ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 04 | April - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE EVALUATION OF ANESTHETIC EFFICACY OF 4% ARTICAINE WITH 1:100000 EPINEPHRINE AND 2% LIDOCAINE WITH 1:100000 EPINEPHRINE FOR INFERIOR ALVEOLAR NERVE BLOCK AND LONG BUCCAL NERVE BLOCK DURING ROOT CANAL TREATMENT: AN IN VIVO STUDY

Dental Science

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ABSTRACT

Background: It is important to control the pain associated with root canal treatment (RCT) in endodontic. Pain accompanying fear and anxiety due to endodontic treatment can be reduced by anesthetic techniques. The present study aims to compare the effect of articaine versus lidocaine local anesthesia for inferior alveolar nerve block (IANB) and long buccal nerve block on pain during RCT.

METHODS: Twenty patients diagnosed with symptomatic irreversible pulpitis of mandibular posterior tooth were selected. The patients randomly received either cartridge of lidocaine or articaine using IANB and long buccal nerve block. The patients were randomly divided into two groups of ten. Group 1: patients received IANB and long buccal nerve block 2% lidocaine with 1:100000 epinephrine. Group 2: patients received IANB and long buccal nerve block with 4% articaine with 1:100000 epinephrine. Before the Injection, the patient received all information about the visual analysis scale (VAS). Pain was evaluated using VAS scale in numberic value 1 to 10 number. The pain was evaluated at three different stages: before administration of LA, after immediate access opening, and after immediate obturation procedure. Data were analyzed using various suitable statistical tests.

RESULT: The mean value of efficacy of pain before administration of local anesthesia (LA) was 8.50 ± 0.97 for lidocaine and 8.30 ± 0.48 for articaine had no significant difference. A significant difference was observed at two different duration after immediate access opening and after immediate obturation where articaine has a lower mean value 3.60 ± 1.08 and 1.60 ± 0.17 respectively (P>0.05) as compared to the mean value of lidocaine 4.10 ± 1.10 and 1.60 ± 0.17 respectively

Conclusion: Within the limitations of the study, in cases of symptomatic irreversible pulpitis articaine 4% did not alleviate pain much and showed better anesthetic efficacy than 2% lidocaine with IANB and long buccal nerve block.

KEYWORDS

Articaine, Inferior alveolar nerve block, Lidocaine, Single sitting root canal.

INTRODUCTION:

In dentistry, pain is one of the most frequently encountered symptoms and is a critical challenge for the dentist. Pain is not really an alert signal in dental practice, but it is an evil to be overcome [1]. The pain due to the inflammatory pulp or periapical diseases is the most common pain of the maxillofacial region [2].

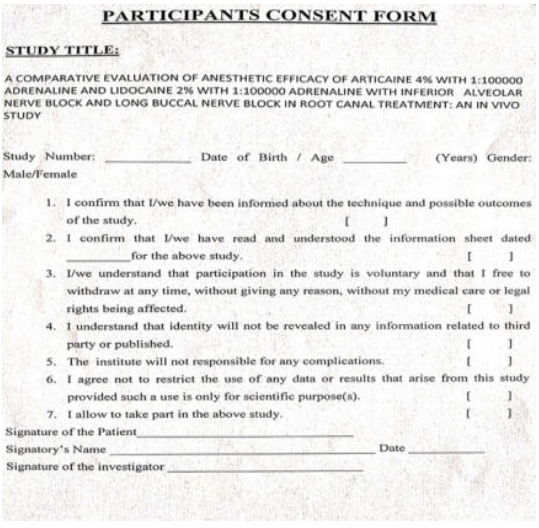
The most crucial skill of all dental practitioners is the ability to provide safe and efficient local anesthesia with effective pain control, fear, and anxiety associated with endodontic procedure [3, 4]. The invention of local anesthesia was a revelatory development in the late 1800s. Anesthetics that without the loss of consciousness enabled pain prevention. Since it was commercially available in 1948, lidocaine hydrochloride has become the most widely used anesthetic agent. Due to its effectiveness, low allergenicity, and reduced toxicity, it is branded as the "gold standard" [5]. It is an amide anesthetic with a short onset of action and intermediate anesthesia duration when interacting with it.

Articaine is an anesthetic agent commonly used in developing countries. It has a deeper level of anesthesia and a greater potential for tissue diffusion [6]. Articaine's clinical benefits include the length of its anesthetic effect and its superior diffusion through bony tissue [7]. The most widely used nerve block is the lower alveolar nerve block that causes anesthesia in the mouth and face areas innervated by lower alveolar nerves. The long buccal nerve block (buccal nerve block) is commonly used to anesthetize the buccal surface of molar teeth [8].

The research was conducted by Suma Prahlad Saraf et al to verify the efficacy of 4% articaine and 2 % lidocaine in the anterior middle superior alveolar nerve block and infraorbital nerve block. Another research was carried out by Ali Ghazalgoo to assess the effect of using articaine versus lidocaine on pain during root canal treatment in the inferior alveolar nerve block. Till date, there has been very little research on the anesthetic efficacy of articaine in patients with permanent pulpitis using inferior alveolar nerve block [9 - 11]. Therefore, to contribute to a more profound knowledge about the quality of articaine versus lidocaine as a local anesthetic for endodontic treatments, the present study was performed. This study aims to comparatively evaluate the anesthetic efficacy of articaine 4% and lidocaine 2% with Inferior alveolar block (IANB) and long buccal nerve block for anesthesia of mandibular posterior teeth during root canal procedure.

MATERIALS AND METHODS

In this study, 20 patients with symptomatic irreversible pulpitis in the lower molar were chosen. The study was performed after institutional ethical approval at the Department of Conservative Dentistry and Endodontics (KSDE/2020/Apr/01 dated 28.10.2020). The procedure was explained to the patients and informed consent was obtained (figure no.1). Patients were randomly divided into two groups according to Interactive Web Response System (IWRS) software, either receiving 2% lidocaine with 1:100,000 epinephrine (Lidocaine; Septodont, Saint Maur des fosses, France) or 4 % articaine with 1:100,000 epinephrine (Septocaine; Septodont Saint Maur des fosses, France) with long buccal nerve block IANB cartridge figure no.2 and 3).



PARTICIPANTS CONSENT FORM

STUDY TITLE:

A COMPARATIVE EVALUATION OF ANESTHETIC EFFICACY OF ARTICAINE 4% WITH 1:100000 ADRENALINE AND LIDOCAINE 2% WITH 1:100000 ADRENALINE WITH INFERIOR ALVEOLAR NERVE BLOCK AND LONG BUCCAL NERVE BLOCK IN ROOT CANAL TREATMENT: AN IN VIVO STUDY

Study Number: _____ Date of Birth / Age _____ (Years) Gender: Male/Female

1. I confirm that I/we have been informed about the technique and possible outcomes of the study. [ ]
2. I confirm that I/we have read and understood the information sheet dated _____for the above study. [ ]
3. I/we understand that participation in the study is voluntary and that I free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]
4. I understand that identity will not be revealed in any information related to third party or published. [ ]
5. The institute will not responsible for any complications. [ ]
6. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). [ ]
7. I allow to take part in the above study. [ ]

Signature of the Patient_____

Signatory's Name _____ Date _____

Signature of the investigator _____

Figure no 1: picture showing consent form

Figure no.2 shows inferior alveolar nerve block

Figure no. 3 shows long buccal nerve block

CRITERIA FOR INCLUSION

Patients with symptomatic permanent lower-molar pulpitis with a closed or intact apex were included.

CRITERIA FOR EXCLUSION

Patients with swelling, periapical abscess, root resorption, any systemic condition, or any other dental abnormality were excluded.

The study was done as a double-blind study in which the patient and operator (who performed the procedure) do not know which of the local anesthesia administrated to the participant. Two operators conducted the analysis, in which all injections were provided by the first operator. The cartridge had a code (figure no.4) that the first the operator who administered the injections was not aware of. The cartridge with opaque labels was masked by the second operator and the cartridge selected was handed over by the second operator to the first operator. No information was revealed by the two operators to each other.

Figure no.4 shows masking of local anaesthetic vials

Procedure

Patients obtained full details about the visual analog scale before the administration of anesthetic injections (VAS). The severity of pain was measured using a VAS scale during all endodontic procedures. The VAS consisted of a 100-mm line with 2 endpoints indicating "no pain " and " pain as bad as it could be." 1 to 10 numbers were added to assess the pain intensity. The patient filled out the VAS scale. The patient has been notified of the VAS scale; all responses were reported on the VAS scale.

The pain was measured at three different stages: previous to LA administration, immediate access opening, and immediate obturation procedure.

Before the LA administration, the first pain assessment was reported. A rubber dam was positioned after 15 minutes of LA administration; a high-speed air rotor handpiece was used to prepare an access cavity. A second pain assessment was performed with the use of the VAS scale after immediate access cavity preparation. A size 10 K-file (Dentsply Sirona Endodontics, Ballaigues, Switzerland) was inserted into the root canal following access cavity preparation.The working length (WL) was established at 1 mm short of the apical foramen.

Working length of the root confirmed by apex locator (J Morita, Tokyo, Japan). All root canals were prepared with the crown down technique using hero shaper rotary files (Micro Mega, Besancon, France). Root canal irrigation was performed using a 26-G one side port needle taken up to 1 mm short of the WL. Root canals were irrigated with a total volume of 25 ml 2.5% sodium hypochlorite (NaOCl). Removal of the smear layer was performed using 3 ml 17% EDTA Followed by a final flush with 2 ml distilled water.

All canals were obturated using gutta-percha coated with sealapex (Kerr, North Ryde, and Australia) sealer in a single appointment. The last pain evaluation was recorded immediately after completion of obturation.

STATISTICALANALYSIS

The readings were statistically SPSS software analyzed using Friedman test at various time intervals for comparision of group. The Wilcoxon rank test for dependent variables was applied for pair wise comparison after having significant result of Friedman test for comparision of both groups. The level of significance was P< 0.5%.

RESULT:

Twenty patients were included in the analysis. With no history of any adverse effects, all the patients reacted well. The mean duration-wise comparison of the efficacy of 2% lidocaine and 4% articaine at three different stages is shown in Table 1 and Table 2: before LA administration, after immediate access opening, and after immediate obturation, respectively, using the Friedman test. The mean pain efficacy value before LA administration was 8.50 ± 0.97 for lidocaine and 8.30 ± 0.48 for articaine, respectively, and there were no major improvements. After immediate access opening and immediate obturation, a major change was observed at two different durations where articaine had a lower mean value of 3.60 ± 1.08 and 1.60 ± 0.17 respectively (p>0.05) compared to the mean value of lidocaine of 4.10 ± 1.10 and 1.60 ± 0.17 respectively [Table 3 and Graph 1]. The pain that was experienced by the patients was recoreded as numerical values on VAS scale.

Table 1 Duration wise comparison of efficacy of 2% Lidocaine

Duration	Minimum	Mean ± SD	Median	Maximum	P Value
Before administration[B,C]	8.00	**8.50 ± 0.97**	9.00	9.00	0.01*
After access opening [A,C]	**5.00**	**4.10 ± 1.10**	5.00	6.00	
After Obturation[A,B]	0	**2.30 ± 1.57**	2.00	4.00	

Descriptive data is presented and compared by using Friedman test. Superscript shows significant results at P<0.05.

Table 2 Duration wise comparison of efficacy of 4% Articaine

Duration	Minimum	Mean ± SD	Median	Maximum	P Value
Before administration[B,C]	6.00	6.30 ± 0.48	8.00	8.00	0.03*
After access opening[A,C]	3.00	3.60 ± 1.08	3.00	5.00	
After Obturation[A,B]	0	1.20 ±0.17	1.00	3.00	

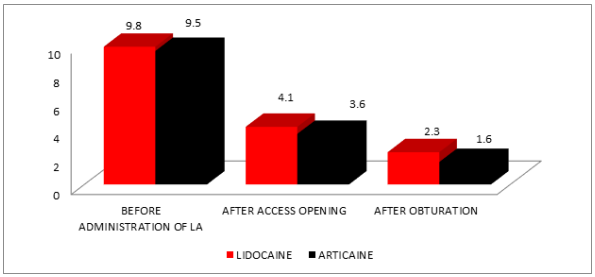
Descriptive data is presented and compared by using Friedman test.

Table 3 Comparison of efficacy of local anaesthetic agent

Descriptive data is presented and compared by using Mann-Whitney p test. P<0.05 is significant. articaine efficacy is better as compared to lidocaine.

Duration	Minimum	Mean ± SD	Median	Maximum	P Value
Before administration					
2% Lidocaine	6.00	8.50 ± 0.97	9.00	9.00	0.04*
4% Articaine	4.00	8.30 ± 0.48	7.00	8.00	
After access opening					
2% Lidocaine	3.00	4.10 ± 1.10	4.00	6.00	0.03*
4% Articaine	2.00	3.60 ± 1.08	3.00	4.00	
After Obturation					
2% Lidocaine	1	2.30 ± 1.57	2.00	6.00	0.01*
4% Articaine	0	1.60 ± 0.17	1.00	3.00	

* Statistically significant



Graph – 1: Duration wise comparison of efficacy of 2% Lidocaine And 4% articaine On VAS Scale

DISCUSSION

In dentistry, local anesthesia remains the backbone of pain management. The effective medications that are available for the prevention and treatment of pain are local anesthetics. Efficient pain management is important during endodontic care for patient satisfaction and to decrease operator stress [12].

A long buccal nerve block is used along with IANB in the current study because IANB does not anesthetize the lower first molar mesial root and so long buccal is to be provided so that the lower first molar mesial root gets anesthetized [13].

Pain assessment was recorded using the VAS scale since other measures such as the Critical Care Pain Observation Tool (CPOT) scale and the McGill pain scale are based on the facial expression, body motions, and muscle tension of the patient, whereas the VAS scale was entirely based on the experience of the pain of the patient and is recorded by the patient himself. The VAS scale consists of a numerical value from 1 to 10 that presents mild, moderate, and extreme pain, making it easier for the patient to assess the pain. Nevertheless, VAS ratings of the pain experiences include a gross, verified, and useful indicator of anesthetic efficacy. It can be used for adults and infants, or patients or researchers [14].

A cartridge of the anesthetic solution of 1.8ml was used in the present analysis. This dose was chosen because it was previously found that the increase in local anesthetic dosage does not increase its efficacy in all cases. Potocnik I et al stated that once the effective volume of the local anesthetic solution has been achieved, no further benefit can be gained by further dosage increases [15]. This effective volume was found to be 2.0 ml of solution in the case of lidocaine. However no further benefit can be achieved once the effective volume is achieved. In this study, the subjective evaluation of lidocaine and articaine was performed through VAS in which the patients were advised [16, 17].

There was no significant difference in the amount of pain experienced by the patient in both the study groups in the present study before administration of LA. In this analysis, articaine (group 2) demonstrated a lower pain value than lidocaine (group 1) in irreversible pulpitis at two separate durations, after immediate access opening (3.60 ± 1.08) and after immediate obturation (1.60 ± 0.17).

Tortamano et al. [18] reported a higher success rate with articaine solution than with lidocaine agents in some other trials, although there were no major differences in patients with irreversible pulpitis. The efficacy of articaine 4 % and lidocaine 2 % was tested by Prahlad Saraf et al [1] in anterior middle superior alveolar nerve block and infraorbital nerve block in root canal therapy. They concluded that the efficacy of articaine was higher. Further research by Ali Ghazalgoo [2] was conducted to evaluate the effect of root canal pain when articaine versus lidocaine was used in inferior alveolar nerve blocks. They find that articaine has better efficacy and that the rationale for greater anesthetic efficacy in the IANB is because the anesthetic the solution is injected near the nerve and diffusion through the cortical plate is needed for penetration in the posterior region of the mandibular.

Articaine's greater ability to spread through soft tissue and bone than other anesthetics is possibly due to its thiophene group, which increases its liposolubility. A methyl ester side linkage is included in the thiopentone ring that leads to the rapid conversion of articaine to articaine acid, its primary metabolite. The ring of thiopentone increases liposolubility, improves epineurium potency and diffusion [19, 20].

More profound levels of anesthesia and a greater ability to diffuse through tissues have been stated by Alam et al. [21]. A few mechanisms for increased efficacy of articaine have been discussed by several other researchers. Borchard and Drouin found that a reduced concentration of articaine was adequate As compared with other amide anesthetics, to block an action potential (benzene derivatives). In a rat sensory nerve conduction analysis, Potocnik et al. discovered that 4% of articaine was superior to 2% of lidocaine in blocking nerve conduction [22]. Brandt et al. recorded that articaine was 3.81 times more likely to achieve anesthetic success when administering infiltration mode is used [23].

The limitation of this study is that the pain perceptions of the patient can be different for every patient so it might be possible that we haven't got accurate value. It can also be possible that the VAS pain scale had numerical value describing pain from 1 to 10 numbers; which can be understood differently by different point.

This research is unique in that the two major anesthetic agents that are clinically useful were compared and found to be clinically relevant in irreversible pulpitis. There is no any study performed in which pain efficacy evaluated in three different stages during root canal treatment for mandibular posterior teeth, IANB and long buccal nerve block were effective in providing pulpal anesthesia.

Another limitation can be that the age of patient was not uniform and the number of patient included was less. Moreover the patients were from different geographical area i.e rural and urban and so the understanding of pain perception might vary.

CONCLUSION:

Within the limitations of the study, in cases of symptomatic irreversible pulpitis articaine 4% with IANB and long buccal nerve block did not alleviate pain much and showed better anesthetic efficacy than 2% lidocaine. There was a statically significant difference with articaine during after immediate access opening and after immediate obturation procedure as compared to lidocaine.

Acknowledgements
Financial support and sponsorship
Nil

Conflicts of interest
There are no conflicts of interest.

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