Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2016;5:2:168-173.

Comparing the Anesthetic Efficacy of 4% Articaine HCL with 1:100000 Epinephrine and 2% Lignocaine with 1:100000 Epinephrine in Periodontal Flap Surgery: A Case-Control Study

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ABSTRACT

Background: The present study compares the anesthetic efficacy of 4% articaine HCL with 1:100000 epinehrine and 2% lignocaine with 1:100000 epinehrine in Periodontal flap surgeries.

Methodology: Twenty adult subjects diagnosed with moderate to severe periodontal disease requiring bilateral periodontal surgery were enrolled. Bilateral periodontal flap surgery was planned in maxillary posteriors in a single appointment. Maxillary posteriors in the first quadrant were selected as experimental site for articane, while the second quadrant in the same patient was chosen as the control sites for lignocane. The intraoperative pain intensity was measured objectively using the visual analog scale. Data was analysed using wilcoxon signed rank test.

Results: All the 20 sites in lignocaine group showed moderate to severe pain while 7 among the articaine group showed absolutely no pain during palatal flap reflection. A statistically significant difference was obtained.[p value=0.002]

Conclusion: Articaine in 4% solution with 1:100000 epinephrine can be recommended as a safe alternative anesthetic to lignocaine local anesthetic in periodontal flap surgeries. Use of articaine can avoid routine administration of painful palatal injection for palatal flap procedures.

Keywords: Bilateral periodontal flap surgery, 4% articaine hydrochloride with 1:100000 epinephrine, 2% lidocaine with 1:100000 epinephrine, visual analog scale.

INTRODUCTION

Dental pain is usually of acute inflammatory nature and it compels the patient for seeking professional help [1]. Effective pain control during dental procedures is essential for the success of treatment. To achieve this goal local anesthesia is being used since the past century [2]. Local anesthetics are chemicals that block nerve conduction in a specific, temporary, and reversible

Received: Jan. 19, 2016: **Accepted:** Mar. 23, 2016
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pISSN 2278-0076
eISSN 2321-9270

manner, without affecting the patient's consciousness [3].

The first substance that was used for this purpose was cocaine in 1884. In 1903, Braun suggested adrenaline as a "chemical tourniquet" to prolong the duration of local anesthetics[4]. In 1940's a new group of local anesthetic compounds, the amides were introduced. The initial amide local anesthetic, lignocaine, was synthesized by the Swedish chemist Nils Løfgren in 1943[4]. 2% lignocaine with 1:80,000 Adrenaline solution is a commercially available as sterile, isotonic aqueous solution. The pH of the solution is 3.3-5.0. Lignocaine causes a reversible blockade of impulse propagation along nerve fibres by preventing the inward movement of sodium ions through the nerve membrane.

Adrenaline can be used in concentrations ranging from 1:50000 to 1:200000 in Local anesthetics[5]. In india commercially it is available as 1:80000 to 1:200000.The addition of adrenaline decreases the rate of absorption of lignocaine from the site of injection, increasing the duration of anesthetic effect. The usual dosage in a normal healthy adult is 1-5 mL (equivalent to 20-100 mg lignocaine hydrochloride). Contraindications for administration include known hypersensitivity to local anaesthetics of the amide type, or other components of the solution, e.g. sodium metabisulphite[6].

In 1969 Rusching et al. prepared a new drug called articaine. It differed from the previous amide local anesthetics that it contained a thiophene ring in its molecule instead of the usual benzene ring (figures 1-3) which make it more lipophilic. It was first named carticaine, but its generic name was changed to articaine in 1984[4]. Commercially articaine for dental use is available in 4% solution with epinephrine 1:200000 or 1:100000. Articaine is claimed to be superior to lignocaine, owing to its better diffusion through soft tissues and bone, the rapid onset, the excellent quality of the anestheisia and the lower degree of toxicity[7].

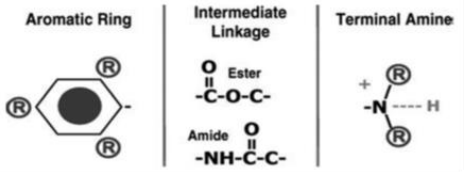

Fig 1: Structure of the local anesthetic molecule.

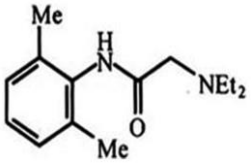

Fig 2: Lignocaine.

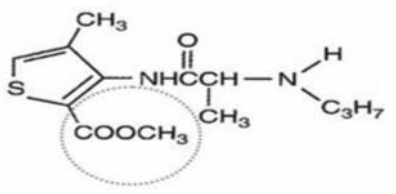

Fig 3: Articaine.

It is well documented that palatal injection is a painful experience to the patients even though surface anesthesia does allow for atraumatic needle penetration. Because of the density of palatal tissues and their firm adherence to the underlying bone, palatal injection is still painful [8]. Several investigators have comfirmed that palatal anesthesia achieved by depositing articaine to the buccal vestibule was as effective as palatal infiltration of lignocaine [11-14].

During periodontal flap surgeries palatal injections are required to reflect palatal flaps. Although there are emerging reports on the efficacy of articaine over lignocaine in dental literature, not many have focused on the use of articaine in periodontal flap procedures. The present study aims to compare the anesthetic efficacy of 4% articaine HCL with 1:100000 epinehrine and 2% lidocaine with 1:100000 epinehrine in Periodontal flap surgeries and to acertain whether buccal injection of articaine is as effective as the routine use of buccal and palatal injection of lignocaine.

MATERIALS AND METHODS

This study was conducted at the Department of Periodontology KMCT Dental College,Manassery, Kerala, India. The study was

approved by Institutional Scientific Review Board and the Ethics Committee.20 adult patients diagnosed with chronic generalized periodontitis enrolled and completed the study. The mean age was 35–55 years. The Male: Female ratio was 3:2.written consent was obtained from all participants.

Selection of subjects

Inclusion criteria

- Chronic Periodontitis : >30 % of teeth with 5mm or more of clinical attachment loss.
- A written informed consent during the pretreatment screening periods were taken.

Exclusion criteria

- The patients with known history of allergy to the local anesthetic agent were excluded
- Pregnancy
- Lactation
- Smokers
- Alcoholics
- Concomitant cardiac disease, neurological disease, liver or renal disease, hyperthyroidism, diabetes mellitus, and immunosuppression.

The details of the Visual Analog scale (VAS) were explained to the patients before the start of the surgical procedure. They were asked to choose a particular scale, with regard to how they felt during the surgical procedure. (Intraoperative pain intensity: 0 – Absolutely no pain, 1 – Very mild pain, 2 to 4 – Mild pain, 5 to 7 – Moderate pain, 8, 9 – Severe pain, 10 – unbearable pain).Scores were recorded immediately after the procedure.

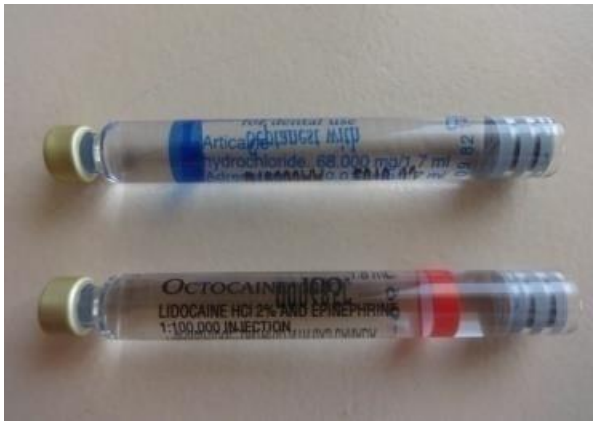

Fig 4: Lidocaine

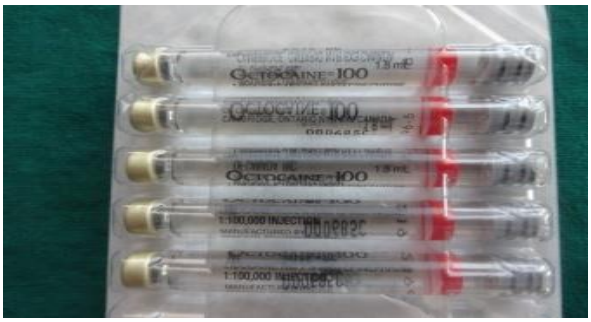

Fig 5: Lignocaine.

Fig 6: Articaine

PROCEDURE

20 adult subjects diagnosed with moderate to severe periodontal disease requiring phase II periodontal therapy (surgical phase) were enrolled in the study. Infiltration anesthesia was chosen. Maxillary posteriors were divided in to experimental site and control site. Bilateral periodontal flap surgery was planned in maxillary posteriors in a single appointment . Maxillary posteriors of first quadrant was selected as experimental site for articane, while the same patients second quadrant was considererd control sites with lignocane(Figure 7 and figure 8). Investigator injected anesthesia with slow injection. Experimental sites were injected with 1.8ml of 4% articaine hydrochloride containing 1:100000 (figures 4-6) incrementally in the buccal vestibule. Controlled sites were injected with 1.8ml of 2% lignocaine with 1:100000 adrenaline incrementally in buccal vestibule.

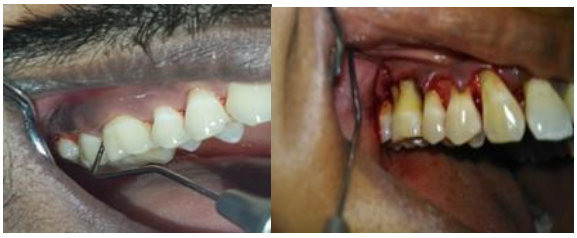

Fig 7: Experimental site.

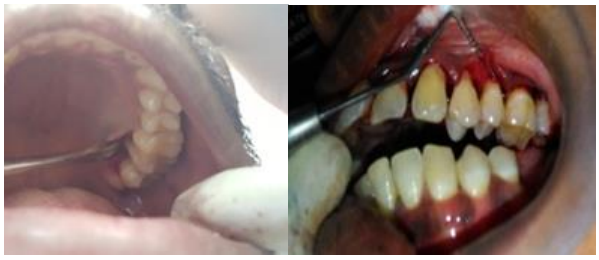

Fig 8: Control site.

PAIN MEASUREMENT

At the end of periodontal flap surgery, the visual analogue scale was scored and collected. Post-operative instructions were given and patients were discharged. The patients were recalled after one week for review.

STATISTICAL ANALYSIS

Wilcoxon signed rank test is used to compare the two groups.p value <0.05 is considered significant.

RESULTS

While assessing the anesthetic effect prior to surgery, palatal aspect of sites injected with lignocaine hydrochloride showed no anesthetic effect. Thus greater palatine nerve block was administered in 20 patients. But in articane group 10 patients had sufficient palatal anesthesia without a greater palatine nerve block, however during flap reflection 3 out of the 10 patients experienced pain and thus required greater palatine nerve block. But remaining 7 completed surgical procedures without any additional local anesthesia.Moderate Pain was experienced by 16 patients during palatal reflection of flap where lignocaine was used as local anesthetic while it was only 7 among the articaine group [table 1, figure 9]

VAS evaluation done for efficacy analysis showed significant difference in pain score in articaine group (p=0.002) [table 2].

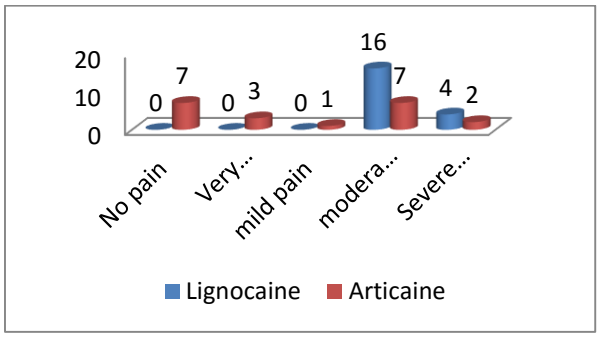

Fig 9: Pain intensity among the lignocaine and articaine groups.

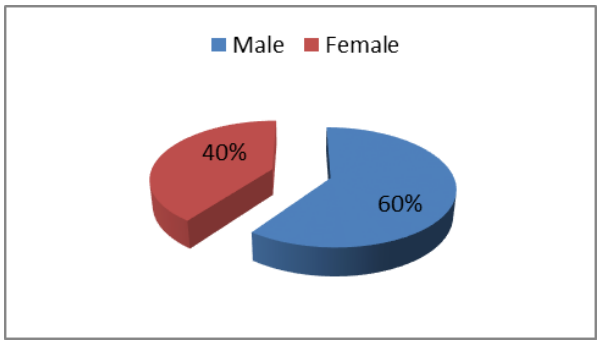

Fig 10: Gender distribution.

Table 1: 2*2 table -number of subjects showing different pain intensities to the local anesthetics during palatal flap reflection.

	Subjects characterized based on VAS scores					
Type of LA	Absolutely no pain	Very mild pain	Mild pain	Moderate pain	Severe pain	Total
Lignocaine	0	0	0	16	4	20
Articaine	7	3	1	7	2	20
Total	7	3	1	23	6	40

Table 2:Post operative pain score(VAS scale).

	Mean pain score	SD	P value
Lignocaine	4.2	1.52	0.002
Articaine	2.7	0.41	

DISCUSSION

Articaine local anesthetic has strong analgesic efficacy. It is having a lower pKa. It means that more uncharged base molecules are present to diffuse through the nerve sheath; thus onset time is decreased. It is well known that the closer the anesthetic pKa is to the pH of the local environment where it is injected, the faster is its onset of action. Therefore, at a tissue pH of 7.4 both 4% articaine and 2% lignocaine have a pKa value of 7.8[4].

Increased lipid solubility permits the anesthetic to penetrate the nerve membrane. The articaine molecule does not contain a benzene ring like the others but instead contains a thiophene ring. This renders the molecule more lipid soluble and therefore better able to cross lipid barriers. Increased protein binding allows anesthetic cations to be more firmly attached to proteins located at receptor sites. Thus the duration of action is increased[2].

Articaine differs from other amide local anesthetics, in that it has an extra ester linkage (COOCH3). 90-95 % is metabolized in the blood, and only 5-10 % in the liver. This is the only anesthetic agent,which is inactivated from our body in two ways. This feature is clearly demonstrated when you compare the half-life (t1/2b) between articaine and lidocaine. The elimination half life for lidocaine is 90 min, versus that for articaine is 20 min. This is the time it takes to reduce the plasma levels of the drug by 50 %. This makes re-injection of articaine safer, since the majority of that initial dose are metabolized after approximately half an hour,and the re-injected dose will not be added to the initial on[4].

The major metabolic product of articaine is articainic acid. It is inactive as a local anesthetic, and systemic toxicity has not been observed. In comparison, lidocaine has active metabolites. It is metabolised in the liver by the microsomal P450 enzyme system to monoethylglyceine and xylidide; xylidide is a local anesthetic and potentially toxic [4]. Articaine is largely excreted in the urine as the metabolite articaninic acid[1]For lidocaine the excretion is also via the kidneys; less than 10 % unchanged, more than 80 % various metabolites[4].

A comparison between articaine and lignocaine showed that the signs of CNS toxicity after intravenous administration of lignocaine were observed more frequently and at a higher degree of severity when compared with articaine. The cardiovascular parameters did not change [4].

The immunogenic potential of articaine is very low. Taken into account that articaine shows an age-independent metabolism, there should be no reason to change the dosage in elderly patients[4]. Zólkowska et alhas reported that like all other anesthetic agents articaine is safe in epileptic patients [2]. Potocnik et al. in an in vitro study concluded that 2 and 4% articaine is more effective than 2 % and 4% lidocaine in depressing the compound action potential of the A fibers in the isolated rat sural nerve[10]. Somuri et al in a randomized trail concluded that the routine use of a palatal injection for removal of permanent maxillary premolar teeth may not be required when articaine /HCL is used as the local anesthetic [9]. Similar result was obtained by Hassan S et al[8] in a study which evaluated the efficacy of 4% articaine hydrochloride and 2% lignocaine hydrochloride in the extraction of maxillary premolars for orthodontic reasons.

Lipid solubility determines to what degree the molecules penetrate nerve membranes. Articaine diffuses better through soft tissues than do other anesthetics, thereby achieving higher intra neural concentration ,more exentsive longitudinal spreading ,and better conduction blockade. Moreover porous thin bone of the maxilla facilitates the diffusion of the articaine [9].

In the present study, all the 20 patients among lignocaine group reported moderate to severe painwhile 7 among articaine group reported absolutely no pain during palatal flap reflection. 13 among the experimental group required additional greater palatine nerve block. But in control sites all the 20 patients required additional greater palatine nerve block [Figure.1] [table1]. It is a well-known fact that palatal anesthesia is a very painful experience even though surface anesthesia is used. Hence, if articaine is used, patients can be relieved from the painful palatal anesthesia without compromising with safety and efficacy. The mean value for pain score was 4.2±1.52 in control group

while it was 2.7±0.41 in experimental group. There was statistically significant difference in mean value between the two groups.[P=0.002][Table 2]

LIMITATIONS

Pain perception and reaction greatly vary among individuals. Further controlled clinical trials and comparative studies with greater sample sizes , with similar local anesthetic agents in other areas of the oral cavity to evaluate the time of onset and duration of action and safety are required.

CONCLUSION

Articaine in 4% solution with 1:100000 epinephrine can be used as an alternative to lignocaine in periodontal flap surgeries. Routine use of painful palatal injection for palatal flap reflection may not be required when articaine was used as local anesthetic.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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