ORIGINAL ARTICLE

EVALUATION OF ANESTHETIC EFFICACY OF 4% ARTICAINE AS BUCCAL INFILTRATION VS 2% LIDOCAINE AS IANB IN THE MANDIBULAR 1ST MOLAR WITH IRREVERSIBLE PULPITIS

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ABSTRACT

The purpose of this prospective, randomized, study was to compare the anesthetic efficacy of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:200,000 epinephrine for buccal infiltration and inferior alveolar nerve block respectively in patients experiencing irreversible pulpitis in permanent mandibular first molars.

Sixty emergency patients diagnosed with irreversible pulpitis of a mandibular first molar randomly divided into two groups. Thirty patients received buccal infiltration of 1.7 ml of 4% articaine with 1:100,000 epinephrine and thirty patients received standard inferior alveolar nerve block with 1.8 ml of 2% lidocaine with 1:200,000 epinephrine. Endodontic access was begun 10 minutes after solution deposition, success (anesthetic efficacy) was defined as none or mild pain (Visual Analogue Scale recordings) on endodontic access preparation or pulp extirpation.

Twenty-two patients out of 30 did not experience pain with 4% articaine (success = 52.4%) and 20 out of 30 patients did not experience pain in 2% lignocaine group (success = 47.6%). There was no statistically significant difference between the articaine formulation as buccal infiltration and lidocaine formulation as IANB with regard to anesthetic success (p value =0.220).

Even though buccal infiltration of 4% articaine and IANB of 2% lidocaine were equally effective, buccal infiltration can be considered a viable substitute in IANB for anesthetizing mandibular first molar with irreversible pulpitis.

Key Words: *Irreversible pulpitis, Articaine, Lidocaine, Buccal infiltration, Inferior alveolar nerve block.*

INTRODUCTION

Accurate local anesthesia is significant for successful pain management in endodontic treatment to decrease anxiety and discomfort of the patient. The most common techniques used for local anesthesia in endodontic are inferior alveolar nerve block (IANB) and infiltration techniques. The IANB is the most frequently used injection technique for achieving local anesthesia for mandibular molars in endodontic treatment procedures.[1]

IANB essentially blocks major nerves to that area which is why one loss his/her sensation in half of tongue and lower lip as well as all teeth in that quadrant of mouth, an infiltration is done to just anesthetize one particular tooth or area and not beyond. Usually the infiltration techniques is less painful, its effect wear off much faster and is less uncomfortable as compared to IANB.[1]

Local anesthesia in restorative dentistry where teeth have normal pulps can be executed successfully, ranging from 75% to 90%.[2] However, the effectuality of local anesthesia reduces in teeth with inflamed dental pulps, for e.g., irreversible pulpitis especially in mandibular molars. After an IANB, anesthetic failure

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may be caused by many factors, which may includes collateral innervations and cross innervations.[3]

As seen in study that, IANB with 2% lidocaine may be inadequate in patients with irreversible pulpitis especially in mandibular molars[4] and due to severe pain it is very difficult for endodontist to proceed for further treatment. Previous studies demonstrate 19%-56% success for IANB in irreversible pulpitis patients.[2,5] Therefore, supplemental techniques and alternative approaches and material should be considered by practitioners when there is a failure of IANB to provide pulpal anesthesia in irreversible pulpitis. Articaine is one of the most recent local anesthetic drugs available to dentist worldwide and was introduced in United Kingdom in 1999 and in United States in 2000.[6] Basically this is a safe and effective local anesthetic agent.[7,8]

Articaine diffuses properly through soft tissue and bone more efficiently on comparison to other local anesthetics.[9] This property of articaine makes it an appealing local anesthetic agent.

Many studies found that 4% articaine with 1:100,000 epinephrine was more effective than 2% lidocaine with 1:200,000 epinephrine in mandibular molar using buccal infiltration.[2,10-12]

These studies however carried out on normal teeth, very few studies were performed to observe the effectiveness of articaine to achieve the local anesthesia in patients with irreversible pulpitis. Furthermore, researchers still do not fully predict the clinical efficacy of different anesthetics in these hyperalgesic pulpal conditions.

So, the purpose of this prospective, randomized clinical trial was to compare the anesthetic efficacy of 4% articaine buccal infiltration with 2% lidocaine IANB as a means of providing pulpal anesthesia of mandibular first molar tooth in irreversible pulpitis.

METHODLOGY

Sixty patients between 18-65 years of age were selected from Department of Operative Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro / Hyderabad that fulfilled the criteria for a clinical diagnosis of symptomatic irreversible pulpitis in mandibular first molar. The sample size was calculated by using the open epitool, by putting the figures of a reference in study a mean difference module, at 95% confidence interval.[2] Patients younger than 18 and older than 65 years, with significant medical disease, taking any medication that might affect anesthetic assessment, allergic to local anesthetics and pregnant females were excluded from the study. Written informed consent was obtained from each patient before starting the treatment.

The subjects were divided into two groups, Group A and Group B by means of probability simple randomized (lottery method) Table 1. Patients in group A received standard buccal infiltration of 4% articaine with 1:100,000 epinephrine (Septanest, Septodont, France). Whereas, the group B patients received standard IANB (inferior alveolar nerve block) of 2% lidocaine with 1:200,000 epinephrine (Xylonibsa 2%, Inibsa, Spain). The patients were instructed to raise their hands if any pain was felt during access preparation and pulp extirpation. If patients feel pain procedure was aborted and the patients were asked to rate the pain on the VAS (visual analogue scale) i.e. no pain (0), mild (1-3), moderate (4-6) and severe (7-10).

Patients were asked to rinse their mouth with 0.12% chlorhexidine mouth wash before giving anesthesia. Topical anesthesia achieved by applying cold spray (Ghiaccio Spray comfort, Ice spray, Italy) for 15 seconds to make the area numb before injecting the needle. In Group A patients, 1.7 mL of 4% articaine with epinephrine 1:100,000 (Septanest, Septodont, France) administered by using standard dental aspirating syringe fitted with a 27-gauge needle (Top ject 25 mm). After needle penetration toward the target site, aspiration has been performed when no blood was aspirated then anesthetic solution was deposited at the rate of 1mL/min.

Similarly in group B, administered standard IANB (inferior alveolar nerve block) by using 1.8 mL of 2%lidocaine with epinephrine 1:200,000 (Xylonibsa 2%, Inibsa, Spain), with standard dental aspirating syringes with a 27- gauge needle (Top ject, 40mm). The patients were instructed to definitively rate any discomfort or pain during access preparation and pulp extirpation by using a Heft-Parker 10- cm VAS (Fig 1).

After 10 minutes of administration of local anesthesia in both groups, the access cavity was started to prepare with Endo access bur (Maillefer, Dentsply, Ballaigues, Switzerland), and pulp extirpations done with barbed broach (Medin, Jinonice, Czech Republic).

DATA ANALYSIS PROCEDURE

Data was analyzed by using SPSS version 16.0. The chi square test was used to compare both groups. The level of significance was considered as p-value $\leq$ 0.05 at 95% confidence interval.

RESULTS

Sixty patients aged 18-65 years (mean age, 37 years) were involved in the present study. 4% articaine

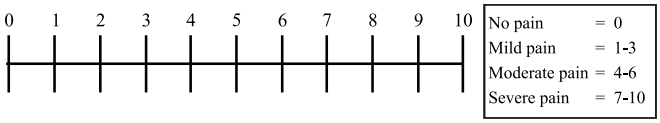

Fig 1: Visual Analogue Scale (VAS)

TABLE 1: STUDY GROUPS

Groups	No: of patients	Tooth Type	Anesthetic Used	Technique Used
Group A	30	Mandibular first molar	1.7 mL of 4% articaine with 1:100,000 epinephrine	Buccal infiltration
Group B	30	Mandibular first molar	1.8 mL of 2% lidocaine with 1:200,000 epinephrine	IANB

TABLE 2: SUCCESS OF LOCAL ANAESTHETIC AGENT AND TECHNIQUE (n=60)

	Type of Local Anaesthetic Agent	Outcome of LA		Total	P-Value
		Effective	Not Effective		
	4% Articane (Buccal Infiltration)	22	8	30	
		52.4%	44.4%	50.0%	0.220
	2% Lidocane (Ian Block)	20	10	30	
		47.6%	55.6%	50.0%	
		42	18	60	
Total		100.0%	100.0%	100.0%	

was given with buccal infiltration technique in group A patients (n=30) and 2% lidocaine with the inferior alveolar nerve block (IANB) was given in group B patients (n=30). With regard to anesthetic success among the total patients; 4% articaine was effective in 52.4% patients and 2% lidocaine was effective in 47.6% (Table 2). However this difference is statistically not significant (p value =0.220). The degree of pain experienced by the group A and group B patients was similar. Out of the entire failure cases in both groups one patient experienced severe pain (rate on VAS= 7-10) and the rest experienced moderate pain (rate on VAS= 4-6).

DISCUSSION

Lidocaine has retained its status as the most commonly used local anesthetic solutions in dentistry since its introduction. It has proven effectiveness, very low allergenicity, and negligible toxicity through clinical use and research has established the significance and safety of this drug. Thus, it became the gold standard to which all new local anesthetics are compared. Despite the gold standard status of lidocaine several reports have advocated the use of articaine as a better anesthetic agent, principally on the basis of its enhanced anesthetic potency, which is 1.5 times greater than that of lidocaine, with faster onset and increased success rate.[13] Success rate of IANB lidocaine in symptomatic irreversible pulpitis in a study of Aggarwal et al. and Kreimer was only 26% and 13% respectively.[14,15] However, controlled comparisons of IANB have failed to show any difference between articaine and lidocaine solutions.[16] We evaluated pulpal anesthesia using articaine as buccal infiltration for permanent mandibular first molar teeth. In previous studies,[17,18] the success of mandibular infiltration with 4% articaine and epinephrine for anesthetizing first molar was originate to be similar to that of an inferior alveolar nerve block with 2% lidocaine and epinephrine when similar outcome measures are used.

The results of the present study verify the results of previous studies[17,18] showing that 4% articaine was successful as a buccal infiltration. In the current study the success of the mandibular first molar infiltration of 4% articaine with 1:1,00,000 epinephrine was 52.4 % when compared to 47.6% for 2% lidocaine with 1:2,00,000 epinephrine as IANB.

The success of mandibular first molar buccal infiltrations has been investigated by various authors using asymptomatic subjects with 4% articaine containing 1:100,000 epinephrine and an electric pulp tester to evaluate pulpal anesthesia. Kanaa et al[10] Robertson et al[12] Jung et al[2] and Corbett et al[11] demonstrated 64%, 87%, 54% and 64-70% success rates respectively for the buccal infiltration of asymptomatic mandibular first molar. The success rate of 52.4% of buccal infiltration with articaine of the current study is similar to that of Jung et al[2] but differs and inferior from the results of other authors.[10-12] This could be due to difference in selection criteria because we selected the subjects with symptomatic irreversible pulpitis in contrast to asymptomtic subjects. The study also differs from the previous study by Aggarwal et al[19] where the success rate was greater, however this may be due to change in the methodology used where buccal infiltration with articaine was given in addition to IANB. Though a similar success rate was reported by Haase et al[20], it was also a combination of IANB and supplemental buccal infiltration with articaine.

Though numbness of the lower lip on the side of injection is assumed to be a sign of success of mandib-

ular nerve anesthesia, still patients feels pain during access opening despite lip anesthesia. This was similar to the observation in the study by Aggarwal et al[19] who reported pain on access opening inspite of lip anesthesia.

As the results of the present study show that buccal infiltration with 4% articaine was as effective as IANB in anesthetizing the pulp of the mandibular first molars. We are not sure why the success rates of articaine with buccal infiltration and lidocaine with IANB were similar. A possible mechanism as speculated by researcher[13] that success of articaine [(4-methyl-3-[1-oxo-2-(propylamino)-propionamido]-2-thiophenecarboxylic acid methyl ester hydrochloride)] could be because it contains a thiophene ring in its molecule instead of the benzene ring exist in lidocaine, thiophene increases the lipid solubility of the drug as well as its potency. Robertson and colleagues[12] suggested that buccal infiltration of articaine might have resulted in penetration of the solution through the mental foramen, leading to the higher success rates in the premolars and first molar. But a higher success rate can be expected in the premolars and first molar than in the second molar for both articaine and lidocaine formulations. This may be because of a comparatively thicker bone in the buccal aspect of second molar region which may prevent anesthetic penetration and diffusion.

Success of IANB anesthesia very much depends upon operator's skill and experience.[21] Furthermore in contrast to buccal infiltration the complications associated with IANB are maximum.[22] Since, the option of buccal infiltration would be a better choice for first molar, it is better that the superiority should be studied among different races because success may vary based on the bone density and porosity which may vary among races.[23]

CONCLUSION

Even though buccal infiltration of 4% articaine and IANB of 2% lidocaine were equally effective, it can be concluded that, 4% articaine with 1:100,000 epinephrine can be considered as an alternative for pulpal anesthesia in mandibular first molar with irreversible pulpitis instead of IANB with 2% lidocaine with 1:200,000 epinephrine.

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