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Efficacy of infiltrative anesthesia for extraction of endodontically treated mandibular molars: A randomized controlled trial

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Ethical approval was obtained (Clinical Research Ethics Committee, 14567952-050/465; Ministry of Health, Medicine, and Medical Devices Agency, 66175679- 514.11.01- E.67415). All subjects were recruited from the Necmettin Erbakan University, Faculty of Dentistry, Oral and Maxillofacial Surgery Department.
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Abstract

Background/Aim: In most dental curricula, it has been taught that infiltrative anesthesia (IA) is not sufficient for the extraction of lower molars and that an inferior alveolar nerve block (IANB) is required instead. This study compared the effectiveness of IANB and IA for the extraction of mandibular molars that had previously undergone root canal treatment.

Methods: Patients older than 18 years who had a mandibular molar with previously completed root canal treatment were included. Patients who were allergic to local anesthetics, those with severely mobile teeth, those with severe pain due to acute infection, and those using psychotropic drugs were excluded. Sixty subjects were randomly divided into the study (n=30) and control (n=30) groups. An anesthetic solution containing 20 mg/mL lidocaine and 0.0125 mg/mL epinephrine was used. In the study group, only vestibular and lingual IA were used. In the control group, IANB was performed. The teeth were extracted following the standard procedure. The pain experienced during extraction was compared between the study and control groups.

Results: There was no significant difference in extraction pain between the two anesthesia techniques (P=0.836). The gender of the patient and whether the tooth to be extracted was a first or second molar did not affect pain (P=0.953 and P=0.900, respectively).

Conclusion: Buccal and lingual IA can be used to extract the mandibular molars in certain cases. Teaching dental students that IA can be used instead of IANB in some mandibular molar extractions may provide them with comfort and confidence in clinical practice.

Keywords: local infiltration anesthesia, inferior alveolar block, tooth extraction

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Introduction

The most commonly used local anesthetic techniques for tooth extraction are infiltration anesthesia (IA) and inferior alveolar nerve block (IANB) [1].

IA is a simple method that can be used to extract all maxillary teeth, mandibular incisors, and premolars. Traditionally, IANB is used in the mandibular molar region because of the presence of thick buccal cortical bone, which hinders the infiltration of anesthetic solutions, making IA inadequate [2]. On the other hand, IANB has a high failure rate, reported to be as high as 20–25%, and can also lead to various complications, such as trismus, hematoma, and facial nerve palsy [3]. All of these possibilities put considerable stress on dental students.

Given the complexity of the IANB technique, some researchers have proposed alternative approaches; however, these methods have not gained widespread popularity primarily because they require specialized equipment, such as specific syringes, needles, or computer-controlled systems [4].

On the other hand, it is widely acknowledged that performing buccal and lingual IA is typically sufficient in most cases during implant surgery in the posterior region of the mandible [5]. From the anesthesia perspective, the only difference between inserting a dental implant and extracting a tooth is the presence of tooth pulp. Therefore, we hypothesized that a devitalized mandibular molar can be thought of as a dental implant and can be extracted using IA alone without the need for IANB.

In this study, we aimed to compare the efficacy of IANB and IA applied with lidocaine for the extraction of previously root canal-treated mandibular first and second molars.

Materials and methods

The study was implemented as a prospective, randomized, and non-blinded clinical trial. Ethical approval was obtained (Clinical Research Ethics Committee, 14567952-050/465; Ministry of Health, Medicine, and Medical Devices Agency, 66175679-514.11.01-E.67415). All subjects were recruited from the Necmettin Erbakan University, Faculty of Dentistry, Oral and Maxillofacial Surgery Department.

The inclusion criteria were as follows: the patients should be over 18 years old, the tooth to be extracted should be a mandibular first or second molar, and the tooth to be extracted should have undergone root canal treatment. The exclusion criteria were as follows: local anesthetic allergy, severely mobile teeth, and severe pain due to an acute infection. Patients who use psychotropic drugs that may alter their perception of pain were also excluded from the study.

Written informed consent forms, which described the procedure to be performed and provided explanations of the clinical benefits and potential complications, were obtained from all subjects. All anesthesia and extraction procedures were performed by the same surgeon.

Sixty subjects (27 males and 33 females) who met the criteria were selected. They were randomized according to their identification numbers and divided into two equal groups. In both groups, 2 mL of a local anesthetic solution containing 20 mg/mL lidocaine and 0.0125 mg/mL epinephrine was used (Jetokain, Adeka, Samsun/Türkiye).

The control group (n=30) underwent conventional IANB, commonly referred to as the "Halstead" technique. For this purpose, 1.5 mL of anesthetic solution was injected around the mandibular foramen. The syringe was then withdrawn slightly, and approximately 0.2 mL of solution was administered for lingual nerve anesthesia [1]. The remaining 0.3 mL of solution was infiltrated into the vestibule to anesthetize the vestibular gingiva.

In the study group (n=30), 1.5 mL of anesthetic solution was infiltrated on the vestibular side, and a 0.5 mL solution was infiltrated on the lingual side of the tooth to be extracted.

In both groups, after waiting for approximately five minutes, one tooth was extracted from each patient in the usual manner, using straight elevators and dental forceps. Forty of the teeth were first molars and twenty were second molars. A visual analog scale (VAS) was used to compare the pain experienced during extraction. It was a 100 mm horizontal line with “no pain” at the left end and “the worst pain imaginable” at the right end.

Statistical analysis

Statistical analysis was performed using IBM SPSS v22. Because the data did not follow a normal distribution, the non-parametric Mann-Whitney U test was used to compare groups. The statistical significance level was set at P <0.05. Pain experienced during tooth extraction was compared between the study and control groups, between genders, and between first and second molars.

Results

All participants remained in the study. The study group ranged from 19 to 62 years (mean: 40.07 [12.32]), while the control group ranged from 20 to 73 years (mean: 35.57 [12.88]). All tooth extractions were completed without complications. There were no significant differences in pain experienced during extraction between the study and control groups (Table 1), between genders (Table 2), or between the first and second molars (Table 3).

Table 1: Comparison of pain levels between the control and study groups.

Group	n	Mean pain score	*P*-value
Control group	30	2.17 (1.45)	0.836
Study group	30	2.51 (2.01)	

Table 2: Comparison of pain levels according to the gender

Gender	n	Mean pain score	*P*-value
Female	33	2.38 (1.87)	0.953
Male	27	2.29 (1.62)	

Table 3: Comparison of pain levels in the first and second molars

Tooth	n	Mean pain score	*P*-value
First molar	40	2.35 (1.78)	0.900
Second molar	20	2.32 (1.73)	

Discussion

Dental schools insist on teaching and training students in the conventional IANB technique for mandibular molars. Most clinicians continue this habit after they finish dental school. In this study, we compared the effectiveness of IANB and IA in the extraction of devitalized mandibular molars to reduce the number of cases in which clinicians had to perform IANB. IANB is relatively difficult to perform and is prone to complications. The failure rate can be as high as 15-20% and repeating the injection may not be effective in addressing this issue [6, 7]. It may be

accompanied by complications, such as pain during injection, trismus, facial paralysis, hematoma, needle breakage, diplopia, temporary blindness, and ophthalmoplegia [1, 8, 9].

IA is widely employed in the maxilla because of its ability to achieve adequate pulpal anesthesia through the diffusion of anesthetic solution into cancellous bone [10]. However, in the mandible, thicker and denser cortical bone presents a challenge for the anesthetic solution to effectively reach the inferior alveolar nerve, particularly in the molar region. As a result, block anesthesia is the preferred method for extracting the mandibular molars, for which IANB has traditionally been used [11].

The idea of anesthetising mandibular molars using IA alone is not a new one. Jung et al. reported that the use of buccal and lingual IA with lidocaine in vital mandibular first molars achieved pulpal anesthesia in 32-67% of patients [12]. When articaine was used, the success rate increased to 57-92%.

In a double-blind study of 60 subjects, Robertson et al. [13] performed buccal IA using lidocaine and articaine in the mandibular first molars. The reported success rates varied from 45% to 67% with lidocaine and 75% to 92% with articaine.

Bataineh and Alwarafi [14] conducted a comparative study between IANB and IA, assessing the efficacy of articaine for mandibular first molar extractions in a group of 52 subjects. They reported no significant differences between the two anesthesia methods. Corbett et al. found that the effectiveness of buccal and lingual articaine infiltration for pulp anesthesia of the first molar was comparable to that of an IANB carried out using lidocaine [15].

Jung et al. [12] conducted a study on 35 mandibular first molars by performing IA and IANB procedures using articaine. They reported that both methods yielded comparable success rates, leading to the conclusion that IA could be a valuable alternative.

Studies that utilized articaine for the extraction of mandibular molar teeth and compared IANB with IA claimed that articaine diffuses into the bone more effectively than other local anesthetics. As a result, it can increase the success rate of pulpal anesthesia in mandibular teeth [14].

Although articaine offers superior potency and duration of anesthesia when compared to lidocaine, some authors contend that articaine may have higher neurotoxicity levels and, therefore, should not be preferred in IANB [16]. Documented and repeated allergies to lidocaine are rare, and it remains the gold standard in dental local anesthesia, to which all new local anesthetics are compared [17].

We used lidocaine in both techniques and did not limit tooth extractions to the mandibular first molars. This is important because it has been claimed that the thickness of the buccal cortical bone in mandibular second molars is greater than that in first molars; consequently, the success rate of IA is more likely in first molars [13]. However, we demonstrated that the efficacy of IA was similar and sufficient in both molars.

The idea of this study was that only IA is sufficient, and IANB is not needed when placing dental implants in the mandibular molar region. The local anesthetic used in IA effectively numbs the bone surrounding the roots, although penetrating the pulp is more challenging.

We aimed to eliminate the pulp factor, but neither electrical pulp tests nor heat tests could provide conclusive results regarding the complete devitalization of the entire pulp. This decision required the support of devices such as a laser Doppler flowmeter and pulse oximeter which were obviously impractical [18].

Therefore, we included mandibular first and second molars that had previously undergone root canal treatment to confirm that the tooth to be extracted was non-vital. Local anesthesia failure is up to eight times more common in symptomatic teeth, as noted by others [12]. Thus, we excluded teeth with severe pain caused by a periradicular acute infection.

We employed the visual analogue scale (VAS), a widely used method for assessing pain that demonstrates high reliability and validity [19]. Gender is recognized as a significant factor in the pharmacodynamics and pain perception of local anesthesia [20].

While some studies argue that women tend to experience higher levels of pain, others report the opposite or claim that gender has no effect on anesthetic efficacy or injection discomfort [21, 22]. Therefore, we compared the pain scores of females and males and found that gender had no impact on the results.

The effectiveness of IA depends on the ability of the anesthetic solution to infiltrate the bone. Since the thickness of the buccal bone of the first and second molars may differ, we compared them but found no difference.

The most important limitation of our study is that it focused on mandibular molars that underwent root canal treatment. By expanding the study group, the study shows that teeth with devitalized pulp due to other reasons, such as a prolonged caries process, can also be extracted with infiltrative anesthesia.

Conclusion

IA is a simple and comfortable technique that virtually eliminates the risk of nerve damage and minimizes the risk of intravenous injection. We suggest that buccal and lingual IA can be used instead of IANB for the extraction of mandibular molars that have previously undergone root canal treatment and perhaps for otherwise devitalized molars. Dental students should be informed that such a practice is available.

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