

Original Article

Local Infiltration of 4% Articaine vs Routine Inferior Alveolar Nerve Block with 2% Lignocaine During Impacted 3rd Molar Extraction – A Split Mouth Randomised Clinical Trial

Sourav Kumar¹✉, Dipti Nayak², Musaab Khan³, Shashank Kumar⁴,
Neha Nayak⁵, Vaishali Samant⁶

ABSTRACT

Background: Adequate duration of anesthesia and quicker onset is perfect criteria of any anesthetic agent. The aim of this study was to evaluate effectiveness, onset and duration of action of both anesthetic agent 4% articaine and 2% lignocaine.

Methods: In this split mouth randomised clinical trial study was carried out in 24 patients needing bilateral extraction of mandibular impacted 3rd molar. Volume of 0.6 - 1 ml of 4% articaine HCl was injected in buccal vestibular region along with 0.2 ml lingual infiltration and 2ml of lignocaine HCl was injected as conventional inferior alveolar nerve block. Onset of action, duration of action, patient's perception of pain etc. were evaluated.

Results: Time of onset between two groups revealed statistically significant difference ($p < .001$) - articaine 0.91 ± 27 minutes while lignocaine 2.42 ± 0.78 minutes. Duration of anaesthesia was 82.08 ± 7.93 min for articaine and 60.21 ± 8.78 min for lignocaine ($p < .01$). Pain scale (VAS) in articaine ranged from 0.58 ± 0.72 mm while in lignocaine it was 2.04 ± 1.00 mm revealed significant statistical difference ($p < .001$). Drug volume needed in articaine group was 1.1 ± 0.13 ml while in lignocaine group was 1.83 ± 0.21 ml ($p < .001$).

1,3,6. Dept. of Oral and Maxillofacial Surgery,
Kothiwal Dental College and Research Centre,
Moradabad, Uttarpradesh

2. Dept. of Prosthodontics Crown & Bridge,
Kothiwal Dental College and Research Centre,
Moradabad, Uttarpradesh

4. Dept. of Orthopaedic, Narayan Medical
College and Hospital, Sasaram, Bihar

5. Dept. of Oral and Maxillofacial Surgery,
Buddha Institute of Dental Science, Patna,
Bihar

✉ email: kumarurbeyaurav4@gmail.com

Received: 01 April 2021

Revised: 10 April 2021

Accepted: 11 April 2021

Published online: 15 April 2021

Citation: Kumar S, Nayak D, Khan M, Kumar S, Nayak N, Samant V. Local infiltration of 4% articaine vs routine inferior alveolar nerve block with 2% lignocaine during impacted 3rd molar extraction – a split mouth randomised clinical trial. J West Bengal Univ Health Sci. 2021; 1(4):42-48.

Conclusion: Articaine is clinically more effective than lignocaine and it can be use as alternative to lignocaine due to its faster onset of action, longer duration of action, lees requirement of drug and reduced patient's perception of pain.

Keywords: articaine, inferior alveolar nerve block, lignocaine.

Introduction:

Third molar surgery is complex procedure during which pain control, onset of anesthesia and duration of action is very important. Pain management is the main goal of all surgeons. Pain, swelling, trismus are incredibly very common complication associated with mandibular 3rd molar surgical removal.¹

Nowadays articaine is frequently use in dentistry. Fat solubility increases its efficiency and became famous to dentists and surgeons.² Articaine has better diffusion rate and can be diffused in soft and hard tissue better than other anesthetics.³

Inferior alveolar nerve (IAN) block is the most widely used injection technique of local anesthesia of the mandible during surgery. But it is not always successful in pulpal anesthesia and the rate of its failure is in the range of 10% to 39 % .⁴ Previous studies has not shown a definite reasonable difference between the effect associated with articaine and 2% lidocaine when used for inferior alveolar nerve block and periodontal ligament or infiltration injection however articaine appear to induce long lasting pulpal anesthesia.⁵

El-Kholey (2013) additionally carried out a study on infiltration anesthesia for the extraction of mandibular molars. He investigated the potency of 1.8 ml of 4% articaine with that of 3.6 ml of same drug through buccal infiltration to extract the impacted third molar. Thirty adult patients with two symmetrical impacted teeth underwent surgical extraction of 3rd molar in two different appointments. He concluded that buccal infiltration of 4% articaine with epinephrine1:100000 (3.6 ml) could be

effective in the extraction of mandibular 3rd molar.⁶ In another study the adequacy of 4% articaine was assessed in pain control during extraction of third molar. Articaine was found to be proficient in the extraction of third molars.^{7,8}

Consequently to achieve a suitable LA (local anesthesia) for 3rd molar surgical removal we conducted this study with the aim of -

AIM:

1. To compare the effectiveness of 4% articaine HCl injected in buccal vestibular region along with 0.2 ml lingual infiltration and 2ml of lignocaine HCl was injected as conventional inferior alveolar nerve block using VAS for (visual analogue scale) for pain.
2. Time of onset of anesthesia
3. Duration of action

Materials and Methods

In this split mouth randomised clinical trial 24 adult patients were included who underwent similar type of bilateral transalveolar extraction of impacted mandibular 3rd molars at two appointments separated by at least 24 weeks. All of the subjects were evaluated preoperatively. Informed consent was obtained. Inclusion criteria were 1) Adult patients (18-60) years with similar type of bilateral impacted mandibular 3rd molars, 2) American Society of Anesthesiologists (ASA) physical status Grade 1 & 2. Patient with known bleeding disorders and hypersensitivity to these local anesthetics drugs were excluded.

Surgical Procedure

A prospective, randomised, split mouth clinical trial was performed after approval from the institutional ethics committee. Each and every patient underwent surgical procedure of bilateral extraction of same kind of impacted 3rd molar (Fig.1) in two independent appointments with an interval of 4 weeks. Block randomization was performed to divide both group of the patients. Twenty four (24) cases into two experimental group was divided by block randomization by a dental surgeon who was blinded to the group allocation. In group A cases (one side of the patients) 4% articaine 1:200000 was administered - 0.8ml for buccal infiltration and 0.2 ml for lingual infiltration. In group B cases (another side of patients) 2% lignocaine 1:100000 epinephrine was administered for conventional IAN block. A total 1 ml of articaine was administered in group A and 2 ml of lignocaine was administered in group B.

In all patients an envelope entry point was made with vertical augmentation mesial



Figure 1: Similar type of bilateral impacted mandibular 3rd molar

to mandibular 2nd molar. A mucoperiosteal flap was raised and bone guttering was performed by single specialist. Wound was irrigated with normal saline and povidone iodine solution. Wound edges were carefully stitched with simple interrupted sutures using 3-0 silk non-absorbable sutures. Patients were advised antibiotics and painkiller to be taken 8 hourly for 5 days.

The following parameters had been recorded:

Pain score:

The pain was one of the variables of the current study and was assessed using the visual analogue scale (VAS). The patients had to have no pain at the surgical site preoperatively (zero pain score is considered), and the highest pain was considered 100.

Onset of anesthesia

The onset of anesthesia was recorded and was defined by the time elapsed from withdrawal of the needle to the time at which the patient felt maximum lip numbness.

Duration of anesthesia

The duration of anesthesia was recorded as the time from the patient's perception of the anesthetic effect to the moment when the subjective lip numbness began to fade.

Drug volume

Total amount of anesthetics (ml) used, including the key anesthetic dose, volumes used for the lingual soft tissue anesthesia, any subsequent use for hemostasis or for supplementing soft tissue anesthesia.

Statistical Analysis

Data were summarized as Mean \pm SD (Standard deviation). Outcome measures of two independent groups were compared by parametric student's t test and non

parametric Mann–Whitney U test wherever applicable. The VAS score was analyzed by non parametric Wilcoxon matched pair signed rank test (W). The data were subjected to both parametric and non parametric statistical tests based upon the distribution of the data. Analyses were performed on SPSS Software (Windows version 17.0).

Results

Pain was assessed and compared between these two groups. In articaine group ranged from 0.0-2.0 mm (mean 0.58 ± 0.72) while in lignocaine group it was 1.0-4.0mm (mean 2.04 ± 1.00) showed significant statistical difference ($p < .001$). It was 71.2% higher in lignocaine as compared to articaine, suggesting that articaine is clinically better anesthetic drug than lignocaine.

In articaine group, the time of onset ranged from 0.6-2.1 minutes (mean 0.91 ± 0.27) while in lignocaine group it ranged coming from 1.0-4.0 minutes (mean 2.42 ± 0.82). Typically the mean onset time of articaine was faster than lignocaine. When we compared the mean time of both group with applying t test we found considerable difference between these two groups and it was greater than 62.0%. It showed a significant statistical difference ($p < .001$).

Regarding the duration of the anesthesia depending on subjective lip numbness, in articaine group it ranged from 40-80 min (mean 82.08 ± 7.93) while

in lignocaine group it ranged from 60-90 min (mean. 60.21 ± 8.78). It is higher in articaine group. When t test was applied on mean outcome of both group significant difference ($p < .01$) was found. Duration of anesthesia of articaine was greater by 26.6% to lignocaine.

Concerning about drug volume needed, in articaine group volume used ranged from 0.8-1.5 ml with mean 1.1 ± 0.13 ml while in lignocaine group it ranged from 1.5-2.0 ml with mean 1.83 ± 0.21 ml. The mean drug volume used of lignocaine was comparatively higher than Articaine. Comparing the mean drug volume used of two groups, t test showed significant difference ($p < .001$) and higher (56.6%) drug volume used in lignocaine as compared to articaine. (Table 1)

In all the cases bone removal was required; however tooth sectioning was required only in 10 cases.

Discussion

In dentistry 3rd molar removal is the most regular oral surgical procedure. It is associated with several difficulties including hemorrhage, echymosis, infection, swelling, pain, alveolar osteitis, trismus etc.⁹

The present study was conducted as a split mouth clinical trial investigate the efficacy of two local anesthetics such as articaine used as buccal and lingual infiltration another one was lignocaine used

Table 1: Pain perception, time of onset, duration of anesthesia, drug volume needed

	Articaine (n=24) Mean \pm SD	Lignocaine (n=24) Mean \pm SD	p value
Patient's perception of pain	0.58 \pm 0.72 mm	2.04 \pm 1.00	< .001
Time of onset	0.91 \pm 0.27 min	2.42 \pm 0.82	< .001
Duration of anesthesia	82.08 \pm 7.93 min	60.21 \pm 8.78	< .01
Drug volume needed	1.1 \pm 0.13 ml	1.83 \pm 0.21 ml	< .001

as conventional IAN block to reduce pain. Amount of drugs used, onset and duration of anesthetics was studied following removal of impacted 3rd molar. To the best of the author's knowledge, this is the 1st clinical trial studying the comparative evaluation of buccal and lingual infiltration of articaine and conventional IAN block with lignocaine.

The particular finding of present study suggested that the pain of group A was lower than group B throughout the surgical procedure and on subsequent days. This specific difference is statistically significant. More cooperation of patient leads to more precise surgery & lesser complication such as trismus, postoperative oedema.¹⁰ Longer surgical procedure causes more manipulation and may lead to more complication.

Asraf et al performed a study about the effect of articaine against lignocaine in the form of block anesthesia and infiltration in teeth with irreversible pulpitis. They reported a reduce efficacy for buccal injection after inadequate IAN infiltration block with lignocaine (29%) than articaine (71%) in mandibular 1st and 2nd molar extraction.⁵ Therefore like present study articaine infiltration anesthesia had performed significant role in lowering the pain after surgery. The 4% articaine infiltration played an efficient function in reducing pain on the 1st day after surgery, and patient had more pleasurable experience of treatment and fewer stress.

Concerning about the onset and duration of anesthesia, the present study shows time of onset of articaine is faster than lignocaine. In articaine time of onset was approximately 1 minutes whereas in lignocaine it was approximately 2 minutes. Mittal et al (2018) compared the effectiveness of 4% articaine with 2% lignocaine in surgical extraction of

the impacted 3rd molar. They concluded that 4% articaine had a faster onset of action than 2% lignocaine.¹¹

Regarding duration of anesthesia articaine had longer duration of action compared to lignocaine (26% more). Rebollello et. al (2007)¹² published a comprehensive study aiming to determined the effectiveness of 4% articaine with 2% lignocaine during surgical extraction mandibular 3rd molar. In this study duration period of anesthetics was 4% higher in articaine group compared to lignocaine group. No significant differences was found in terms of pain, onset and volume of anesthetics agent except duration.^{12,13,14}

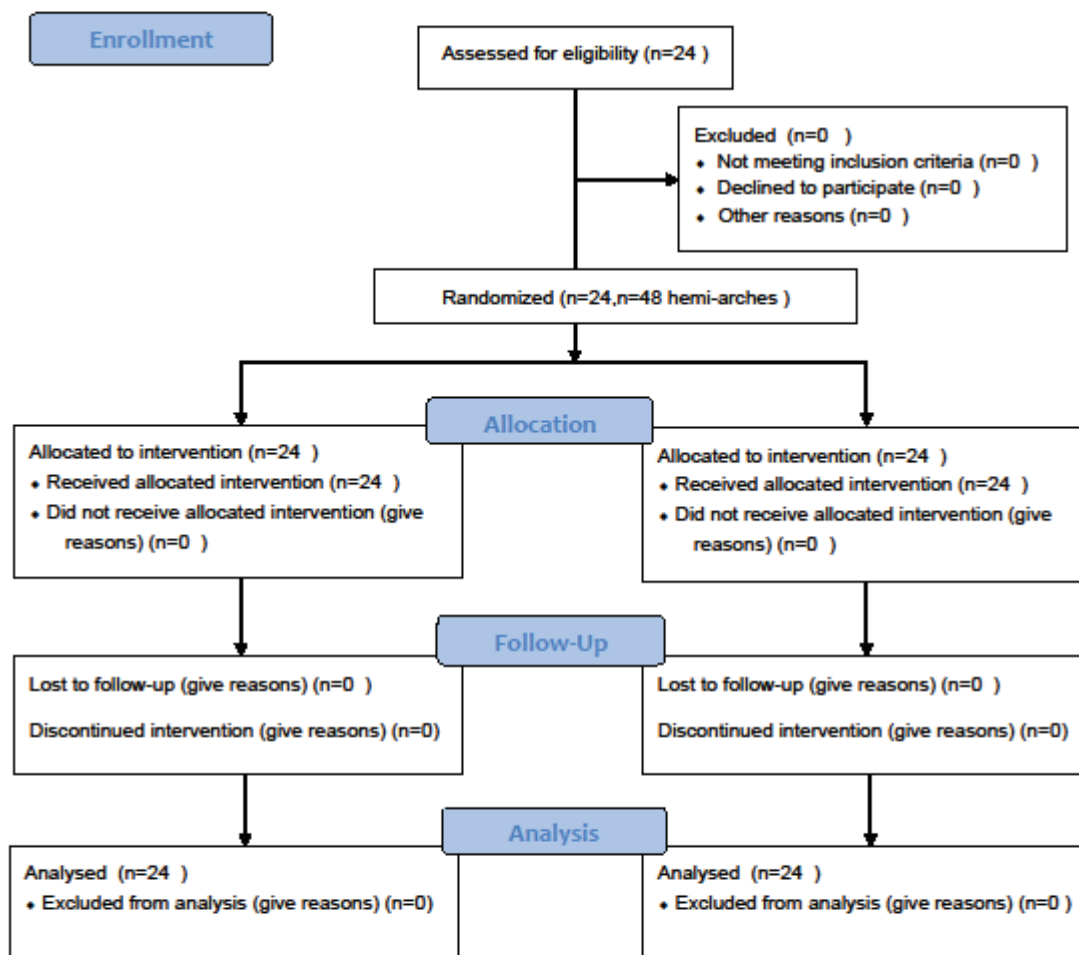
A meta-analysis study on safety of articaine showed that this specific agent even more effective in typically in the 1st molar area. There was negligible pain on injection. Articaine was even more safe and effective than lignocaine in dentistry, whenever applied as infiltration of mandibular teeth in adults. Probable mechanisms may be infiltration through to the inferior alveolar nerve canal, blocking the inferior alveolar nerve distal to that point, or infiltration through the mental foramen to produce a modified mental incisive nerve block. However, this hypothesis cannot explain the high percentage of pulpal anesthesia (75%) achieved in second mandibular molars in the study by Robertson et al.¹⁵

Conclusion

Articaine can be good alternative to lignocaine in extraction of impacted 3rd molar. It has several advantages over lignocaine such as faster onset of action, longer duration and greater diffusing property resulting in more precise surgery, less complication, less postoperative pain and fast recovery.



CONSORT 2010 Flow Diagram



References

1. Lim D, Ngeow WC. A comparative study on the efficacy of submucosal injection of dexamethasone versus methylprednisolone in reducing postoperative sequelae after third molar surgery. *J Oral Maxillofac Surg.* 2017 Nov;75(11):2278-86. doi: 10.1016/j.joms.2017.05.033.
2. Nizharadze N, Mamaladze M, Chipashvili N, Vadachkoria D. Articaine - the best choice of local anesthetic in contemporary dentistry. *Georgian Med News.* 2011 Jan;(190):15-23.

3. Sharifi M, Karimaghaee A, Iranmanesh F, Sheikhfathalahi M. Comparison of the anesthetic efficacy of articaine infiltration versus lidocaine inferior alveolar nerve block in pulp therapy of lower primary molars. *J Mash Dent Sch.* 2017; 41: 305-16.
4. Mikesell P, Nusstein J, Reader A, Beck M, Weaver J. A comparison of articaine and lidocaine for inferior alveolar nerve blocks. *J Endod.* 2005 Apr;31(4):265-70. doi: 10.1097/01.don.0000140576.36513.cb.
5. Ashraf H, Kazem M, Dianat O, Noghrehkar F. Efficacy of articaine versus lidocaine in block and infiltration anesthesia administered in teeth with irreversible pulpitis: a prospective, randomized, double-blind study. *J Endod.* 2013 Jan;39(1):6-10. doi: 10.1016/j.joen.2012.10.012.
6. El-Kholey KE. Infiltration anesthesia for extraction of the mandibular molars. *J Oral Maxillofac Surg.* 2013 Oct;71(10):1658.e1-5. doi: 10.1016/j.joms.2013.06.203.
7. Colombini BL, Modena KC, Calvo AM et al. Articaine and mepivacaine efficacy in postoperative analgesia for lower third molar removal: a double-blind, randomized, crossover study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006 Aug;102(2):169-74. doi: 10.1016/j.tripleo.2005.09.003.
8. Lima-Júnior JL, Dias-Ribeiro E, de Araújo TN et al. Evaluation of the buccal vestibule-palatal diffusion of 4% articaine hydrochloride in impacted maxillary third molar extractions. *Med Oral Patol Oral Cir Bucal.* 2009 Mar 1;14(3):E129-32.
9. Miloro M, Ghali GE, Larsen PE, Waite PD. *Peterson's Principles of Oral and Maxillofacial Surgery - Vol. 1, 2nd edn.* London: BC Decker Inc, 2004.
10. Alcântara CE, Falci SG, Oliveira-Ferreira F, Santos CR, Pinheiro ML. Pre-emptive effect of dexamethasone and methylprednisolone on pain, swelling, and trismus after third molar surgery: a split-mouth randomized triple-blind clinical trial. *Int J Oral Maxillofac Surg.* 2014 Jan;43(1):93-8. doi: 10.1016/j.ijom.2013.05.016.
11. Mittal J, Kaur G, Mann HS et al. Comparative Study of the Efficacy of 4% Articaine vs 2% Lidocaine in Surgical Removal of Bilaterally Impacted Mandibular Third Molars. *J Contemp Dent Pract.* 2018 Jun;19(6):743-8.
12. Sierra Rebolledo A, Delgado Molina E, Berini Aytís L, Gay Escoda C. Comparative study of the anesthetic efficacy of 4% articaine versus 2% lidocaine in inferior alveolar nerve block during surgical extraction of impacted lower third molars. *Med Oral Patol Oral Cir Bucal.* 2007 Mar 1;12(2):E139-44.
13. Katyal V. The efficacy and safety of articaine versus lignocaine in dental treatments: a meta-analysis. *J Dent.* 2010 Apr;38(4):307-17. doi: 10.1016/j.jdent.2009.12.003.
14. Meechan JG. The use of the mandibular infiltration anesthetic technique in adults. *J Am Dent Assoc.* 2011 Sep;142 Suppl 3:19S-24S. doi: 10.14219/jada.archive.2011.0343.
15. Robertson D, Nusstein J, Reader A, Beck M, McCartney M. The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth. *J Am Dent Assoc.* 2007 Aug;138(8):1104-12. doi: 10.14219/jada.archive.2007.0324.