

Comparison of Articaine and Lignocaine for Uncomplicated Maxillary Exodontia

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ABSTRACT

Objective: To compare single buccal articaine injection versus conventional lignocaine buccal and palatal injections for uncomplicated maxillary tooth extractions.

Study Design: Single blinded randomized control trial.

Place and Duration of Study: The outpatient department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry, Rawalpindi, from February to September 2011.

Methodology: Patients aged 20 - 60 years under simple extraction in the maxillary arch were included in the study. Patients were randomly divided into two groups-A and B toss method. Maxillary teeth were divided into three groups; group-1 (posterior teeth) including first, second and third molars on either side, group-2 (middle teeth) including the premolars and group-3 (anterior teeth) including incisors and canines. Group-A (study group) received buccal infiltration of 4% articaine with 1:200,000 adrenaline and group-B (control group) received buccal and palatal infiltration of 2% lignocaine/HCl with 1:100,000 adrenaline. Faces Pain Scale (FPS) and a Visual Analogue Score (VAS) was used for objective and subjective assessment of per operative pain respectively.

Results: A total of 194 patients were included in the study. Group-A comprised of 100 patients while group-B consisted of 94 patients. The mean age of the total sample was 41.12 ± 13.6 years. Statistically significant difference was found for the VAS scores of anteriors ($p=0.9$), premolars ($p=0.2$) and molars ($p=0.2$) for groups A and B. The FPS scores for both groups were also statistically insignificant ($p=0.864$).

Conclusion: Buccal infiltration with a single articaine injection and lignocaine buccal and palatal infiltration were equally effective for maxillary exodontia.

Key Words: Local anesthesia. Lignocaine. Articaine. Maxillary exodontia.

INTRODUCTION

Local anesthetic agents are membrane stabilizing agents that reversibly decrease the rate of depolarization and repolarization of excitable membranes. This produces local analgesia which induces absence of pain sensation, although other local senses are often affected as well.^{1,2}

The most commonly employed anesthetic agent is lignocaine which has been the dentist's first choice owing to its incomparable benefits.³ Many other local anesthetics including prilocaine, mepivacaine and bupivacaine are sparingly used by dental surgeons.³⁻⁵

A standard maxillary tooth extraction using lignocaine usually requires administration of 1.0 ml of the anesthetic in the buccal vestibule followed by a 0.2 - 0.4

ml palatal infiltration. The palatal infiltration anesthetizes free nerve endings of nasopalatine or the greater palatine nerves and is often perceived as a painful procedure. This is because the injecting solution causes separation of tightly bound mucoperiosteum from the underlying bone of the hard palate and causes discomfort to the patient. Some degree of pain is also produced due to needle penetrating the mucosa.^{1,6}

A newer agent articaine has been proposed to have high bone penetration and in theory can anesthetize the palatal mucosa with standard buccal infiltration only.^{7,8} It is gaining popularity in the dental practice because of its unique pharmacokinetics, excellent bone penetration and its effectiveness in patients with hypokalemic sensory overstimulation.^{8,9} It is hypothesized that owing to the thiophene ring in articaine structure, it has greater lipid solubility and potency as a greater portion of administered dose can enter neurons.⁸⁻¹⁰

The rationale of the study was to determine if buccal infiltration alone with 4% articaine can effectively anesthetize maxillary teeth during extraction. This will eliminate the requirement for painful palatal anesthesia.

The objective of the study was to compare success rate of infiltration anesthesia for maxillary exodontia with buccal infiltration of 4% articaine versus the standard palatal and buccal infiltrations with 2% lignocaine.

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METHODOLOGY

A randomized controlled trial was carried out at the outpatient department of Oral and Maxillofacial Surgery, Armed Forces Institute of Dentistry, Rawalpindi, Pakistan for the duration of 6 months from February to September 2011.

Sample size calculation for non-inferiority clinical trial was calculated using NCSS PASS software. The proportion of affective anesthesia with one articaine injection was taken as 0.957 (68 out of 71 patients),⁸ whereas the proportion was for lignocaine 0.972 (69 out of 71). Taking these proportions (difference in proportion 1.5%) at alpha 5%, power of 80%, the sample size for non-inferiority trial was calculated to be at least 90 patients in each group, where maximum accepted difference for non-inferiority of articaine was set at 3%.

Patients aged 20 - 60 years irrespective of gender undergoing simple tooth extraction in the maxillary arch, medically fit and willing to participate in the research were included in the study. Exclusion criteria included any contraindication to local anesthesia, e.g. known allergy, local acute infection at the site of injection, patients under 20 years and above 60 years of age and patients unwilling to participate in the study.

Informed written consent was taken from all patients who were willing to participate in the study. A total of 194 patients meeting the inclusion criteria were enrolled for the study. The procedures were performed by only two operators, both having over 4 years clinical experience in oral surgery. All patients were divided into two groups A and B randomly by simple coin toss method. The study was single blinded and the patients were kept unaware of the type of anesthetizing drug used during the procedure. All maxillary teeth were divided into three groups, group-1 termed the posterior teeth containing first, second and third molars on either side, group-2 containing the premolars and group-3 containing incisors and canines.

Group-A received 4% articaine with 1:200,000 adrenaline in a cartridge ampoule of 1.7 ml. Group-B received 2% lignocaine/HCl with 1:100,000 adrenaline in a cartridge ampoule of 1.8 ml.

For both groups, the anesthetic was delivered using standard non-aspirating dental syringe with sterile single use 27G 0.40 x 21 mm disposable dental needle. For buccal vestibular local infiltration, the anesthetic was administered at the buccal vestibule supraperiosteally adjacent to the tooth to be extracted at a rate of approximately 1 ml/min. For group-A, after waiting for 5 minutes a sharp probe test was performed using a standard dental probe. The probe was inserted into the free gingival margin on the buccal and palatal sides. The test was labeled positive if the patient showed visible signs of pain (measured as blinking of the eye or change in facial expressions). The test was considered negative

in case of absence of these signs. In case of positive test, a 0.2 - 0.4 ml of same local anesthetic agent was injected supraperiosteally on the palatal aspect at midpoint between palatal gingival margin of tooth and mid palatal line. After two minutes, the test was performed again. This step was repeated again till a negative result was achieved. For group-B after buccal infiltration, a supraperiosteal palatal infiltration of 0.2 - 0.4 ml was injected directly. The sharp probe test was performed after two minutes and palatal injection step was repeated in case of a positive result till a negative result was achieved.

All the teeth were extracted using either elevators or dental forceps as per case requirements. Subjective per-operative pain was measured using Visual Analogue Score (VAS)¹¹ by asking the patient to point the number most precisely describing amount of pain experienced during the extraction procedure on a 10 cm scale, with markings at every 1 cm anchored by the end points of "no pain" on the right and "worst pain" on the left. The objective pain was measured by the dental surgeon using a Faces Pain Scale (FPS)¹² with six categories which described best the facial expressions of the patient during the extraction procedure which described point 0 with "no pain" to point 5 as "hurts worst".

The data was analyzed using SPSS version 16. For descriptive analysis mean and standard deviation was reported for age, gender and VAS score, where frequency and percentages were calculated for categorical variables and FPS scores. The normality of the VAS score in both treatment groups was assessed using Kolmogorov-Smirnov test. The test showed non-normal distribution of data in lignocaine group ($p=0.009$) and in articaine group ($p=0.034$), hence for comparison of VAS score in treatment groups Mann-Whitney U test was used at 5% level of significance. For comparison of FPS scores (categorical variable) Fisher's exact test was used.

RESULTS

A total of 194 patients participated in the study. Group-A (study group) contained a total of 100 patients whereas group-B contained 94 patients. Out of these, 113 (58.2%) were males and 81 (41.8%) females which were almost equally distributed among both groups; articaine group had 54 (54.0%) males and 46 (46.0%) females and the control group had 59 (62.8%) males and 35 (37.2%) females. The mean age of the total sample was 41.12 ± 13.6 years whereas the mean age of the articaine group was 40.58 ± 13.78 and 41.70 ± 13.46 for the lignocaine group. The distribution of tooth groups is shown in Figure 1.

Insignificant difference was found for the Visual Analogue Scale (VAS) scores of anteriors ($p=0.9$),

DISCUSSION

premolars ($p=0.2$) and molars ($p=0.2$) for groups A and B (Table I). The lowest mean VAS score was recorded for the articaine group in the premolar region (3.54 ± 1.75) and the highest for lignocaine group in the anteriors (4.28 ± 1.49). For group-A, 84% of patients did not require a palatal injection at all. Palatal injection was needed only in 16% of the patients (Table II). The Facial Pain Scale (FPS) scores for both groups were also statistically insignificant ($p=0.864$) as shown in Table III. Fisher's Exact Test was used to compare both the groups (Table III). The VAS and FPS scores of the standard 2% lignocaine with 1:100,000 adrenaline used as both buccal and palatal infiltration with 4% articaine with 1:200,000 adrenaline with buccal infiltration were statistically insignificant showing that extractions in the latter group can be carried out without palatal infiltration.

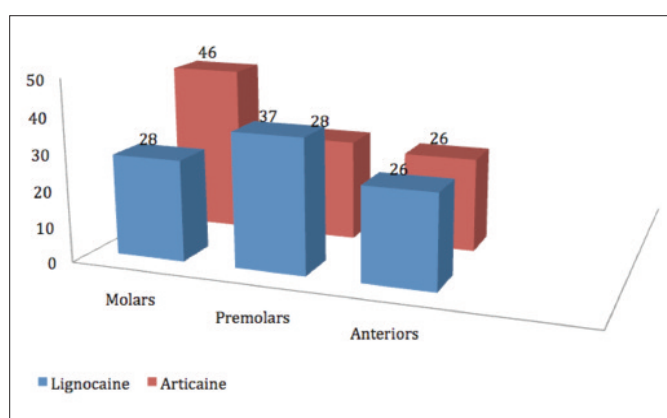


Figure 1: Distribution of tooth groups for articaine and lignocaine.

Table I: Comparison of VAS values of group A and B.

	Anaesthetic agent	VAS (mean \pm SD)	Mean rank	p-value
Molars	Articaine	3.83 ± 1.67	37.73	0.02
	Lignocaine	3.82 ± 1.44	37.13	
Premolars	Articaine	3.54 ± 1.75	29.63	0.2
	Lignocaine	4.14 ± 1.57	35.55	
Anteriors	Articaine	3.77 ± 1.79	25.17	0.9
	Lignocaine	4.28 ± 1.49	30.53	

Test of significance Mann-Whitney U test.

Table II: Requirement for palatal injections.

Palatal injection	Articaine	Lignocaine
Not given	84 (84.00%)	0 (0.00%)
Given	16 (16.00%)	94 (100.00%)

Table III: Comparison of FPS scores of group A and B.

Injection technique			Total n = 194	p-value
	Articaine n = 100	Lignocaine n = 94		
FPS 0	72 (72.0%)	66 (70.2%)	138 (71.1%)	0.864
FPS 1	18 (18.0%)	15 (16.0%)	33 (17.0%)	
FPS 2	6 (6.0%)	6 (6.4%)	12 (6.2%)	
FPS 3	3 (3.0%)	4 (4.3%)	7 (3.6%)	
FPS 4	1 (1.0%)	3 (3.2%)	4 (2.1%)	

* Test of significance Fisher's exact test.

Extraction of maxillary teeth is a routine practice in dentistry and palatal anesthesia is necessary for sufficient anesthetization of the maxillary arch.¹⁵ Various studies have been carried out in this regard to devise techniques for reducing the discomfort including application of topical anesthesia, trans papillary injections and computer assisted anesthesia. Articaine, owing to its molecular behavior, can be used as an alternative to palatal infiltration as it can diffuse through tissues more efficiently and can give clinicians a chance to avoid the painful palatal injections.^{1,2,8-10}

The study was a single blinded randomized control trial in which the patient was blinded to the type of anesthetic drug used. The results showed insignificant difference in two groups confirming the hypothesis that 4% articaine can successfully anesthetize palatal mucosa for a pain free tooth extraction.

There are relatively few studies that strongly substantiate the high vestibule-palatal diffusion capacity of articaine. A literature search revealed only a handful of similar studies, nevertheless these shared the statistically significant rate of successful anesthesia of palatal tissues with buccal 4% articaine.¹⁶⁻²⁰ The insignificant difference in the studied groups is in coherence with the study of Uckan *et al.*⁷ whose VAS and FPS scores for permanent maxillary tooth removal with palatal injection were (97.5%) and without palatal injection (96.8%). These results were also confirmed by Badcock *et al.*⁶ and Fan *et al.*⁸ who successfully extracted maxillary teeth with a single buccal injection without significant difference in pain between the two groups.

The efficacy of palatal anesthesia was further correlated in different regions of maxilla to determine if anatomical thickness of cortical bone in different buccal and palatal sites had any influence on the anesthetizing capability of articaine. The groups analyzed were namely molar group, premolar group and the anterior group. When the results were analyzed it was observed that no statistically significant difference exists between the ability of the articaine to anesthetize different maxillary teeth and can be successfully employed for extraction of all the maxillary teeth including incisors, premolars and molars. This is the advantage of articaine over trans-papillary injection technique which can be really demanding in molars due to tight contacts and relatively apically placed height of contours.¹³

As this drug is new in the market, the ranges of side effect have yet to be explored thoroughly. Nevertheless, so far, this drug has shown minimal difference in frequency of side effects as compared to lignocaine, which is considered as the safest drug of this group. For safety purpose and requirement of articaine to be used at a higher concentration, the drug has been placed as

pregnancy category class-C.^{1,8,10} Other problems with articaine include increased cost which is almost three to five times than that of lignocaine and an increased reported incidence of post-injection persisting neuroparexia of lingual or inferior alveolar nerve when mandibular block is used.¹⁴ Such a complication was not observed during extractions of teeth in maxillary arch.

CONCLUSION

The study showed that with the use of buccal infiltrated 4% articaine, maxillary teeth can be extracted without the need for palatal infiltration and hence patient discomfort can be lowered during exodontia. The authors recommend its use in all cases of maxillary uncomplicated exodontia to improve the patient's experience.

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