

Anesthetic efficacy of Articaine Buccal Infiltration compared to Lidocaine Inferior Alveolar Nerve Block in symptomatic mandibular premolars: a randomized control trial

Ahsan Ali, Fawad Ali Shah, Saadia Nawaz, Syed Muhammad Junaid

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Author Information

Dr. Ahsan Ali

Assistant Professor
Rehman College of Dentistry,
Peshawar, Khyber
Pakhtunkhwa, Pakistan
(Corresponding author)
Email: ahsan.ali@rmi.edu.pk

Dr. Fawad Ali Shah

Assistant Professor
Khyber College of Dentistry,
Peshawar, Khyber
Pakhtunkhwa, Pakistan

Dr. Saadia Nawaz

FCPS-II Trainee
Rehman College of Dentistry,
Peshawar, Khyber
Pakhtunkhwa, Pakistan

Dr. Syed Muhammad Junaid

Assistant Professor
Sardar Begum Dental
College, Peshawar, Khyber
Pakhtunkhwa, Pakistan

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ABSTRACT

Introduction: Pain during root canal treatment is the leading cause of anxiety among dental patients; 10-81% of patients with an irreversibly inflamed pulp experienced moderate pain during the procedure even after local anesthesia.

Objective: To compare the anesthetic efficacy of 4% Articaine Buccal Infiltration to 2% Lidocaine Inferior Alveolar Nerve Block in patients with symptomatic irreversible pulpitis in mandibular premolars.

Materials & Methods: A randomized control trial was done at the Endodontics Department of Rehman College of Dentistry, Peshawar, from January 2023 to July 2023. Eighty-six patients with symptoms of irreversible pulpitis in mandibular premolars were selected using purposive sampling technique and divided into two groups by random allocation using the lottery method: Articaine Buccal Infiltration and Lidocaine Inferior Alveolar Nerve Block. Pain was recorded at two points using Visual Analogue Scale (VAS): before the administration of anesthesia and during the root canal treatment. SPSS version 26.0 was used to enter and analyze the data for descriptive and comparative statistics. Differences of means were compared by the Paired Samples T test and the Independent Samples T test within and between the two groups. The Chi-square test was used to determine the anesthetic efficacy. A p value ≤ 0.05 was considered significant.

Results: Four percent Articaine buccal infiltration was successful in 53.5% of the cases and 2% Lidocaine inferior alveolar nerve block was successful in 60.5% of the cases in anesthetizing mandibular premolars with signs of irreversible pulpitis. No significant difference was found between the two techniques ($p > 0.05$).

Conclusion: None of the two techniques showed superiority or produced profound anesthesia in irreversibly inflamed mandibular premolars. Supplemental anesthesia was needed for painless root canal treatment.

Keywords: Anesthesia, Dental; Articaine; Lidocaine; Bicuspid; Dental Pulp Cavity; Pulpitis.

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INTRODUCTION

Root canal treatment (RCT) is a commonly performed procedure used to remove an inflamed or an infected pulp from inside a tooth. However, it is a very painful procedure that requires profound anesthesia. Profound anesthesia in an Irreversibly Inflamed Pulp (IIP) is difficult to achieve.¹ Thus, patients with symptoms of Irreversible Pulpitis (IP) feel moderate to severe pain during the procedure.¹ Inflammatory transformation in an IIP may cause the failure.² Various anesthetic techniques and solutions have been tried to anesthetize teeth with an IIP.³

Mandibular Premolars (MP) are anesthetized by either Inferior Alveolar Nerve Block (IANB) or Buccal Infiltration (BI) anesthesia. IANB blocks the nerve from the trunk area, thus anesthetizing all teeth in that quadrant. However, the infiltration method only anesthetizes a single tooth or adjacent teeth. IANB is the choice of technique for anesthetizing inflamed MP. However, this technique is associated with multiple drawbacks including its sensitivity, high failure rate,^{4,5} trismus, hematoma, nerve injury,⁶ paresthesia of lower lip,⁶ facial nerve palsy⁶ and ocular complications.⁷

Maxillary teeth are anesthetized by BI. However, the presence of dense cortical bone reduces the efficiency of infiltration technique in mandibular posterior teeth.⁸ BI was used as a supplemental technique in case of IANB failure.^{9,10} However, studies¹¹ have shown that it can be used as primary anesthesia for inflamed mandibular posterior teeth. Infiltration anesthesia is less technique sensitive, no numbness of lip/tongue, has minimal complications, and the effect of the anesthesia wear off much faster than block anesthesia.¹¹

Lidocaine is the most used local anesthetic agent for RCT.¹² Articaine, another amide, was introduced into dental practice in 1998. It contains a thiophene ring instead of benzene that makes it more lipid soluble, hence having an even faster onset of action, being available in twice the concentration of Lidocaine and being more potent than it.¹² The half-life of Articaine is 20 mins and that of Lidocaine is 90 mins.¹³

Studies^{14,15} evaluating the efficacy of Articaine showed that 4% Articaine is more efficacious than 2% Lidocaine in patients with Symptomatic Irreversible Pulpitis (SIP). A randomized controlled trial was done by Khan¹⁴ on mandibular molars with SIP. She compared the anesthetic efficacy of Articaine to Lidocaine during root canal treatment. According to that study Articaine success was 90.2% as compared to Lidocaine (76.2%) with a p value of <0.05. However, other studies^{16,17} showed that the type of anesthesia does not affect the efficacy in case of irreversible pulpitis. Zain et al,¹⁶ compared the Articaine buccal infiltration (ABI) with the lidocaine inferior alveolar nerve block (LIANB) in patients with SIP. According to that study ABI success was 76.9% and that of the LIANB was 62.8% without any significant difference (p value >0.05). Only one study had compared the efficacy of ABI against LIANB in MP. A study was conducted by Yilmaz,¹⁸ in which he compared the efficacy of the ABI versus the LIANB in MP. The result of that study showed that the efficacy of the ABI was 60% and that of the LIANB was 70% with p value >0.05.

Root Canal Treatment (RCT) is a routinely performed procedure in dental practice and achieving profound anesthesia before RCT is the foremost step. Sometimes it becomes difficult to achieve profound anesthesia in patients with SIP. Therefore, every dentist should be aware of the anesthetic technique and anesthetic agent that are most effective in SIP. Four percent (4%) ABI as a supplementary anesthesia is being used in SIP. However, as a primary anesthesia its efficacy is still questionable. Therefore, the present study was conducted to compare the anesthetic efficacy of 4% ABI to 2% LIANB in MP with SIP.

MATERIALS & METHODS

A Randomized Controlled Trial was done at the Endodontics Department of Rehman College of Dentistry, Peshawar from 20th January 2023 to 20th July 2023. An ethical approval was taken from the ethical committee of the institute. Patients within the age range of 18-60 years with symptoms of IP in any of the MP with closed apices were selected via purposive sampling technique. Medically compromised patients, pregnant females, patients taking any medications, allergic to local anesthetics, having mild or no pain, not willing to give consent, non-vital teeth, and non-restorable teeth were excluded from the study. A sample of 86 MP in 86 participants were selected with a 95% confidence level and 80% power of test using the openepi.com software; 43 participants were placed into ABI group and 43 in LIANB group by random allocation using the lottery method. An informed consent was received from every participant.

A single trained endodontist not taking part in the study was assigned to record the patient’s pain on a visual analogue scale (VAS). A 10cm line (0-10) drawn on the page was given to every patient to mark their pain. Anesthesia was given to every participant by the same operator who was not part of the study. Patients were blinded to the type of anesthesia. In ABI group, 1.8 ml of 4% Articaine (Orabloc) using 27G needle in an aspiration syringe was administered as buccal infiltration to the participants. In IANB group, 1.8ml of 2% Lidocaine (Medicaine) using 27G needle in an aspiration syringe was administered as an IANB to the participants. A rubber dam was applied 10 minutes after the

administration of anesthesia and access cavity was prepared. A 15-K file was introduced into the root canal of the tooth. At that point, pain was also recorded. VAS score from 0 to 3 was labelled as successful. Efficacy was considered as failure if the VAS score was 4 to 10 during the procedure. Supplemental anesthesia was given in that case.

Data were collected using SPSS v 26.0. Means and SD were calculated for age and pain. Percentages and frequencies were calculated for gender and efficacy. The Paired Samples T test was used to assess the mean difference in pain score before treatment and pain score during treatment in each group. Independent Samples T test was used to compare the means of two independent groups. The Chi-square test was used to determine the anesthetic efficacy. A p value ≤0.05 was considered significant.

RESULTS

Gender distribution, age and pain scores are given in Table 1. The mean difference in pain scores during the treatment between both the groups is 0.579 (p >0.05).

Table 1: Demographics and pain scores of participants (n=86).

Variables	ABI	LIANB
Gender		
Male	41.9%	51.2%
Female	58.1%	48.8%
Age	34.44 ± 10.44	36.26 ± 11.33
Pain scores		
Before	6.21 ± 1.582	6.33 ± 1.569
During	4.16 ± 2.360	3.86 ± 2.660
Mean Difference	2.047 ± 2.743	2.465 ± 2.979
p value	0.639	0.612

Efficacy in terms of success or failure according to the technique is presented in table 2. No significant relation of efficacy with gender and age was found (p > 0.05).

Table 2: Efficacy according to the anesthetic techniques (n=86).

Efficacy	ABI n=43(%)	LIANB n=43(%)	p>0.05
Success	23 (53.5)	26 (60.5)	
Failure	20 (46.5)	17 (39.5)	
Total	43 (100)	43 (100)	

DISCUSSION

Local Anesthetic (LA) is the most used method for painless RCT. However, painless RCT still remains a dream to a dentist, particularly in patients with an IIP. In this study 4% ABI was compared to 2% LIANB in terms of difference in pain scores before and during the RCT. The pain score in both groups decreased, but the difference between pain score before and during the treatment was not significant (p>0.05). Similarly, difference in pain between ABI and LIANB groups was also non-significant (p>0.05). These results are not in accordance with the study done by K Yilmaz,¹⁸ in which he compared the difference in pain scores before and during RCT by using two anesthetic techniques in irreversibly inflamed MP. The result of that study

shows that the pain scores decreased significantly in both the groups after administration of Local Anesthetic (p value ≤ 0.05).

In the present study LIANB was more successful (60.5%) than ABI (53.5%); however, the difference was insignificant ($p > 0.05$). This result is in accordance with the study done by Yilmaz,¹⁸ in which 60% anesthetic success was achieved with 4% ABI and 70% success was achieved with 2% LIANB, but without any significant difference ($p > 0.05$). However, Zain et al,¹⁶ showed that ABI was more successful (76.9%) than LIANB (62.8%) in anesthetizing mandibular molars with SIP.

As maxillary bones are more porous than dense, they allow the spread of anesthesia from cortical to cancellous bone and towards the tooth nerve supply.¹⁹ Hence, the BI is the technique of choice in maxillary teeth. Thick cortical bone in the mandible particularly in the posterior region, prevents the spread of anesthesia towards the tooth nerve supply.¹⁹ Hence, IANB is the preferred technique in mandibular teeth. However, there are porosities in the mandible in the anterior and premolar regions which permit the spread of anesthetic agents.¹⁹ For that reason and due to the advantages of infiltration anesthesia over block anesthesia,¹⁸ clinicians prefer BI anesthesia in MP.

Articaine, due to more rapid onset of action and the ability to penetrate cortical bone is preferred by many clinicians over Lidocaine. Various studies^{15,16} have evaluated the anesthetic efficacy of Articaine showing that it is as effective as Lidocaine.

In the current study, confounding factors like age and gender were assessed against anesthetic efficacy, and showed no significant impact ($p > 0.05$). Moreover, anesthetic efficacy was only determined in terms of pain during the treatment. No consideration was given to onset and duration of anesthesia, discomfort during and after the injection and complication associated with anesthesia. Therefore, it is recommended that anesthetic efficacy should be further measured in terms of pain, onset, duration, injection discomfort, and any complications.

CONCLUSION

No significant difference was found between 4% Articaine BI and 2% lidocaine IANB in anesthetizing symptomatic mandibular premolars. Neither technique provided profound anesthesia in irreversibly inflamed mandibular premolars and supplemental anesthesia was needed for painless root canal treatment.

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