QuickSleeper® and 2.8±2.5 mm. with the conventional technique. The differences were not statistically significant (p>0.05).

Whilst pain assessment during surgery was 5.2±3.0 mm. with QuickSleeper® and 2.5±2.7 mm. with the conventional technique were statistically significant differences (p<0.05).

The differences of pain assessment after surgery was 1.8±2.4 mm. with QuickSleeper® and 1.8±2.2 mm. with the conventional technique were also not statistically significant (p>0.05).
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Subjective onset of anesthesia was $5.8 \pm 3.5$ minutes with QuickSleeper® and $2.9 \pm 2.5$ minutes with the conventional technique, the difference were statistically significant. ($p<0.05$)

Objective onset was $14.6 \pm 10.6$ minutes with QuickSleeper® and $8.8 \pm 5.2$ minutes with the conventional technique, the differences were not statistically significant. ($p>0.05$)

The duration of the anesthetic effect in soft tissues was $227.3 \pm 105.0$ minutes with QuickSleeper® and $267.7 \pm 74.0$ minutes with the conventional technique, the differences were not statistically significant. ($p>0.05$)

### Table 1

<table>
<thead>
<tr>
<th>Methods of anesthesia</th>
<th>QuickSleeper®</th>
<th>Conventional technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not add to anesthetic</td>
<td>8 (30.7%)</td>
<td>24 (92.3%)</td>
</tr>
<tr>
<td>Add to anesthetic</td>
<td>18 (69.3%)</td>
<td>2 (7.7%)</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Methods of anesthesia</th>
<th>QuickSleeper®</th>
<th>Conventional technique</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective onset (minutes)</td>
<td>$5.8 \pm 3.5$</td>
<td>$2.9 \pm 2.5$</td>
<td>0.03*</td>
</tr>
<tr>
<td>Objective onset (minutes)</td>
<td>$14.6 \pm 10.6$</td>
<td>$8.8 \pm 5.2$</td>
<td>0.14</td>
</tr>
<tr>
<td>Duration (minutes)</td>
<td>$227.3 \pm 105.0$</td>
<td>$267.7 \pm 74.0$</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*Wilcoxon Signed Ranks Test. - Statistically significant ($p<0.05$)
Discussion

Intraosseous injection with the injection device (QuickSleeper®)\textsuperscript{13} which has the advantages of less pain, sudden onset, complete numb in surgical area, lesser soft tissue effect\textsuperscript{1,2,3} and effective use in infectious teeth\textsuperscript{4,5} is now popularly used in daily dental practise. However, the previous studies; just being in the field of endodontic treatment and simple extraction; showed that it was effective enough to perform these procedures.\textsuperscript{14}

Our study aims to prove whether the surgical removal of lower third molar can be performed by intraosseous injection with injection device or not.

Neither intraosseous nor conventional nerve block injection technique has statistic difference in pain both during injection and after the surgery. Thus, intraosseous injection technique with injection device is not better than conventional nerve block technique in aspect of less pain and comfortable for patients during the injection. Our results showed the onset of intraosseous injection group was slower than the conventional group when compared to the study of Quarnstrom\textsuperscript{15}, which found that conventional injection has an onset of 7 min. while 36 seconds is the onset of intraosseous injection. We recorded onset in two ways, subjective onset and objective onset. Although there is no statistic significant difference in objective onset between conventional and intraosseous group, the objective onset of intraosseous group was slower than conventional group. So was the subjective onset, but difference was statistic significant between both groups.

These difference in onset might be explained by longer period is required for the anesthetic agent to distribute into the cancellous marrow anteriorly to the canine region and posteriorly to the second molar region comparing to the blocking of nerve impulse by conventional nerve block technique. Bone density also plays an important role by affecting on distribution of anesthetic agent along the mandible.

Numbness of the lower lip was the clearly symptom that the patients could realize in conventional nerve block group. In the other hand, in intraosseous group, the patients might not be able to know exactly whenever numbness occurred. This should explain why the onset of the intraosseous group was slower than the conventional group.

Duration of soft tissue anesthesia between these two groups was no statistic significant difference although it was shorter in the intraosseous group. The duration of intraosseous group was $267.7 \pm 74.0$ minutes that was sufficient for third molar surgery.

The important disadvantage of the intraosseous group in our study is the profoundness of anesthesia. Third molar surgery especially with osteotomy needs profoundness of anesthesia more than simple extraction. Just only one-third of intraosseous group (30.7%) had enough profoundness for third molar surgery. Intraosseous injection really seems like infiltration, but directly in the marrow. The anesthetic agent has to diffuse between the marrow to the target\textsuperscript{12,16}, which can be affected by many factors such as the density of bone, distance of the target, amount of the anesthetic agent used, etc. Limitation of the intraosseous injection device method also takes part of responsibility.

The intraosseous injection technique with injection device is not suitable for third molar surgery because of insufficiency profoundness.\textsuperscript{17} The other aspects of anesthesia, like onset, duration, pain during injection and after surgery, are not better than conventional nerve block.
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References


