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Efficacy of the Gow-Gates and Inferior Alveolar Nerve Block Techniques in Providing Anesthesia During Surgical Removal of Impacted Lower Third Molar: A Controlled Randomized Clinical Trial

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Background: In spite of common usage of the inferior alveolar nerve block (IANB), this method has some well-defined restrictions.
Objectives: The purpose of the present study was to compare these two techniques for the surgical removal of impacted lower third molars.
Patients and Methods: A total of 44 similarly impacted lower third molars (22 patients with two similar teeth) were selected. In each patient, one side was anesthetized with the Gow-Gates technique and another side with the IANB, randomly. The number of injections for achieving anesthesia, incidence of pain during injections, and the supplementary injections during surgery were recorded for each side
Results: In Gow-Gates technique, less repetition of injection was required to achieve anesthesia as well as less supplementary injections during surgery; however, these differences were not significant statistically (P = 0.39, P = 0.11). The pain during Gow-Gates injections was significantly shorter than that of the IANB (P = 0.007).
Conclusions: Even though the patients felt less pain during the Gow-Gates injection, this technique has no advantage over the IANB during surgical removal of impacted lower third molar.

Keywords: Local Anesthesia; Mandibular Nerve Block; Inferior Alveolar Nerve

1. Background

Nowadays pain control is the most important part of any dental treatment. In fact, many patients choose clinicians based on their previous ability to perform a pain-free treatment. Dentists usually use the inferior alveolar nerve block (IANB), which has been introduced by Jorgensen and Hayden in 1967, for mandibular anesthesia (1). This is an efficient as well as a safe technique to anesthetize the mandible; however, it has some disadvantages. For example, it depends on the existence and detection of anatomic landmarks like teeth and pterygomandibular raphe. Anatomy of the mandibular ramus and foramen can vary; hence, failure to perform the correct mandibular anesthesia is more frequent with IANB in comparison with the other techniques (2). Nonetheless, the main reason of IANB failure is improper performance of this technique by dentists (3, 4). The high incidence of positive aspiration and intravascular injection, i.e. 10% to 15%, due to the proximity of injection site to the neuromuscular bundle, is another disadvantages of the IANB (5).

In 1973, George Gow-Gates introduced a new technique to block the mandibular nerve in which the anesthetic solution was administered close to the neck of the mandibular condyle (6). In this technique, the target site of anesthetic solution is proximal to the mandibular nerve innervation and therefore, inferior alveolar and its branches (incisive and mental), lingual, mylohyoid, auriculotemporal, and buccal nerves (approximately 75% of cases) are anesthetized (6-9). In contrary, only the inferior alveolar and its branches (incisive and mental) and lingual nerves are anesthetized in the IANB. Generally, the Gow-Gates block technique (GGB) is more efficient than the IANB; firstly, less supplemental injections are required to anesthetize the accessory nerves in the GGB (10, 11). Secondly, the alveolar vein and artery are far from the injection site; hence, the incidence of positive blood aspiration and intravascular injection is less (2%) than the IANB injection (10, 12, 13). Therefore, the complications following the GGB injection are rare (8, 14). Likewise, some anatomic variations such as bifid inferior alveolar nerve or accessory innervations do not required any separate anesthesia in the GGB; therefore,

anatomic variation has no significant effect on the success rate (4, 15, 16). Nevertheless, onset of anesthesia is slower in the GGB (five to ten minutes) in comparison with the IANB (7). Although some studies reported that the success rate of the GGB was more than the IANB (7, 11, 17, 18), others showed that both techniques had the same success rate (20, 21) and in some cases, the IANB had a higher success rate (19).

2. Objectives

The aim of this study was to compare the success rate of the GGB with the IANB in surgical removal of impacted lower third molars.

3. Patients and Methods

A total of 44 similar impacted lower third molars were selected. Actually, 22 patients (15 women and seven men) aged 19 to 30 years old with the mean age of 25.6 years were enrolled in this study. All the patients were in good health conditions and were not taking any medications that would affect the perception of pain (NSAIDs, Opioids, or antidepressants); moreover, the degree of their mouth opening were normal. All the patients had two impacted lower third molars that were equal in angulation and Pell and Gregory classification. The exclusion criteria were being younger than 18 and older than 60 years of age, pregnancy, any inflammation or infection at the site of injection or surgery, allergies to local anesthetics and sulfites, and reluctancy to sign the consent form. The protocol and consent form were approved by the Committee of Ethics of Hamadan University of Medical Sciences (D/P/16/35/1011).

Each patient was subjected to surgery in order to remove bilateral impacted lower third molars with a ten-day interval between two operations. The surgical technique was same the both sides and was performed by the same maxillofacial surgeon. We used GGB or IANB techniques for anesthetizing the jaw before surgery (2). One of these two techniques was randomly selected for the right side and the other for the left side.

For anesthesia, a solution consisted of 3.6 mL of 2% lidocaine with 1:100000 epinephrine (Persocaine-E, Darou Pakhsh Mfg. Co., Tehran, Iran) was used. A total of 44 injections were administered and patients served at their own controls. By using four-digit numbers from a random number table, either IVNB or GGB were randomly assigned to either left or right sides in each patient. The injections were administered by another surgeon who was blinded to the experiment. Therefore, the surgeon who did the operations was not aware of the technique of anesthesia used in each side. In order to obtain buccal mucosa anesthesia during surgery, the long buccal nerve was anesthetized separately in both techniques.

Before the injection, each patient was instructed to rate the pain of injection by using visual analog scale (VAS) on a ruler marked from zero to ten. A 27-guage 38-mm needle was used for injection (Nik Rahnamakar Co., Tehran, Iran). After the injection, the patients were asked to rate the pain of injection using VAS.

At tenth minute after injection, the patient was asked whether his or her lower lip was numb. If yes, the other injection was administered in the infiltration way in the area for long buccal nerve anesthesia. If lower lip numbness was not achieved within 20 minutes, the injection was repeated. Without lower lip numbness within the 20 minutes after the second injection, the injection was considered unsuccessful and the patient would be excluded from the study. At the end, the frequency of injections to achieve successful anesthesia was recorded. With lower lip numbness, the surgery started. If the patient had pain during surgery, the impacted tooth was anesthetized by using the periodontal ligament (PDL) supplementary technique. The number of injections for anesthesia with supplemental injections during surgery was also recorded.

The statistical analysis was performed using SPSS 15 for Windows (SPSS Inc., Chicago, IL, USA). Independent samples t, Chi square, and Mann-Whitney U tests were used to compare the association between quantitative and qualitative variables. In all tests, $P < 0.05$ was considered as statistically significant.

4. Results

In one case, the numbness of lower lip was not achieved after repeating the GGB injection; therefore, this case was excluded from the study and substituted with another patient. As it can be seen in Table 1, in the cases that the GGB was used, the need for repeating the injection was lower in comparison with the IANB; however, the difference was not statistically significant ($P = 0.39$). The pain during injection was significantly shorter in the GGB in comparison with the IANB ($P = 0.007$) (Table 2).

Table 1. The Frequency of Injections to Achieve Anesthesia Before Surgical Removal of Impacted Lower Third Molar

Injection Technique	Frequency of Injections, No. (%)		Mean	P value [a]
	One	Two		
Inferior alveolar nerve block	13 (59.1)	9 (40.9)	1.41	0.39
Gow-Gates block	17 (77.3)	5 (22.7)	1.27	

[a] Independent samples t-test.

Table 2. The Pain Perception During Injections and Before Surgical Removal of Impacted Lower Third Molar According to the Visual Analogue Scale

Injection Technique	Mean	Z	P value [a]
Inferior alveolar nerve block	7.68	2.68	0.0007
Gow-Gates block	5		

[a] Mann- Whitney U-test.

The results of this study showed that during surgery, six PDL injections were needed with the IANB while only four PDL injection were administered with the GGB; however, this difference was not statistically significant (P = 0.11).

5. Discussion

This study evaluated the success rate of GGB in the surgical removal of impacted lower third molar in comparison with IANB. In three patients, the needle tip did not contact the neck of the condyle during the GGB injections; however, all of them felt numbness in their lips after 20 minutes. Therefore, it could be concluded that anesthetic solution was deposited in the pterygomandibular space. In this study, although we tried to contact the needle tip with the neck of the condyle during injection, sometimes it was not achieved. It seems that the angle of the ear to the neck of the condyle in mandible is not always an accurate indicator for the GGB injection (20).

Kohler et al. (21) indicated that when the volume of anesthetic solution was increased from 1.8 to 3.6 mL, the success rate of the GGB would increase too; therefore, in the current study, 3.6 mL of the anesthetic solution was injected in each side in every injection.

The patients reported that the perceived injection pain with the GGB was significantly lower than the IANB. The finding of Yamada and Jasstak (10) were similar to the current study; however, the perceived injection pain was the same with both techniques in most studies (22-24).

The onset of anesthesia with the GGB is usually ten minutes, which is longer than that of IANB (usually three to five minutes); therefore, the patients were asked whether their lower lips were numb after ten minutes (19). Agren and Danielsson (25) explained this difference in their findings; they demonstrated that the site of solution deposition with GGB was farther from the inferior alveolar nerve in comparison with the IANB; thus, the onset of anesthesia took longer time.

After anesthetizing the inferior alveolar nerve with the GGB or IANB, the long buccal nerve was separately anesthetized. Although Gow-Gates indicated that it is not necessary to make the long buccal nerve separately anesthetized following his technique (6), the rate of long buccal nerve anesthesia varied from 20% to 89% in previous studies (14, 22). Thus, when anesthesia of soft tissue is required in the molar teeth, it is recommended to anesthetize the soft tissue in molar regions by a separate injection (20).

In comparison with the IANB, repeating the injection for anesthesia was less frequently required by the GGB. In the other words, although the success rate of the GGB was more than the IANB, the difference was not statistically significant. In addition, in the case of using the GGB for anesthesia, the supplement injection required during surgery was less frequent than IANB; however, there was no statistically significant difference between them. In some studies, the success rate was higher with the GGB than that the IANB (7, 8, 11); however, Todorovic et al. reported that the IANB was more successful than the GGB for teeth removal (19). It was difficult to compare the findings of current study with those from previous studies because the type of surgery, the number of subjects, and the measured variables were different. In general, the mandibular teeth pulp anesthesia was 100% successful with none of the techniques (20); therefore, it is better to use a supplemental techniques like intraosseous (26, 27) or PDL injection (28) during treatment. In this study, the indicator of anesthesia was numbness of lower lip while this is not an adequate indicator of pulp anesthesia. Therefore, when the patient felt pain during surgery, the impacted tooth was anesthetized by supplemental PDL injection.

With the GGB injection for mandible anesthesia before surgery of the impacted lower third molar, patient would feel less pain in comparison with the IANB but there is no significant difference between these two techniques with regard to the success rate of anesthesia during surgery.

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