COMPARISON OF EFFECTIVENESS OF 4% ARTICAINE BUCCAL INFILTRATION VERSUS INFERIOR ALVEOLAR NERVE BLOCK IN SYMPTOMATIC MANDIBULAR 1ST MOLAR TOOTH

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Date Received:
February 14, 2015
Date Revised:
October 23, 2015
Date Accepted:
November 18, 2015

ABSTRACT

Objective: To evaluate the pulpal anaesthesia of mandibular 1st molar by using 4% articaine in two different techniques i-e buccal infiltration and inferior alveolar nerve block.

Methodology: Ninty emergency patients who had 1st molar diagnosed with irreversible pulpitis participated in the study. Subjects were randomly allocated into two groups One group received 4% articaine buccal infiltration and the other group received inferior alveolar nerve block of 4% articaine. Subjects' self reported pain response was recorded on Heft Parker Visual Analogue Scale after local anesthetic administration during access cavity preparation and pulp extirpation.

Results: Mean age of subjects was 32.96 years ± 10.105 years. The success rate of 4% articaine buccal infiltration was 71.11% whereas the success rate of 4% articaine inferior alveolar nerve block was 64.4%. There was no statistically significant difference between two groups.

Conclusion: Since there was no difference between the two procedures 4% articaine buccal infiltration can be considered a viable alternative to inferior alveolar nerve block in securing successful pulpal anesthesia for endodontic therapy.

Key Words: articaine, mandibular 1st molar, buccal infiltration, inferior alveolar nerve block, pulpal anaesthesia.

This article may be cited as: **Zain M, Khattak SR, Shah SA, Sikandar H, Khattak Y. Comparison of effectiveness of 4% articaine buccal infiltration versus inferior alveolar nerve block in symptomatic mandibular 1st molar tooth. J Postgrad Med Inst 2015; 29(3): 176-80.**

INTRODUCTION

An important requirement prior to endodontic treatment is the ability to achieve and maintain profound anaesthesia. Teeth requiring endodontic treatment have increased significantly, with mandibular teeth requiring it more frequently than maxillary teeth1. The most commonly used injection technique for anaesthetizing maxillary teeth is infiltration and commonly used injection technique for anaesthetizing mandibular teeth is inferior alveolar nerve block (IANB) 2.

It is reported that teeth with inflamed pulp are more difficult to anaesthetize3. Irreversible pulpitis is considered more likely to experience local anaesthesia failure as compared to non-inflamed control teeth4. In cases of irreversible pulpitis, lip anaesthesia can be achieved following inferior alveolar nerve block, whereas pulpal anaesthesia is ineffective5.

Mandibular teeth are commonly anaesthetized by IANB. Other techniques such as intra-osseous, periodontal ligament anaesthesia and buccal infiltration anaesthesia may be used to supplement or replace IANB2. Unfortunately IANB proves to be the most frustrating, with highest percentage of clinical failures (approximately 15% to 20%) even when properly administered2. Complications related to IANB injection include transient facial paralysis, trismus, local anaesthetic injected into blood vessel, self-inflicted trauma, damage to sphenomandibular ligament and pterygomandibular space infection. Buccal infiltration anaesthesia is considered relatively easier to perform and no specific equipment is needed. Moreover, there is minimal damage to adjacent periodontal ligament and less chances of bacteremia.

Articaine is the first local anaesthetic of amide type. It contains thiophene ring and ester group6. The safety and efficacy of articaine is reported in different studies7-9. A number of studies have been conducted to

determine pulpal anaesthesia obtained after buccal infiltration and IANB of 4% articaine. Studies conducted by Young et al and Poorni et al compared effectiveness of 4% articaine in buccal infiltration and showed that buccal infiltration had a success rate of 69.2% while the success rate of IANB was 43%5,7. The aim of this study is to compare 4% articaine in buccal infiltration vs. IANB.

METHODOLOGY

This randomized single blind clinical trial compared the effectiveness of 4 % articaine BI versus IANB in symptomatic mandibular 1stmolar. Institutional Review Board of Sardar Begum Dental College, Gandhara University, Peshawar, Pakistan approved this study. An informed consent was taken from all patients. Strict inclusion and exclusion criteria were observed for the selection of subjects. Ninety subjects experiencing moderate to severe pain in mandibular 1st molar were enrolled. All subjects were asked about analgesics as these can alter the perception or severity of pain.

After a proper history taking and investigations (periapical radiographs and pulp vitality tests) subjects were divided into two groups by random allocation (lottery method). Sample size was calculated using WHO sample size calculator keeping confidence level 95% and power of test 80%. Thus ninety subjects were included in the study. Each group was having 45 subjects. Before starting the procedure the subjects were inquired about their pain using VAS, to get the baseline reading of preoperative pain. All anaesthetic injections were administered by a single operator who was not involved in assessing the outcome. The injections were administered with a 27-G needle(brand name) attached to a standard aspirating syringe, and the anaesthetic solution(brand name) was deposited at a rate of 1.8 mL per 60 seconds. Group 1 consisted of subjects who received a standard IANB of 4% Articaine with 1:100,000 epinephrine using 27 gauge 0.4x42mm needle. As access was gained to the specific area, aspiration was done, and then infiltration of 1.8ml of local anaesthetic was carried out.

Group 2 consisted of subjects who received BI of 4 % Articaine with 1:100,000 epinephrine using 27 gauge 0.4x25 mm needle. Buccal Infiltration was administered adjacent to the mandibular first molar, bisecting the approximate location of the mesial and distal roots. After administration of local anaesthetic 10 to 15 minutes were given for induction of anaesthesia and was confirmed by lip numbness and EPT. Subjects who reported lip numbness were studied for data analysis.

Subjects of both groups underwent same procedure which included rubber dam isolation, access cavity preparation and performing the preliminary filing of the canals. Subjects of both groups were advised to elevate one hand if they felt pain. The anaesthesia was considered successful if no or mild pain was reported on access cavity preparation and pulp extirpation. Subjects who reported moderate to severe pain during access cavity preparation and pulp extirpation, were administered supplementary injections (intra-ligamental, intra-pulpal or intra-osseous) accordingly, and no further records were taken. They were considered to have unsuccessful anaesthesia in there corresponding technique.

Visual analogue scale (VAS) was used to assess preoperative pain and pain during the procedure. VAS was explained to every subject before starting treatment10. To interpret the data, experienced pain was categorized into following 04 categories based on VAS:

0=No pain, <4= Mild pain, 4-6= Moderate pain and >7= Severe pain.

RESULTS

Patients were recruited from the outpatient department of Operative Dentistry, Sardar Begum Dental College. There were 48 males and 42 females. Average age of subjects was 32.96±10.105 years with a range of 18 to 60 years (Figure 2). Average pain score before starting the treatment was 3.71 ± 0.45. 67.78% of subjects (61/90) secured successful pulpal anaesthesia and had no pain or mild pain during access cavity preparation and pulp extirpation while 32.22% of subjects (29/90) felt moderate to severe pain during the procedure and were recorded as unsuccessful in their respective technique (Table 2).

Thirty two subjects experienced anaesthetic success (71.11%) after Buccal Infiltration of 4% Articaine compare to 29 subjects (64.4%) who received IANB of 4% articaine. This difference was not significant (p=0.499) (Table 3).

No adverse reactions were recorded after administration of local anaesthesia with either technique.

DISCUSSION

The most common technique of anesthetizing mandibular teeth undergoing endodontic treatment is IANB. However successful pulpal anaesthesia is not always achieved and failure rates have been reported regarding this technique in the range of 15% to 20% 2. IANB produces unnecessary anesthesia of full quadrant and half tongue which is sometimes quite disturbing for the patients. Although buccal infiltration is not without disadvantages, avoiding IANB has many advantages. Trismus and non-surgical paraesthesia due to needle injury to inferior alveolar or lingual nerve is prevented in infiltration technique. It produces less unwanted soft tissue anaesthesia. Moreover, it can be preferred in some patients (e.g. haemophiliacs) to avoid haemorrhage.

The mandibular teeth pulpal anaesthesia can be

Table 1: Mean pain with standard deviation.

Local anesthesia technique		Pain Before Treatment	Pain duringTreatment
Inferior Alveolar Nerve Block	MEAN	3.80	2.044
	STD.Deviation	0.404	0.877
Buccal Infiltration	MEAN	3.844	1.844
	STD.Deviation	0.366	0.851

Table 2: Anesthetic success in both groups.

		local anesthetic technique		Total
		Inferior Alveolar Nerve Block with Articaine	Buccal Infiltration with Articaine	
Anesthetic efficacy	yes	29	32	61
	no	16	13	29
Total		45	45	90

P value = 0.499

Table 3: both the groups stratified with respect to age and gender.

		Local anesthetic TECHNIQUE n = 90				P value
		IANB with 4% articaine n= 45		BI with 4% Articaine n= 45		
		Anesthetic success		Anesthetic success		
		yes	no	Yes	No	
AGE GROUP	18-30	12	0	21	09	0.032
	31-50	14	15	09	04	0.207
	51-60	03	01	02	0	0.439
GENDER OF SUBJECTS	MALE	16	9	16	07	0.683
	FEMALE	13	7	16	06	0.588

P value = 0.499

achieved with greater success, if either we change the technique of administration of local anaesthesia or change the local anaesthetic solution. In this study we have changed local anaesthetic and administered it with two different techniques i-e BI and IANB.

The primary anesthetic efficacy parameter in this study was the subjective evaluation of pain during access cavity preparation and pulp extirpation. Evaluation of pain was done on VAS which provided validated and meaningful measure of anesthetic efficacy. The patient's age, gender and initial pain score were not statistically significant between two groups at the start of study

Results of our trial showed that successful pulpal anaesthesia achieved after buccal infiltration of 4% articaine was 71.11 % and inferior alveolar nerve block with 4% articaine was64.4%. These results are similar to Ashraf et al8 (71%) who used articaine buccal infiltration of 4% articaine after failure of IANB with 4% articaine. Jung et al5 showed that successful pulpal anaesthesia after administration of 4% articaine buccal infiltration was 54% and inferior alveolar nerve block with 4% articaine was 43%. These values are quite low as compared to our study. Possible reason for the better results as compared to the work of Jung et al5 may be due to larger sample size and inclusion of patients ranging in age from 18 to 60 years. Study conducted by Poorni et al7 showed that IANB with 4% articaine had a success rate of 75% as compared to buccal infiltration which had success rate of 69.5%. Difference of results from the work of Poorni et al7 may be due to race specific effect.

After the administration of local anesthetic (articaine / lidocaine) by either technique, wait of 10 to 15 minutes was observed for induction of anesthesia. This is based on times suggested by previous studies for injection to take full effect9-12. Lip numbness was present in all subjects in our study. This may be due to close proximity of mental nerve to mandibular 1st molar.

No significant difference was found between success rates of buccal infiltration with 4% articaine as compared to inferior alveolar nerve block of 4% articaine. Articaine is 4-methyl-3 (2-[propylamino] propionamido)-2-thiophenecarboxilic acid, methyl ester hydrochloride13,14. Potency of a local anaesthetic is dependent on its lipid solubility. This intrinsic quality allows anaesthetic solution to penetrate easily through the lipid membrane of nerve and adjacent tissues15. The anaesthetic is considered to release more slowly from its receptor sites when efficiently bonded. Plasma proteins binding properties are also important. Lipid solubility alone is not a major determinant of duration of local anaesthetic16.

This thiophene ring increases its liposolubility as well as its potency. Penetration of articaine through buccal cortical plate is also dependent of density and porosity of bone which vary among races17. Robertson9 and colleagues suggested BI of articaine might be due to penetration of solution through mental foramen leading to higher success rate in premolars and 1st molar. As mentioned, articaine is an amide containing thiophene ring and an additional ester group. This thiophene ring increases its lipid solubility. Articaine anaesthetic success in buccal infiltration also depends on density and porosity of bone which vary among races17. Success of articaine in buccal infiltration may also be due to its penetration through mental foramen leading to anaesthesia in mandibular premolars and molars9.

There are some limitations to this study. This study was not double blinded. Duration of anaesthesia and discomfort at the site of local anaesthetic injection were not assessed. Moreover the sample size was small in this study.

CONCLUSION

Within the limitations of this study we can conclude that teeth with irreversible pulpitis have no statistically significant difference between articaine buccal infiltration and inferior alveolar nerve block. Hence compared with inferior alveolar block, buccal infiltration can be considered a viable alternative to secure pulpal anaesthesia for endodontic therapy.

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CONTRIBUTORS

MZ conceived the idea, did data collection and wrote the manuscript. SRK and SAS helped in data collection. HS helped in the write up of manuscript. YK did the data analysis. All authors contributed significantly to the final manuscript.