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Original Article

Dentistry Section

Anaesthetic Efficacy of 4% Articaine Mandibular Buccal Infiltration Compared To 2% Lignocaine Inferior Alveolar Nerve Block in Children with Irreversible Pulpitis

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ABSTRACT

Background: Lidocaine is the gold standard anaesthetic solution that has been used since its inception into dentistry till date. Around 80% of failures have been reported when lignocaine has been used for inferior alveolar nerve block in children and adults with irreversible pulpitis. There is a need to use newer drugs which are available which have been reported to be effective like lignocaine, such as articaine. Although articaine has been used in adults, literature supporting its use in children is sparse.

Aim: The purpose of this study is to compare the anaesthetic efficacy of 4% articaine buccal infiltration and 2% lignocaine inferior alveolar nerve block in children with irreversible pulpitis. It also aims to assess the need for supplemental intrapulpal injections.

Materials and Methods: This study was designed as a randomized double-blind cross over trial comparing the anaesthetic effectiveness of 4% articaine with 1:100,000 epinephrine in buccal infiltration and 2% lignocaine IAN block anaesthesia. The study subject and the pediatric dentist performing the pulpectomy procedures were blinded to the study. A sample size of 40 subjects in the age group of 5-8 y was included in the study.

Results: The onset of anaesthesia with 4% articaine was faster as compared to 2% lignocaine. The duration of anaesthesia with articaine infiltration was shorter. The need for supplemental injection in the articaine group was less.

Conclusion: Four percent articaine infiltration can be used in children with irreversible pulpitis. It can be used to replace the IAN block in children thereby reducing the post anaesthetic complications like lip biting.

Keywords: Articaine, Buccal infilteration, Irreversible pulpitis, Supplemental injection

INTRODUCTION

Pain control in dentistry is an important part in reducing the fear and anxiety associated with dental procedures especially in children. Local anaesthetics form the back bone of pain control in dentistry and there has been a substantial research for a safe and effective anaesthetic agent for a few decades for endodontic procedures [1]. Two percent lignocaine is the gold standard and considered the most efficacious anaesthetic agent for use in pediatric and adult patients and has been widely used for inferior alveolar nerve blocks [2]. Clinical studies have shown the failure of IAN blocks to be approximately 44-84% and 0-36% in maxillary infiltrations which necessitated the need for supplemental injections in the form of intrapulpal, buccal infiltrations etc [3-5]. Articaine entered into the clinical practice in 1976 and has been widely used since then due to its enhanced efficacy and safety. Along with the ester group, articaine consists of thiophene ring instead of benzene ring which makes it different from other anaesthetic solutions. The increased diffusion of the articaine solution is attributed to the presence of thiophene ring, which increases the lipid solubility thereby allowing the solution to cross the lipid membrane [6]. According to some authors [7,8] due to the increased diffusion it can produce profuse pulpal as well as palatal anaesthesia after maxillary buccal infiltrations thus enabling the clinicians to avoid painful nerve block specially in children. The available literature indicates that articaine is equally effective when statistically compared to other local anaesthetics [9-15].

Many studies have shown articaine and lignocaine to be equally efficacious when used for providing IAN block, intraligamentary or infilteration techniques in irreversible pulpitis [11]. However, most of these studies are performed in adults and data about the efficacy in children with irreversible pulpitis are relatively sparse. Hence, the present study was done to evaluate the efficacy of 4% articaine buccal infiltration as compared to 2%lignocaine IAN block in children with irreversible pulpitis.

MATERIALS AND METHODS

This study was designed as a randomized double-blind cross over trial comparing the anaesthetic effectiveness of 4% articaine with 1:100,000 epinephrine in buccal infiltration and 2% lignocaine 1:100,000 epinephrine IAN block anaesthesia. The study was conducted in Krishnadevaraya College of Dental Sciences, Bangalore in 2012-13. The study was in accordance with the ethical standards of the institutional ethical committee on human experimentation and with the Helsinki Declaration. The study subject and the paediatric dentist performing the pulpectomy procedures were blinded to the study. A sample size of 40 subjects in the age group of 5-8 y was included in the study. The following are the inclusion and exclusion criteria of the subjects in the study:

Inclusion criteria

Deep dentinal caries irt 74,75,84,85.

Moderate to severe spontaneous pain, positive response to electric pulp tester.

Widened periodontal ligament space

Children falling in the frankel behaviour rating scale of positive

Exclusion criteria

Allergies to local anaesthetics or sulphites

H/O significant medical conditions

Any medications

Presence of abscess, sinus opening.

Method: After obtaining the informed consent from the parents, 40 subjects were randomly divided into two groups. Group 1 constituted the 4% articaine group, while Group 2, 2% lignocaine group. The procedure was performed by 2 investigators. The procedure to be performed was explained to the patients. The investigator 1 administering all anaesthetics had no involvement in measuring outcomes. Randomization was performed by investigator 1 who delivered the local anaesthetic. Blinding of both the investigators was maintained until completion of the trial. All the interventions were performed in a dental hospital clinical setting. The following treatments were given at separate visits:

1. 1.8 ml 4% articaine with 1:100,000 epinephrine was used for buccal infiltration. The solution was injected in the mucobuccal fold adjacent to a mandibular first primary molar on the right side.
2. 1.8 ml 2% lignocaine with 1:100,000 epinephrine was used for IAN block. The solution was was injected on the left side.

The treatment was performed by investigator 2 over a period of 2 visits which were separated by atleast one week interval. The same mandibular primary molar area was anaesthetized at each visit; the investigator 2 evaluated the onset of anaesthesia, pain during the procedure and the duration of anaesthesia.

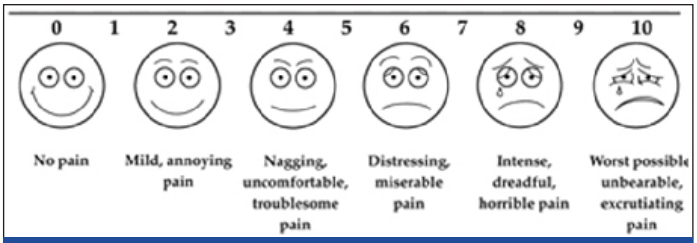
Behavior modified pain scale was used to assess the behavior of the child during the injection procedure.

Behavioral modified pain scale (TADDIO et al.,) [16]

- Facial display(eyebrow bulge/eye squeeze)
- Arm/leg movements
- Torso movements
- Crying.

The investigator 2 assessed the pain present in the child during the access opening procedure. If the child did not allow the investigator to perform the procedure, the need for supplemental intra-pulpal injection was also assessed. Efficacy was determined on a gross scale immediately following the procedure by having both the subject and investigator rate the pain experienced by the subject during the procedure using a visual analog scale (VAS) [17-19]. The 10 cm VAS scale ranged from “it didn’t hurt” (smiley face = 0) to “worst hurt imaginable” (frowning face = 10) [Table/Fig-1]. The parent or guardian explained the method of marking the scale to the child. This assured the investigators that the child understood what he/she is supposed to do. A 10 cm scale similar to the one given to the child before the start of the procedure was given to the child to indicate the presence / absence of pain during the procedure. Duration of the anaesthesia was assessed after 1h and 24h after the procedure by a telephonic conversation.

All the values obtained were tabulated and subjected to statistical analysis. Onset of anaesthesia and duration was analysed using Chi-square test and Mann-Whitney-Wilcoxon test were used for pain scores (p<.05).

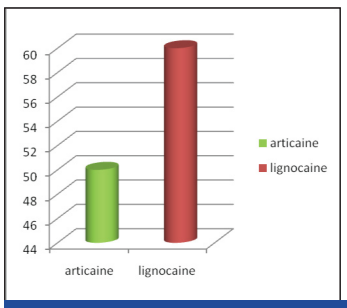


[Table/Fig-1]: VAS scale

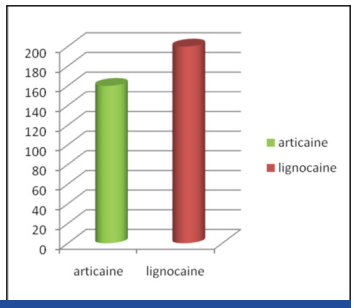
RESULTS

Twenty subjects under the age of 5-8 y were treated with articaine and twenty subjects with lidocaine.

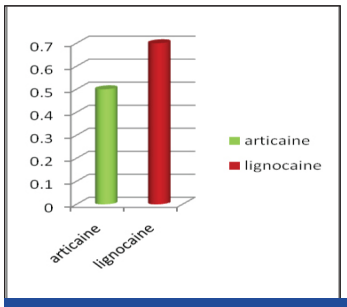
Onset of anaesthesia: The mean time of onset of anaesthetic effect with articaine was found to be 50 sec while with lignocaine it was found to be 60 seconds which was found to be statistically non-significant (p > 0.85) [Table/Fig-2].



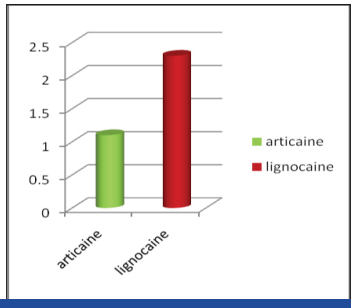
[Table/Fig-2]: Onset of anesthesia



[Table/Fig-3]: Duration of anesthesia



[Table/Fig-4a]: Pain score of the investigator



[Table/Fig-4b]: pain scores of the subjects

Duration of anaesthesia: The anaesthetic effect lasted for 160 min with articaine buccal infilteration while that of lignocaine IAN block lasted for 200 min which was found to be statistically not significant (p = 0.80) [Table/Fig-3].

Pain scores: The investigator assessed the pain experienced by the subject during access opening and observed it to be less with articaine group as compared to the lignocaine group, which was found to be statistically significant. On the VAS scale articaine had the score of 0.5±0.18 while lignocaine had 0.7±0.26 [Table/Fig-4a].

The subjects also reported less pain on the right side (articaine group) as compared to the left side (lignocaine group). The subject gave a pain score of 1.1±0.33 for articaine, while for the lignocaine group a score of 2.3±2.25 was given [Table/Fig-4b], which was found to be statistically significant. The behavioral changes upon injection of articaine were observed to be less as compared to the lignocaine group.

Supplemental injections: In the articaine group only 2 subjects needed supplemental intra-pulpal injections while in the lidocaine group 8 subjects needed supplemental injections which was found to be statistically significant.

DISCUSSION

In our study the onset of anaesthesia with articaine infiltration was faster as compared to lidocaine. This was similar to the study by Bortolizzi et al., [10] who also showed earlier onset of anaesthesia with articaine. This could be attributed to the increased liposolubility of articaine which helps in greater diffusion of the anaesthetic solution in the tissues, leading to faster action.*

Articaine produced shorter duration of action as compared to lidocaine. This is in contrast to the study by Ram and Amir’s [19] have shown that articaine produced longer soft tissue numbness as compared to articaine. But in our study articaine was used for infiltration unlike their study where articaine was used as an IAN block.

Clinical trials comparing the time of onset of clinical anaesthesia and the duration and depth of anaesthesia have shown that 4% articaine provides significantly shorter time of anaesthesia as well as greater consistency than 2% articaine [13,20-23] Toxicity of 4% articaine as compared to lowered concentrations was found to be non-significant [22]. Hence published data suggest 4%articaine to be preferable to a lower concentration for consistent efficacy, including onset and duration of anaesthesia.

Many previous studies have concluded that 4% articaine can be successfully used in children of 4 to10 y of age. Lemay et al and Dudkeiwich et al., [24,25] found the mean time of onset of anaesthesia to be shorter in children than adults. This could be attributed to the cancellous nature of the paediatric maxilla and mandible. Articaine's excellent pediatric safety and efficacy profile supported by other studies in the literature [26].

CONCLUSION

Based on the results of our study it can be concluded that 4% articaine is safe and effective in children. Infiltration with articaine can replace the IAN block in children as infiltration was found to be equally effective as compared to IAN block. This may also reduce the post anaesthetic complications like lip biting injury which most commonly occurs with IAN block.

REFERENCES

[1] Malamed SF, Gagnon S, Leblanc D. Articaine hydrochloride: a study of the safety of a new amide local anaesthetic. *J Am Dent Assoc*. 2001;132:177–85.
[2] Malamed SF. Handbook of Local Anaesthesia, 4th ed. St. Louis: Mosby–Year Book; 1997. pp. 63–64.
[3] Claffey E, Reader A, Nusstein J, Beck M, Weaver J. Anaesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. *J Endod*. 2004;30:568–71.
[4] Kaufman E, Weinstein P, Milgrom P. Difficulties in achieving local anaesthesia. *J Am Dent Assoc*. 1984;108:205.
[5] Meechan JG. Supplementary routes to local anaesthesia. *Int Endod J*. 2002;35:885–96.
[6] Isen DA. Articaine: pharmacology and clinical use of a recently approved local anaesthetic. *Dent Today*. 2000;19:72-77.
[7] Lipp M, Daublander M. The German experience of articaine. In: Proceedings of the international symposium on local analgesia in dentistry. London: Faculty of General Dental Practitioners, 1999. Pp. 21-22.
[8] Sloss DR. Articaine in dental practice. In: Proceedings of the international symposium on local analgesia in dentistry. London: Faculty of General Dental Practitioners, 1999. Pp. 23-24.
[9] Simon MA, Gielen MJ, Alberink N, Vree TB, van Egmond J. Intravenous regional anaesthesia with 0.5% articaine, 0.5% lidocaine, or 0.5% prilocaine. A double-blind randomized clinical study. *Reg Anesth*. 1997;22:29-34.
[10] Malamed SF, Gagnon S, Leblanc D. A comparison between articaine HCl and lidocaine HCl in pediatric dental patients. *Pediatr Dent*. 2000;22:307-11.
[11] Malamed SF, Gagnon S, Leblanc D. Efficacy of articaine: a new amide local anaesthetic. *J Am Dent Assoc*. 2000;131:635-42.
[12] Donaldson D, James-Perdok L, Craig BJ, Derkson GD, Richardson AS. A comparison of Ultracaine DS (articaine HCl) and Citanest forte (prilocaine HCl) in maxillary infiltration and mandibular nerve block. *J Can Dent Assoc*. 1987;53:38-42.
[13] Haas DA, Harper DG, Saso MA, Young ER. Comparison of articaine and prilocaine anaesthesia by infiltration in maxillary and mandibular arches. *Anesth Prog*. 1990;37:230-37.
[14] Wright GZ, Weinberger SJ, Marti R, Plotzke O. The effectiveness of infiltration anaesthesia in the mandibular primary molar region. *Pediatr Dent*. 1991;13:278-83.
[15] Vahatalo K, Antila H, Lehtinen R. Articaine and lidocaine for maxillary infiltration anaesthesia. *Anesth Prog*. 1993;40:114-16.
[16] RAMD, AMIR E. Comparison of articaine 4% and lidocaine 2% in paediatric dental patients. *Int J Ped Dent*. 2006;16(4): 252–56.
[17] Meechan JG, Blair GS. The effect of two different local anaesthetic solutions on pain experience following apicectomy. *Br Dent J*. 1993;175:410-13.
[18] Primosch RE, Brooks R. Influence of anaesthetic flow rate delivered by the Wand Local Anaesthetic System on pain response to palatal injections. *Am J Dent*. 2002;15:15-20.
[19] Meechan JG. A comparision of ropivacaine end lidocaine with epinephrine for intraligamentary anaesthesia. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2002;93:469-73.
[20] Winther JE, Nathalang B. Effectivity of a new local analgesicHoe 40 045. *Scand J Dent Res*. 1972;80:272-78.
[21] Winther JE, Patirupanusara B. Evaluation of carticaine–a new local analgesic. *Int J Oral Surg*. 1974;3:422-27.
[22] Raab WHM, Muller R, Muller HF. Comparative studies on the anaesthetic efficiency of 2% and 4% articaine. *Quintessence*. 1990;41(7):1208-16.
[23] Ruprecht S, Knoll-Kohler E. Comparative study of equimolar solutions of lidocaine and articaine for anaesthesia. A randomized, double-blind cross-over study. *Schweiz Monatsschr Zahnmed*. 1991;101(10):1286-90.
[24] Lemay H, Albert G, HJlie P, et al. L'articaine en dentisterie operatoire conventionnelle. *Le Chirugien Dentiste de Frsnce*. 1985;281(92):39-43.
[25] Dudkiewicz A, Schwartz S, Lalibert JR. Effectiveness of mandibular infiltration anaesthesia in children using the local anaesthetic Ultracaine® (articaine hydrochloride). *J Canad Dent Assoc*. 1987;1:29-31.
[26] Wright GZ, Weinberger SJ, Friedman CS, Plotske OB. The use of articaine local anaesthesia in children under 4 years of age.–a retrospective report. *Anesth Prog*. 1989;36:268-71.

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