

Comparison of Anesthetic Efficacy of Articaine and Lidocaine in Patients with Irreversible Pulpitis

SHEBA RAMZAN¹, MADIHA ZAIGHUM², ZAHID IQBAL³, DARSHANA⁴, RAFIQUE AHMED⁵, AREEBA MEMON⁶

¹BDS,FCPS, Operative Dentistry, Consultant Dental Surgeon, Liaquat University hospital Hyderabad

²BDS,MSC, Assistant Professor Operative Dentistry Isra Dental College Hyderabad

³BDS,FCPS, Operative Dentistry Isra Dental College Hyderabad

⁴BDS,MDS, Operative Dentistry Isra Dental College Hyderabad

⁵BDS,(MDS) Registrar Operative Dentistry Isra Dental College Hyderabad

⁶BDS, Lecturer Operative Dentistry Isra Dental College Hyderabad

Corresponding Author: Dr. Sheba Ramzan, Email Address: sheeba_palh@hotmail.com, Cell No. 03318878544

ABSTRACT

Objective: to compare the anesthetic efficacy of articaine with that of lidocaine during pulpectomy in patients with irreversible pulpitis for inferior alveolar nerve block in mandibular posterior teeth.

Methods: this cross sectional study consist of 192 Patients with irreversible pulpitis referred to the Department of Operative Dentistry, ISRA Dental College, Hyderabad during the period 1st September 2015 to 15 August 2017, randomly received an inferior alveolar nerve block containing 1.8 mL of either 4% articaine with 1: 100,000 epinephrine or 2% lidocaine with 1: 80,000 epinephrine. Chi-square test was performed to establish the success rate of 2 local anesthetic drugs. Data was analyzed using SPSS 21.

Results: The success rate during access cavity was 73% for lidocaine and 56% for articaine, while during pulpectomy success rate with lidocaine was 56% and that of articaine was 58%. difference between the two solutions were not statistically significant.

Conclusions: Articaine has been considered alternate to lidocaine as local anesthetic agent. it is equally effective as lidocaine in patient with irreversible pulpitis in posterior mandibular molars.

Keywords: Efficacy, Articaine, Lidocaine, Mandibular First molar, Access Cavity, Pulpectomy.

INTRODUCTION

For the overall success of the dental treatment it is prudent to achieve profound anesthesia of the dental pulp. It might not be same for every patient, at times it becomes a challenge for the dentist, and especially in patients with irreversible pulpitis.¹In endodontics pain management is the primary concern of the clinician. Adequate pain control is necessary to control the fear and anxiety related to dental treatment.² Ample amount of knowledge and error free technique is important for the pain control.³ Lidocaine is most commonly used anesthetic that contain vasoconstrictor epinephrine that has a ph of 2.9 and 4.4,ph is decreased in order to increase shelf life and its associate oxidation but there are certain disadvantages associate with low ph such as burning sensation, slow onset anesthesia, and reduce efficacy of anesthesia.⁴

Articaine (the generic name was changed) have the same clinical potential as that of lidocaine but has few additional features which makes it quite attractive to be used in dentistry.⁵Articaine is an amide anesthetic solution which has increased lipid solubility and because of presence of a thiophene ring.² The efficacy and safety of 4% articaine with 1:100000 epinephrine was superior to 2% lidocaine with 1:100000 epinephrine in patients with irreversible pulpitis.⁶Ahmad ZH,RavikumarHetal in 2015 compare the efficacy of 4% articaine with 2% lidocaine with epinephrine and they conclude that 4% articaine can be used effectively for obtaining profound anesthesia for endodontic procedures in patients with irreversible pulpitis in mandibular posterior teeth.⁷ However, the literature contains studies that are limited to confirm the anesthetic effect of articaine in comparison to lidocaine in cases of irreversible pulpitis.^{5,8,9} 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.¹⁰ 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.¹¹

PATIENTS AND METHODS

Total of 192 adult patients, who were diagnosed with irreversible pulpitis scheduled to have an endodontic treatment at ISRA Dental College were selected to be the part of this study. Non-vital teeth, Allergy or sensitivity to articaine and lidocaine or Patients on pre-operative analgesics.Patient taking other medications that can alter the pain perception were excluded from the study.

Patients with informed consents were randomly divided in to two equal groups (96 in each) group A and B by lottery method. Group A received 1.8 ml cartridge commercially available articaine solution Group B received 1.8 ml cartridge commercially available lidocaine solutionA topical anesthetic gel with a cotton tip applicator was passively inserted in the IAN injector for 60 s. An anesthetic solution was applied to a normal lower alveolar nerve block with a 27-gauge needle. 0.4 ml of either anesthesia solution was deposited after initial needle penetration during 15 s, when the needle was moved to the target location. The needle was removed 1 mm after mild contact with the bone, aspiration was carried out, and over a duration of 1 minutes, the remaining 1.8 ml anesthetic solution is deposited. Subjective lip antesthesia was tested

by asking the patient whether or not the lip of the patient was numb and electrical pulp stimulations were carried out to assess the pulp anesthesia to monitor a confusing variable (anesthesia technical) after 15minutes of postinjecting. The patient was removed from the study if he responded with electrical stimulation of the pulp and without lip enthusiasm. The teeth were separated by a rubber dam and the pulpectomy and the access cavity were performed. In addition to the visual analog scale from 0 to 100 mm, patients have been requested to definitely rate and rate the pain in accordance with the intensity of the pain of the VAS, the feeling during the access operation and pulpectomy. The patient has been described as active with the pain reporting on VAS when accessing the pulp chamber and the pulpectomy was carried out without pain and without success.

RESULTS

192 patients diagnosed with irreversible pulpitis were randomly divided into two equal A and B groups' i.e 96 patients in each. In group A (articaine) sixty patients (62.5%) were females and thirty six (37.5%) were males and in group B (lidocaine) fifty even (59.3%) were females and thirty nine (40.7%) males. (Table I), with age groups from 18 to 40 years.(Fig 1)

The mean pain score during access cavity preparation for group A was 1.489 with SD±0.889 and for group B was 1.660 with SD±0.934. (TABLE II) Similarly, the mean pain score during pulpectomy for group A was 1.745 with SD±1.036, while that for group B was 1.713 with SD±0.911. (TABLE II). Total pain score mean during access cavity and pulpectomy for both groups is 1.5000 with SD±.50131.

The percentage of successful anesthesia during access cavity preparation was 73 % in group A and 56 % in group B respectively. Similarly, the percentage of successful anesthesia during pulpectomy was 58.3 % in group A and 56 % in group B respectively. (Table III) Based on the chi-square statistics p value (0.047) showed significant difference of successful anesthesia between groups during access cavity preparation whereas during pulpectomy the difference between both groups was insignificant i.e. p- value (0.77). (Table III).

Table I: Total Frequency Of Gender Distribution

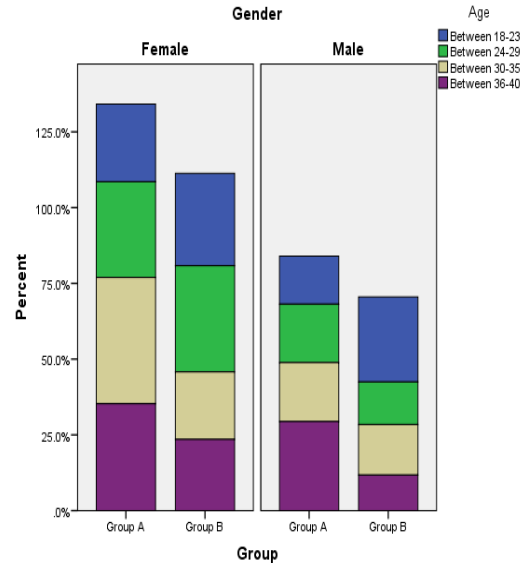
		Frequency	Percent
Total frequency of gender distribution	Female	117	60.9
	Male	75	39.1
	Total	192	100.0

Table II: Mean and Standard Deviation of Pain Score During Access Cavity & Pulpectomy

	Group A		Group B	
	Mean	SD	Mean	SD
Pain Score during Access Cavity	1.489	±0.889	1.660	±0.934
Pain Score during Pulpectomy	1.745	±1.036	1.713	±0.911

Table III: Number And Percentage Of Successful Anesthesia In Groups A And B, During Access Cavity And Pulpectomy

	Age Groups	Group	Efficacy		P-Value
			Yes	No	
Access		A	70 (73%)	26(27%)	0.047
		B	57(56%)	39 (44%)	
Pulpectomy		A	56 (58%)	40(42%)	0.77
		B	54 (56%)	42(44%)	



DISCUSSION

Success rate of IANB lidocaine in symptomatic irreversible pulpitis in a study of Aggarwal et al. and Kreimer was only 26% and 13% respectively. However, controlled comparisons of IANB have failed to show any difference between articaine and lidocaine solutions.¹²In our study we compared the anesthetic efficacy of lidocaine (Group A) and articaine (Group B) in posterior teeth with irreversible pulpitis using IANB technique.

Success of pulpal anesthesia is measured by using the electric pulp tester or cold stimuli does not always signify its success during access cavity or pulpectomy.¹³ So in the present study efficacy of lidocaine and articaine were also determined by assessment of pulpal anesthesia during access cavity preparation and pulpectomy through recording pain score on visual analog scale

The mean pain score in this study was 1.489 ±0.88 in group A and 1.660 ± 0.93 in group B with the mean difference of 0.048, which showed statistically significant difference of pain score between the groups during access cavity preparation. (P=0.048<0.05). while the mean score during pulpectomy was 1.74 ±1.03 in group A and 1.71 ±0.91 in group B with the mean difference of 0.66 which showed statistically insignificant difference between the groups (P=0.66>0.05). In this study pain score was assessed by using values noted on VAS reported by the patients during access cavity and pulpectomy. S.Ali et al assessed intensity of pain score during access cavity with mean pain score of 1.96±2.50 in lidocaine as IANB and 2.36±2.37 in articaine as infiltration with no statistically significant difference of pain score (p=0.0001) at confidence level of 99%¹⁴. A study by Khattak et al on

anaesthetic efficacy of 4% articaine primary buccal infiltration versus 2% lidocaine inferior alveolar nerve block in symptomatic mandibular first molar teeth assessed intensity of pain score during access cavity with mean pain score of 2.15 ± 0.85 in lidocaine as IANB and 1.84 ± 0.77 in articaine as buccal infiltration with no statistically significant difference of pain score ($p > 0.05$).¹⁵ So in comparison the result of our study are not in accordance with this previous study as we found significant difference in pain score between groups as IANB during access cavity.

Claffey et al¹⁶ compared anesthetic efficacy of articaine for IANB in Patients with Irreversible Pulpitis found insignificant difference between groups before access cavity preparation through electric pulpal stimulation. Similar research on comparison of anesthetic efficacy of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:80,000 epinephrine for inferior alveolar nerve block in patients with irreversible pulpitis by the assessment of pulpal anesthesia before access cavity was followed by R.Sood in 2014 and found insignificant difference (p -value= 0.056) between groups.¹⁷ Tortamano et al¹⁸ compared the efficacy of IAN blocks containing 4% articaine with 1:100,000 epinephrine with those containing 2% lidocaine with 1:100,000 epinephrine in patients with irreversible pulpitis and reported 65% no pain and 35% with pain in 4% articaine and 45% no pain, 55% with pain in 2% lidocaine during pulpectomy with p value of 0.20. R.Sood,¹⁷ in his study found 12% in articaine group and 18% in lidocaine group reported pain during the pulpectomy and again, this difference was not statistically significant $P = 0.40$.

The success rate of IANB anesthesia between groups were analyzed which showed the success rate of 70% and 27% failure rate in group A and 56% success rate and 44% failure rate in group B with significant difference between the groups after access cavity preparation. ($p = 0.047 < 0.05$). R. Sood¹⁷ in 2014 compared success rate but on the basis of electric pulpal stimulation before access cavity and he reported 76 % success rate in articaine 58% in lidocaine with no significant difference (p -value 0.056). Tortamano et al¹⁸ and Carlos et al¹⁹ also used this criteria of electric stimulation for pulpal anesthesia in mandibular IANB anesthesia of articaine and lidocaine and they found no significant difference of success rate between articaine and lidocaine. The results of current study during access cavity reported similar findings with recent study by Brandon S et al²⁰, conducted a prospective, randomized, double-blind study on efficacy of articaine versus lidocaine as a supplemental buccal infiltration in mandibular molars with irreversible pulpitis and they reported 26% success rate during endodontic access cavity after IANB with 4% articaine. Success rates for supplemental BIs were 62% for articaine and 37% for lidocaine with significant difference ($P < .05$) between articaine and lidocaine as buccal infiltration. The results of current study during access cavity are also compared with study by Fozia and colleagues²¹ conducted a study on anesthetic efficacy of 4% articaine as buccal infiltration vs 2% lidocaine as IANB in the mandibular 1st molar with irreversible pulpitis and reported significant difference in success rate between the two anesthetic agents during access cavity as it was reported in the present study.

During pulpectomy the present study showed the success rate of 58.3% and failure rate 41% for lidocaine and 56.2% success rate and 43% failure rate for articaine with no significant difference between the groups (p -value = $.77 > 0.05$). Carlos E and colleague¹⁹ conducted a randomized clinical trial on anesthetic efficacy of both agents in irreversible pulpitis, and reported that the success rate of 63.6% and failure rate of 36.4% for articaine while 54.5% success rate and 45.5% failure rate for lidocaine with no significant difference ($p = 0.45$), this study and present study both showed insignificant difference between both anesthetic agent during pulpectomy. In the study by Claffey et al¹⁶ in 2009 found the success rate for the IAN block using the articaine solution was 24% and for the lidocaine solution success was 23% There was no significant difference ($p = 0.89$) between the two solutions. While in the study by Tortamano et al.¹⁸ the success rates were 65% with articaine solutions and 45% with lidocaine solutions with the p -value of 0.20 during pulpectomy. These both studies results are in accordance with the success rate of present study which showed insignificant difference between lidocaine and articaine as IANB in patient with irreversible pulpitis.

CONCLUSION

In summary, our findings showed that while lidocaine was more effective in terms of lack of pain during pulpectomy than articaine for IAN blocks, these differences were not important in the 2 local anesthetic solutions. Thus, in patients with pulpitis, even with large samples, articaine superiority over lidocaine cannot again be statistically verified by the clinical trial for the lower alveolar nerve blocks.

REFERENCES

1. Nusstein.J.M, Reader.A and, Drum.M. Local anesthesia strategies for the patient with a hot tooth: Inc Elsevier: Dent Clin North Am 2010; 54: 237–247.
2. Poorni.S, Veniashok. B, Senthilk.K. Durairaj, Indira. R, Ramachandran. S. Anesthetic efficacy of four percent articaine for pulpal anesthesia by using inferior alveolar nerve block and buccal infiltration techniques in patients with irreversible pulpitis: a prospective randomized double blind clinical trial. J Endod 2011; 37:1603–1607.
3. Subbiya.A, Pradeepkumar.A.R, Vivekanadhan.P, Karthick.A. Comparative Efficacy evaluation of articaine as buccal infiltration and lignocaine as IANB in the mandibular first molar with irreversible pulpitis. Ind JM Dent 2012; 2:370-373.
4. Saatchi M, Khademi A, Baghaei B, Noormohammadi H. Effect of sodium bicarbonate-buffered lidocaine on the success of inferior alveolar nerve block for teeth with symptomatic irreversible pulpitis: a prospective, randomized double-blind study. J Endod. 2015; 41:33-5.
5. Malamed.S, Gagnon.S, D Pharm.D. A Comparison between articaineHCl and lidocaine HCl in pediatric dental patients. Pediatr Dent 2000; 22: 307-311.
6. Su N, Li C, Wang H, Shen J, Liu W, Kou L. Efficacy and safety of articaine versus lidocaine for irreversible pulpitis treatment: A systematic review and meta-analysis of randomised controlled trials. AustEndod J. 2016; 42:4-15.
7. Ahmad ZH1, Ravikumar H2, Karale R3, Preethanath RS4, Sukumaran A5. Study of the anesthetic efficacy of inferior alveolar nerve block using articaine in irreversible pulpitis. J Contemp Dent Pract. 2014; 15:71-4.

8. Kumar A, Khanna R, Srivastava RK, Ali I, Wadhvani P. Mannitol an adjuvant in local anaesthetic solution: recent concept & changing trends (review). *J ClinDiagn Res.* 2014; 8:1-4.
9. Haase A, Reader A, Nusstein J, Beck M, Drum M. Comparing anesthetic efficacy of articaine versus lidocaine as a supplemental buccal infiltration of the mandibular first molar after an inferior alveolar nerve block. *J Am Dent Assoc.* 2008; 139:1228-35.
10. Aggarwal V, Jain A, Kabi D: Anesthetic efficacy of supplemental buccal and lingual infiltrations of articaine and lidocaine after an inferior alveolar nerve block in patients with irreversible pulpitis. *J Endod.* 2009; 35:925-9.
11. Carrotte P. Endodontics: Part 3. Treatment of endodontic emergencies. *Br Dent J.* 2004 Sep 25;197(6):299-305.
12. Aggarwal V, Singla M, Miglani S, et al. Comparative evaluation of 1.8 ml and 3.6 ml of 2% lidocaine with 1:200000 epinephrine for inferior alveolar nerve block in patients with irreversible pulpitis: A prospective randomized single-blind study. *J Endod* 2012; 38(6): 753-56.
13. Kreimer T, Kiser R, Reader A, et al. Anesthetic efficacy of combinations of 0.5 mol/L manitol and lidocaine with epinephrine for IAN block in patients with symptomatic irreversible pulpitis. *J Endod* 2012; 38(5): 598-603.
14. Saberi EA, Farhadmollashahi N, Aliabadi T. A Comparison of the anesthesia efficacy of articaine and articaine plus morphine for buccal infiltration in mandibular posterior teeth with irreversible pulpitis. *ZJRMS.* 2014; 16:26–30.
15. Zain M1, RehmanKhattak SU1, Sikandar H2, Shah SA1, Fayyaz. Comparison of Anaesthetic Efficacy of 4% Articaine Primary Buccal Infiltration Versus 2% Lidocaine Inferior Alveolar Nerve Block in Symptomatic Mandibular First Molar Teeth. *J Coll Physicians Surg Pak.* 2016 Jan;26(1):4-8. doi: 01.2016/JCPSP.0408.
16. Elizabeth.C, Al.R, John.N, Mike.B, Joel.W. Anesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. *J Endod* 2004; 30:568-571.
17. Ravi Sood, Manoj-Kumar Hans,corresponding and Shashit Shetty. Comparison of anesthetic efficacy of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:80,000 epinephrine for inferior alveolar nerve block in patients with irreversible pulpitis. *J ClinExp Dent.* 2014 Dec; 6,10.4317/jced.51617.
18. Tortamano. I.P et al. Onset and duration period of pulpal anesthesia of articaine and lidocaine in inferior alveolar nerve block. *Braz Dent J* 2013; 24:371-374.
19. Paula Cristina Brunetto, José Ranali,,Gláucia Maria BoviAmbrosano, Agr. Eng., PatríciaCristine de Oliveira, Francisco Carlos Groppo, John Gerard Meechan, and Maria Cristina Volpato, Anesthetic Efficacy of 3 Volumes of Lidocaine With Epinephrine in Maxillary Infiltration Anesthesia. *AnesthProg.* 2008; 55(2): 29–34.
20. Rogers BS, Botero TM, McDonald NJ, Gardner RJ, Peters MC. Efficacy of articaine versus lidocaine as a supplemental buccal infiltration in mandibular molars with irreversible pulpitis: a prospective, randomized, double-blind study. *J Endod.* 2014 Jun; 40:753-8.
21. Foziarajput,ShahjahanKatpar,MohammadIlyasShaikh,Safiak hatoon. Evaluation of anesthetic efficacy of 4% articaine as buccal infiltration vs 2% lidocaine as ianb in the mandibular 1st molar with irreversible pulpitis. *PODJ.* 2015 March;31-35.