

Efficacy of 2% Lignocaine and 4% Articaine in Oral Surgical Procedure: A Comparative Study

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ABSTRACT

Aim and objective: To compare the efficacy of 2% lignocaine and 4% articaine in the extraction of mandibular molars.

Materials and methods: This study was conducted on 120 patients requiring surgical removal of tooth. Patients were categorized into 2 groups with 60 samples each. Group I patients were administered 2% lignocaine with 1:50,000 epinephrine and group II patients were administered 4% articaine with 1:100,000 epinephrine for the extraction of mandibular molar. Inferior alveolar nerve, lingual, and buccal nerve block used in both groups to anesthetize the area.

Results: The mean onset of action in group I was 85.2 seconds and in group II was 52.6 seconds, duration of anesthesia in group I was 170.2 minutes and in group II was 226.8 minutes, duration of procedure was 30.4 minutes in group I and 32.6 minutes in group II, pain during procedure in group I was 2.75 and in group II was 1.42, pain after procedure was 1.41 in group I and 0.82 in group II, pain during anesthesia insertion was 1.52 in group I and 1.04 in group II. Forty-six (76.7%) patients in group I and 52 (86.7%) patients in group II did not require re-anesthesia, while 12 (20%) in group I and 8 (13.3%) in group II required 1 time re-anesthesia and 2 (3.3%) patients required 2 times re-anesthesia in group I.

Conclusion: Articaine can be effectively used in oral surgical procedures as there is early onset of action, longer duration of anesthesia, and less need of re-anesthesia.

Clinical significance: Articaine is more effective compared to lignocaine, hence it can be recommended alternatively for tooth extraction and other oral surgical procedures.

Keywords: Articaine, Lignocaine, Local anesthesia.

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INTRODUCTION

Pain control is essential in performing oral surgical procedures. Pain is subjective symptoms and the intensity may vary from person to person. A successful surgery demands pain-free procedure and local anesthesia (LA) is widely used agent to control pain. Patient's consciousness remains unaltered during LA insertion, while nerve conduction is blocked temporarily, specific and in reversible manner.¹

Among a wide range of LA, lignocaine (lidocaine) is routinely used in dentistry. It is short-acting and safer as compared to other anesthetics because of its pharmacokinetic characteristics and low toxicity, moreover its efficacy in controlling pain is also superior.² It is seen that 2% lignocaine with epinephrine as vasoconstrictor is potent in inducing its effect which starts from 2 to 3 minutes and lasts for 85 minutes at pulp level and 180 minutes in soft tissues. 2% lignocaine with different concentration of epinephrine, such as 1:30,000, 1:50,000, and 1:80,000, can be used.³

Many investigators have tried to search for an effective local anesthetic agent with faster onset, lower pain, and lesser complications by manipulating the physical and chemical characteristics of local anesthetics.³

Articaine is other intermediate potent local anesthetics available as a 4% solution with epinephrine in concentration of 1:100,000. The presence of thiophene ring in its structure makes it potent among local anesthetic. It possesses high liposolubility and can be well tolerated by tissues. It is short-acting amide LA. It can be used for local infiltration or peripheral nerve block. It has fast onset of action and can be safely used in surgical procedure requiring short duration of action. Thus, both lidocaine and articaine can be used in dental procedures.⁴ It has been observed from earlier

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studies that among several local anesthetic agents articaine is found to be comparatively safe and fast acting and suitable for oral surgical procedure.¹⁻⁴ Considering this, the present study was conducted to compare efficacy of 2% lignocaine and 4% articaine in the extraction of mandibular molars.

MATERIALS AND METHODS

This research was performed in the Department of Dentistry, Patna Medical College and Hospital, Patna. It comprised of 120 patients

of both genders reported to the department for surgical removal of tooth. Inclusion criteria consisted of patient's age ranged 18–50 years of age and systemic healthy patients. Exclusion criteria were patients below 18 years of age, history of allergy to local anesthetic solutions used in the study, pregnancy or lactating women, and non-cooperative patients. The study was approved from ethics committee of Patna Medical College and Hospital, Patna. Informed consent was obtained from all the participating patients.

Patient's information, such as name, age, gender, etc., was recorded. Patients were categorized into 2 groups with 60 samples each. Group I patients were administered 2% lignocaine HCl with 1:50,000 epinephrine injection (Lignox 2%, I Lignox 2%, Indoco Remedies Ltd, Warren Pharma, Mumbai) and group II patients were administered 4% articaine HCl with 1:100,000 epinephrine injection (Septocaine®, Septodont Inc., Canada).

Patient requiring surgical extraction of teeth was administered 1.5 mL of anesthetic solution in both groups to anesthetize buccal, lingual, inferior alveolar nerve, for the extraction of mandibular molar. The concentration of solution could be increased if required. All the extractions were performed following aseptic standard surgical procedure. Following extraction, patients were put on capsule amoxicillin 500 mg thrice a day (TDS), tablet metronidazole 400 mg TDS, and tablet diclofenac potassium 400 mg twice a day (BD) for 5 days.

Duration of surgical procedure and duration of postoperative anesthesia and pain were evaluated as follows:

- Onset of anesthesia was estimated by noting the time of injection to time of patient's first details of numbness. The onset of anesthetic agent was verified by both subjective and objective symptoms; by loss of sensitivity of inferior lip, the buccal mucosa, and half of the tongue.
- Pain ratings on injection and efficacy of anesthesia were evaluated instantly after the extraction using the visual analog scale (VAS) where 0 denoted no pain and 10 denoted worst pains.
- Duration of surgery after anesthetic administration was calculated by recording the time of onset of anesthesia and patient reporting the loss of numbness on soft tissues (tongue, mucosa, and lip) postoperatively.

Table 1: Distribution of patients

Groups	Group I	Group II
Agent	2% lignocaine with 1:50,000 epinephrine	4% articaine with 1:100,000 epinephrine
Male	35	28
Female	25	32

Data were entered in MS excel sheet. Results were assessed with SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Chi-square test and independent *t* test were used for the study. *p* value was considered significant at less than 0.05.

RESULTS

Table 1 shows type of anesthesia and number of patients used in the study. Each group had 60 patients. Group I had 35 male and 25 female and group II had 28 male and 32 female.

Table 2 shows that mean onset of action in group I was 85.2 seconds and in group II was 52.6 seconds, duration of anesthesia in group I was 170.2 minutes and in group II was 226.8 minutes, duration of procedure was 30.4 minutes in group I and 32.6 minutes in group II, pain during procedure in group I was 2.75 and in group II was 1.42, pain after procedure was 1.41 in group I and 0.82 in group II, pain during anesthesia insertion was 1.52 in group I and 1.04 in group II. Independent *t* test showed significant difference in both groups ($p < 0.05$) except duration of procedure and pain during anesthesia insertion ($p > 0.05$).

Figure 1 shows that 46 (76.7%) patients in group I and 52 (86.7%) patients in group II did not require re-anesthesia, while 12 (20%) in group I and 8 (13.3%) in group II required 1 time re-anesthesia and 2 (3.3%) patients required 2 times re-anesthesia in group I. Chi-square test was applied which revealed non-significant difference between both groups ($p > 0.05$).

DISCUSSION

The efficacy of any anesthetic solution can be judged by its ability to relieve pain, frequent onset on action, and longer duration of anesthesia effect. Lignocaine, commonly known as "Lidocaine", is a short-acting amide local anesthetic agent.⁵ World Health Organization (WHO) has included this solution in its essential drug list. It shows its effects by blocking nerve fiber impulse. Lignocaine causes depolarization by binding to sodium channels thus preventing the transient influx of sodium. Its onset of action is rapid and it blocks sensory fibers which are unmyelinated, thinner, and more easily penetrated.⁶

Articaine also imparts its action similar to lignocaine by binding to voltage-gated sodium channels and preventing influx of sodium ions. Diameter of the nerve affects degree of neuronal block. Small myelinated fibers require less concentrations of local anesthetic as compared to larger diameter fibers.⁷ The present study compared efficacy of 2% lignocaine and 4% articaine in the extraction of mandibular molars.

In this study, we included 60 adult patients age ranged 18–50 years. In group I, patients were administered 2% lignocaine with

Table 2: Comparison of clinical parameters in both groups

Groups	Group I		Group II		<i>t</i>	<i>p</i> value
	Mean	SD	Mean	SD		
Onset of action (seconds)	85.2	14.2	52.6	5.8	11.2	0.02
Duration of anesthesia (minutes)	170.2	26.7	226.8	25.7	4.67	0.01
Duration of procedure (minutes)	30.4	11.5	32.6	3.67	0.871	0.81
Pain during procedure	2.75	1.04	1.42	1.23	5.12	0.01
Pain after procedure	1.41	0.78	0.82	0.75	3.16	0.03
Pain during anesthesia insertion (VAS)	1.52	1.12	1.04	0.56	0.745	0.62

Independent *t* test, significant, $p < 0.05$

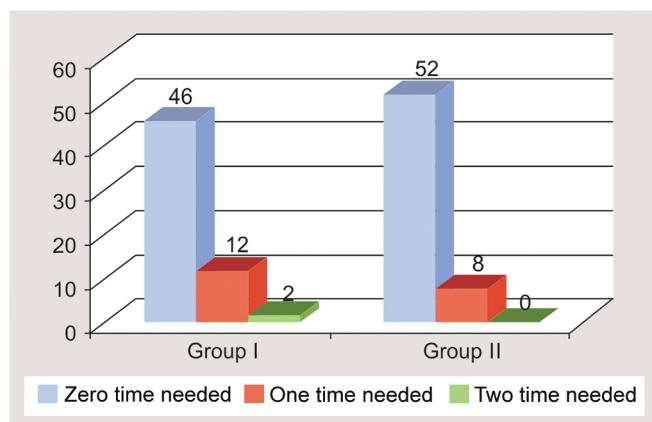


Fig. 1: Need for re-anesthesia in both groups. Chi-square test, significant, $p < 0.05$

1:50,000 epinephrine and in group II patients were administered 4% articaine with 1:100,000 epinephrine.

It is observed in our study that articaine has faster onset, longer duration of anesthesia with shorter period of pain compared to lignocaine. Lesser re-anesthesia required with articaine compared to lignocaine.

Bansal et al. studied the anesthetic efficacy of 4% articaine (1:100,000 adrenaline) over 2% lignocaine (1:80,000 adrenaline) for the extraction of maxillary premolars and they concluded that articaine has faster onset time, extensive period of action contrast to lignocaine, which is similar to our results.¹ da Silva-Junior et al. compared the efficacy of articaine over lignocaine anesthesia and observed that buccal infiltration was better and pain was less with articaine over lignocaine.² Boonsiriseth et al. compared the efficacy of 4% lidocaine and 4% articaine with epinephrine and concluded that articaine is more effective than lignocaine.³ Zhang et al. from systematic review concluded that articaine has superior anesthetic properties compared to lignocaine.⁵ All these results are in favor of our findings.

Jain and John in their study compared 4% articaine with 2% lignocaine on 70 patients requiring extraction of impacted third molar who were grouped based on the anesthesia used. There was 56.57 seconds latency with 4% articaine and with 88.26 seconds with 2% lignocaine. Pain during procedure for articaine was 1.31 and for lignocaine was 2.60; pain after procedure was 0.89 for articaine and 1.31 for lignocaine, and mean duration of anesthetic. Lignocaine group required more re-anesthesia compared to articaine group. Similar to our findings, they found that articaine was better than lignocaine.⁸

In the present study, we observed that mean onset of action in group I was 85.2 seconds and in group II was 52.6 seconds, duration of anesthesia in group I was 170.2 minutes and in group II was 226.8 minutes, duration of procedure was 30.4 minutes in group I and 32.6 minutes in group II, pain during procedure in group I was 2.75 and in group II was 1.42, pain after procedure was 1.41 in group I and 0.82 in group II, pain during anesthesia insertion was 1.52 in group I and 1.04 in group II.

Maruthingal et al. compared 4% articaine and 2% lidocaine in mandibular buccal infiltration anesthesia in 32 patients and found that articaine showed significant results in achieving pulpal anesthesia as compared to lidocaine. Lip numbness was achieved faster with articaine and difference was significant, while lingual mucosa numbness with articaine subjectively was not significant.⁹

Aakanksha et al. conducted a study on 50 patients who were divided to group I (articaine) and group II (lignocaine). The mean pain in group I was 0.95 ± 0.80 . The mean pain in group II was 1.20 ± 1.10 . The mean duration in group I was 230 ± 57.12 minutes. The mean duration in group II was 190 ± 34.21 .¹⁰

Ghosh et al. found that 4% articaine with 1:100,000 adrenaline is a better anesthetic solution. There is less bleeding, early onset, slightly longer duration of action, and comfortable to the patient.¹¹ Kulkarni and Parkar included 40 patients for the extraction of anteriors and premolars using local infiltration anesthesia of 2% lignocaine with 1:80,000 adrenaline and 2% lignocaine with 1:200,000 adrenaline dilution groups. They observed that difference in the onset of anesthesia and the duration of action of local anesthesia.¹²

Kambalimath et al. assessed the anesthetic effect of 4% articaine hydrochloride and 2% lidocaine for dental anesthesia and found that 4% articaine is better in terms of clinical performance than 2% lidocaine.¹³ Kumar et al. compared efficacy of 4% articaine over 2% lignocaine for molar extraction and concluded that efficacy of single buccal infiltration of articaine is equivalent to buccal and palatal infiltration of lignocaine.¹⁴ Saraf et al. compared effectiveness of articaine 4% and lidocaine 2% in infraorbital and middle superior nerve block and found that articaine 4% is more efficacious than lidocaine 2%.¹⁵ Rebolledo et al. from their study found better clinical performance with 4% articaine than 2% lidocaine.¹⁶

Articaine has increased liposolubility and intrinsic potency, as well as greater plasma protein binding compared to other local anesthetic agents due to different chemical structure with the replacement of the aromatic ring with a thiophenic ring, and the existence of an extra ester ring. This difference in chemical structure and higher protein binding property of articaine, clinically reflects as a shorter latency [187 seconds (± 66)] period and longer period of anesthesia, as well as better bony tissue distribution of anesthesia, compared to lignocaine [201 seconds (± 88) latency period].^{1,8} It is believed that articaine is 1.5 times more potent and lesser toxicity than lignocaine.¹ Hence, we found better results with articaine over lignocaine.

It is found from the present and previous studies that articaine is effective than 2% lidocaine for oral surgical anesthetic procedure. Further long-term studies are required to evaluate the effectiveness of articaine.

CONCLUSION

Authors suggested that articaine can be effectively used in oral surgical procedures as there is early onset on action, longer duration of anesthesia, and less need of re-anesthesia.

ETHICAL APPROVAL

Obtained from ethics committee.

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