

ORIGINAL RESEARCH

Study of the Anesthetic Efficacy of Inferior Alveolar Nerve Block using Articaine in Irreversible Pulpitis

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ABSTRACT

Aim: The purpose of this study was to determine the anesthetic efficacy of inferior alveolar nerve block (IANB) using 4% articaine and 2% lidocaine supplemented with buccal infiltration.

Materials and methods: Forty five patients, diagnosed with irreversible pulpitis of a mandibular posterior tooth were included in the study. The first group of 15 patients received 2% lidocaine with 1:200000 epinephrine, the second group 2% lidocaine with 1: 80,000 epinephrine and the third group of 15 subjects received 4% articaine with 1:100000 epinephrine. During the access cavity preparation those patients who complained of pain received an additional buccal infiltration. The percentage of subjects who got profound anesthesia and failure to achieve anesthesia were calculated and tabulated using a visual analog scale.

Results: The results revealed that 87% of subjects who received 4% Articaine with 1:100,000 epinephrine got satisfactory anesthesia with inferior alveolar nerve block alone. Only 2 (13%) subjects received an additional buccal infiltration and none of the patients failed to obtain complete anesthesia with articaine. In comparison only 40% of subjects got complete anesthesia with 2% lidocaine with 1:200000 and 60% with 2% lidocaine with 1:80,000.

Conclusion: It can be concluded that 4% articaine can be used effectively for obtaining profound anesthesia for endodontic procedures in patients with irreversible pulpitis.

Keywords: Articaine, Irreversible pulpitis, Lidocaine, Infiltration anesthesia.

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INTRODUCTION

The commonly used local anesthetics have proven to be effective for most routine dental procedures. Local anesthesia plays a vital role for pain management during endodontic emergencies.¹⁻³ Teeth which present with irreversible pulpitis often require a greater concentration of anesthetic or direct pulpal anesthesia to become completely anesthetized even when the surrounding soft tissue and adjacent teeth may have already achieved anesthesia.

Although lower anterior teeth can be anesthetized by infiltration anesthesia, the inferior alveolar nerve block is commonly used for endodontic procedures in posterior teeth. Various studies over the years have shown that the inferior alveolar nerve block fails to achieve successful pulpal anesthesia,⁴⁻⁷ the failure percentage ranging from 7 to 77%.^{2,3,8,9} It was noticed that the failure percentage increases when the pulp is inflamed.^{2,3,8,9} There are certain factors which inhibit the potency of local anesthesia like cross and accessory innervations,⁹ decreased local pH², tachyphylaxis of anesthetic solution and activation of nociceptors including tetradoxin and capsaicin sensitive transient receptor potential vanilloid type 1.¹⁰

Lidocaine is the most widely used local anesthetic for pain control, since its pharmacokinetic characteristics and low toxicity compared with other ester-type anesthetics make it safe for use in dental practice.¹¹ Articaine is classified as an amide and contains a thiophene ring instead of a benzene ring like other amide local anesthetics.¹²

To overcome the supplemental anesthesia and to increase the effectiveness of the quality of anesthesia, articaine was introduced. A number of studies have evaluated the safety and appropriate dose of articaine.^{12,13} Four percent articaine can be administered to a maximum dose of 500 mg (6.6-7 mg/kg) for adults, reducing the dosage and increasing the effectiveness as compared with 2% lidocaine.

The purpose of the present investigation was to compare the anesthetic efficacy of inferior alveolar nerve block using 4% articaine with 1:100,000 epinephrine with 2% lidocaine with 1:80,000 and 1:200,000 epinephrine in patients with irreversible pulpitis with or without buccal infiltration.

MATERIALS AND METHODS

The study was conducted on forty five adult symptomatic patients (18-40 years of age) who reported to dental outpatient

department. The subjects were in good health and were not under any medications. Subjects who are allergic to local anesthesia or sulphites, pregnant, smokers and teeth with periapical lesion were excluded in the study. Ethical clearance and patient consent was obtained from the department prior to the study.

The vitality test was performed as inclusion criteria before starting the procedure. Prolonged response to cold testing with an ice stick and an electric pulp tester was used (Kerr, Analytic Technology Corp, Redmond, Wash). The pain intensity was recorded based on the patient’s response in the Heft-Parker visual analog scale. The VAS was divided into four categories. No pain corresponds to 0 mm. Mild pain described as faint and weak was recorded a score between 0 and 2.5 mm, moderate pain from 2.5 to 5 mm and severe pain more than 5 mm. The severe pain as interpreted was intense and strong. Standard IANB using the various anesthetic solutions was administered.

The groups were:

- Group A: Two percent lidocaine with 1:200000 epinephrine (n = 15).
- Group B: Two percent lidocaine with 1:80,000 epinephrine (n = 15).
- Group C: Four percent Articaine with 1:100000 epinephrine (n = 15).

After 15 minutes of IANB, subjective and objective symptoms were checked. The teeth were isolated with rubber dam and access preparation was done. During the procedure, if the patient encountered pain, the procedure was stopped and the patient was asked to rate the pain according to VAS scale. The extent of preparation or instrumentation was limited to the teeth and pulp space. Whenever the patient encountered pain, a supplementary buccal infiltration was given. The success rate of the supplementary buccal infiltration was defined as absence of pain after the administration of buccal infiltration.

RESULTS

Forty five patients participated in the study. In the first group (2% lignocaine with 1: 200000 epinephrine) nine patients were given additional buccal infiltration. Three patients failed to achieve anesthesia and was considered as failure of IANB (Table 1 and Fig. 1). In the second group (2% lignocaine with 1:80,000 epinephrine) 6 patients were given buccal infiltration. Two subjects had failed to achieve anesthesia. In the third group (4% articaine with 1:100000 epinephrine) only two patients were given additional infiltration. There was no case of failure in this group. All patients included in the study had a profound lip anesthesia after local anesthesia. Buccal infiltration of lidocaine significantly increased the success rate and was significantly higher in the group anesthetized with 4% articaine.

DISCUSSION

Optimal local anesthesia is a critical component of successful patient management in endodontic therapy. This

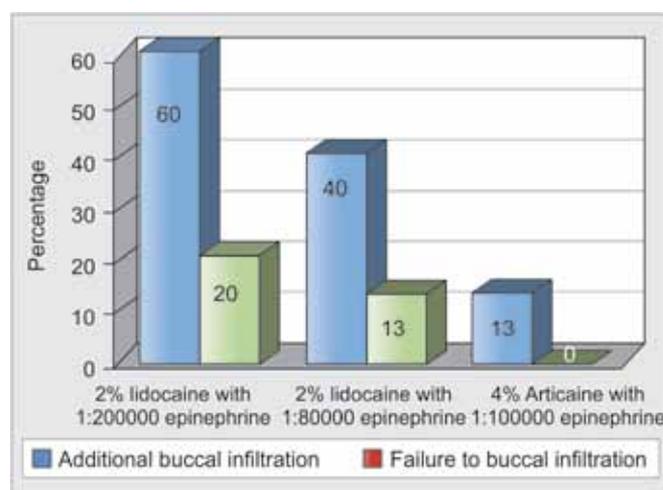


Fig. 1: Percentage of cases that required additional buccal infiltration and percentage of failed cases after additional buccal infiltration

Table 1: Number of subjects who required buccal infiltration and failure to get profound anesthesia with additional buccal infiltration

Groups	Without buccal infiltration		With buccal infiltration		Failure to additional buccal infiltration	
	Number	Percentage	Number	Percentage	Number	Percentage
2% lidocaine with 1:200000 epinephrine (n = 15)	6	40	9	60	3	20
2% lidocaine with 1:80000 epinephrine (n = 15)	9	60	6	40	2	13
4% articaine with 1:100000 adrenaline (n = 15)	13	87	2	13	0	0

study was undertaken to evaluate and compare the local anesthetic effectiveness of articaine for undertaking endodontic procedure in irreversible pulpitis. Comparison was made with lidocaine local anesthetic. The administration of buccal infiltration in addition to inferior alveolar nerve block (IANB) was also studied. The observations showed that 4% articaine in 1:100000 epinephrine showed maximum benefit compared to 2% lidocaine in 1:80,000 and 1:200000 epinephrine.

Articaine is an amide local anesthetic containing a thiophene ring as well as an additional ester ring. The thiophene ring makes up articaine's lipophilic segment (Quinn & Malamed, 1990). These properties makes a slightly different biotransformation of articaine than other amides. Due to the ester ring, articaine is hydrolyzed in the plasma, by plasma esterase as well as in the liver by hepatic microsomal enzymes. Four percent articaine with 1:100,000 epinephrine provides approximately 75 minutes of pulpal anesthesia (Quinn & Malamed, 1990). Articaine has been shown to have better hard and soft tissue diffusion compared to other local anesthetics.

Earlier studies have shown that articaine provided a longer duration of pulpal anesthesia than lidocaine.^{14,15} Due to the failure to obtain profound anesthesia from an initial injection, supplemental injections are often required for the completion of endodontic procedures in cases of irreversible pulpitis.⁵ Kanaa et al¹⁶ found that 4% articaine with 1:100,000 epinephrine was more effective than 2% lidocaine with 1: 200,000 epinephrine in producing pulpal anesthesia in lower molars using buccal infiltration injection. The observations of the current study is in agreement with the earlier studies reported.¹⁶⁻¹⁹

Even though Lidocaine hydrochloride is the most widely used local anesthetic for routine dental procedures, teeth which present with irreversible pulpitis often require a greater concentration of anesthetic or direct pulpal anesthesia. A tooth with irreversible pulpitis will experience throbbing pain from expansion of the vessels, while its periapical tissue remains unaffected. Unless there is direct access to the pulp, diffusion through the apical foramen is the only method for local anesthesia to reach the inflamed pulp. Articaine hydrochloride is a superior anesthetic agent, mainly due to its enhanced anesthetic potency, which is 1.5 times greater than that of lidocaine, with faster onset and increased success rate.²⁰

Other methods of achieving anesthesia for endodontic procedures has several drawbacks. Delivery of intraosseous injection requires perforation of the cortical plate and it requires specialized equipment which leads to some cardiovascular effects, postoperative hyper occlusion and more chances of infection at the perforation site.²¹⁻²³ Intraosseous injection may occasionally leads to perforation and necrosis

at the injection site.²⁴ Intrapulpal injection needs perforation of the roof of the pulp chamber that can provide a backflow of the local anesthetic solution.

In the present study, different anesthetic solutions were tried to avoid buccal infiltration and to achieve adequate pulpal anesthesia by administering inferior alveolar nerve block. It was seen that the success rate with 4% articaine by administering as inferior alveolar nerve block was better than 2% lidocaine with 1:80,000 and 1:200,000 concentration.

It can be concluded that 4% articaine with 1:100,000 epinephrine showed better anesthetic effect when administered as inferior alveolar nerve block without a buccal infiltration followed by 2% lidocaine with 1:80,000 epinephrine and 2% lidocaine with 1:200,000 epinephrine.

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