ORIGINAL ARTICLE

A COMPARATIVE EVALUATION OF 4% ARTICAINE AND 2% LIDOCAINE IN MANDIBULAR BUCCAL INFILTRATION ANESTHESIA

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ABSTRACT

Aim: The aim of this prospective, study was to compare the anesthetic efficacy of 4% articaine HCl with 1:100,000 adrenaline in comparison with 2% lignocaine HCl with 1:80,000 adrenaline in extraction of mandibular tooth.

Materials and Methods: A total of forty patients were included in this study. The onset and duration of anesthesia, pain during injection and extraction, and requirement of rescue blocks were recorded for all patients. The values were compared and analyzed statistically.

Results: No statistical differences in induction of both soft tissue and pulpal anaesthesia among the groups. However, highly significant difference was observed in pain during administration as well as pain during operative procedure favouring articaine. Duration of anaesthesia in the post extraction period was also significantly higher with Articaine .

Conclusion: In our comparative study showed that 4% articaine had a longer duration of action and more depth of anesthesia when compared to 2% lignocaine. Hence, the pain experienced by the patients during and after the surgical procedure was significantly less.

KEY WORDS

Articaine, dental surgery, injection, lignocaine, local anesthesia

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INTRODUCTION

Lignocaine was marketed in 1948 and is up to now the most commonly used local anesthetic in dentistry worldwide. An amide solution was prepared by Rusching et al. in 1969 which was known as carticaine. When it entered clinical practice in Germany in 1976, its generic name was changed to articaine. It differed from other amides as it contains a thiophene ring with additional ester ring.[1] Articaine is able to diffuse through soft and hard tissues more reliably than other local anesthetics, and the infiltration of articaine has been claimed in terms of fast onset, excellent quality of anesthesia, and low degree of toxicity. Successful pulpal anesthesia is not always achieved in mandibular teeth following regional block anesthesia.[2,3] Labial or lingual infiltration injections with lidocaine are not effective for achieving pulpal anesthesia in mandibular teeth.[4] On the contrary, an infiltration injection of the mandibular tooth with 4% articaine with 1:100,000 epinephrine successfully achieved pulpal anesthesia in 63% of cases.[4]

MATERIALS AND METHODS

The study was conducted in the Dept. of Oral and Maxillofacial Surgery of Guru Nanak Institute of Dental Science and Research, Panihati, West Bengal under the hospital setting with necessary setup. The study population was selected from the patients attending the outpatient department of our institute. A total number of forty patients age ranging from 41 to 70 years divided into to equal groups. Patient having both occlusal and proximal carious exposure confirmed by intraoral periapical radiograph were selected . They were treated as Group I to receive both Buccal and lingual infiltration of 2% lidocaine with 1:80,000 epinephrine and the Group II to receive 4% articaine with 1:100,000 epinephrine for bilateral extraction of mandibular tooth upto premolar region.

An ethical clearance was sought from the departmental review committee, and informed written consent was obtained from each participant. Drug volume, onset of anesthesia, pain during

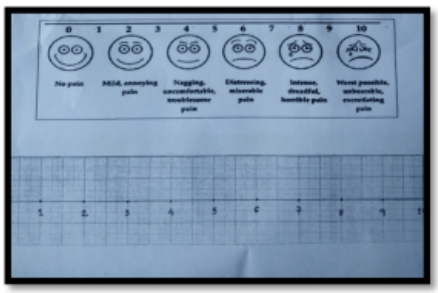
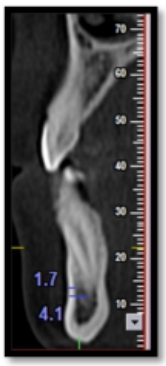
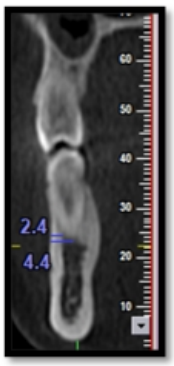


Figure 1 Visual analog scale

Figure 2 Infiltration anesthesia **Pulp Tester** **Articaine cartridge**





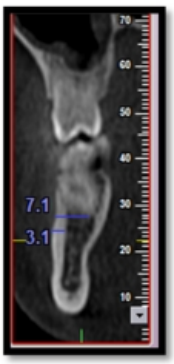


Figure 3 Canine region **Second premolar region** **First molar region**

Measurements were taken on the CBCT from the tooth apex to the facial aspect of the mandible and the thickness of the cortex at that location.

Abbreviation: CBCT, cone beam computerized tomography.

injection and extraction, were recorded for all patients. Pain was evaluated using visual analog scale (VAS).

Materials used in the study

4% Articaine HCl with 1:100000 adrenaline

2% Lignocaine HCl with 1:80000 adrenaline

Disposable syringe with 1 5/8 inch, 26 gauge needle Pulp Tester

Techniques used in administration of local anesthesia

The patients were randomly assigned for mandibular tooth extraction upto second premolar region. In local infiltration technique, 1.5 ml local anesthetic solution was injected in mucobuccal fold adjacent to mandibular tooth to be extracted and 0.2 ml injected over lingual mucosa to the adjacent tooth.

Pulp sensitivity was determined by electric pulp tester on the occlusal surface of the mandibular tooth twice before the injection, to establish a baseline reading. Similarly, the numbers of episodes of no response at the maximum stimulation were recorded. In addition to objective assessment of pulpal anesthesia, patient is asked to inform about the feeling of numbness in the lip and lingual mucosa when it appeared.

In our study we included the mandibular tooth for extraction upto second premolar region.After the premolar region the thickness of the buccal cortical plate and the distance from the buccal cortex to the tip of the root increased and it seems to be less successful anesthesia. It may be that cortical thickness or density and/or distance of the tooth apex from the facial surface of the mandible surface are factors that may prevent or lessen the anesthetic effect.

Table 1

Features	Articaine (n=20)	Lignocaine (n=20)	p Value
Mean age	57.3±9.055	55.25±8.5	0.465
Soft tissue anaesthesia	3.1±0.435	3.3±0.766	0.316
Pulpal anaesthesia	3.1±0.435	3.61±0.96	0.368
Pain during administration (VAS)	1.25±0.993	2.3±1.301	0.0067
Pain during surgery (VAS)	0.95±1.071	4.84±1.576	0.0001
Time of post operative analgesic administration (Minutes)	402±54.182	163.5±76.37	0.0001
Rescue blocks provided	0	7	0.0083

RESULT:

Among the 40 patients, 20 (50%) were male and 20 (50%) were female .

Time of onset of anesthesia

The mean onset time of soft tissue and pulpal anesthesia in articaine group was 3.1±0.435 and 3.1±0.435 and in case of lignocaine group it was 3.3±0.766 and 3.61±0.96 which is not statistically significant.

Pain ratings during injection

VAS was used to rate pain during injection. The mean injection pain rating in articaine group was 1.25±0.993, and for lignocaine, it was 2.3±1.301. Highly significant difference was observed in pain during administration favouring articaine (p=0.0067).

Pain ratings during extraction

VAS was used to rate pain during extraction. In articaine group, the mean pain score was 0.95±1.071 and 4.84±1.576 for the lignocaine group. Highly significant difference was observed in pain during operative procedure favouring articaine. (p=0.0001)

Duration of anesthesia

In articaine group, the mean duration of anesthesia was 402±54.182 min and in case of lignocaine group it was .163.5±76.37 min. Duration of anaesthesia in the post extraction period was significantly higher with Articaine than Lignocaine, which was measured in terms of time to require first analgesic agents after extraction.(p=0.0001)

Rescue blocks

There were 7 cases of failure to achieve local anaesthesia with lignociane, and rescue blocks required whereas no such was found in Articaine arm. This was also statistically significant. All those seven patients received successful rescue blocks with lignocaine later.(p=0.0083)

DISCUSSION

Articaine, a new amide local anesthetic, was introduced in 1969, and has a reputation of providing an improved local anesthetic effect.[5] The formulation is known as Septocaine (Septodont) and is available as a 4% solution with 1:100,000 epinephrine. Articaine is classified as an amide, but contains a thiophene ring instead of the benzene ring of other amide local anesthetics.[1] A second molecular difference between articaine and other amide local anesthetics is the extra ester linkage incorporated into the articaine molecule which results in hydrolysis of articaine by plasma esterases.[6]

The use of nerve blocks has several disadvantages when compared to infiltration. The rate of failures reported is approximately 15% and the incidence of adverse effects such as paresthesia, trismus, and hematoma is much greater. Moreover, treatment of only one tooth does not require anesthesia of the entire nerve branch.

Advantages of infiltration anesthesia compared to regional block

- Technically simple
- More comfortable for patients
- Provides hemostasis where it is needed
- Counters collateral supply in many cases
- Avoids damage to nerve trunks
- Less chance of intravascular injection
- Safer in patients with bleeding diatheses
- Reduced chances of needle stick injury
- Preinjection topical masks needle penetration discomfort

It was previously mentioned that both regional block anesthesia and intraligamentary anesthesia were poor in providing anesthesia of the pulps of the mandibular incisor teeth. In this region the cortex is quite thin and might provide little resistance to infiltration.

In a study by Meechanand Ledvinka,[7] the injection of 1.8 mL 2% lidocaine with 1:100,000 epinephrine provided successful anesthesia in 77% of

cases after the buccal infiltration and 97% after the split buccal/lingual dose. This study also compared for infiltration anesthesia in the anterior mandible. The success rate after articaine as a buccal injection was 94% at the lower central incisor and after the split buccal and lingual technique it was 97%. For the contralateral lateral incisor the success rates with articaine were 61% as a buccal injection and 74% after the split technique compared with 36% and 42%with lidocaine.

In a clinical study shows after the injection of 2ml of either 4% articaine or 2% lidocaine, both with epinephrine 1:100,000, a significant two-fold higher mean of articaine was observed in alveolar blood. The rationale for this "better diffusion" after injection was based on the higher descent of concentration derived from articaine.[8]

In our study, we have compared both the pulpal and Soft tissue anesthesia. To test the onset and efficacy of pulpal anesthesia, we used an electric pulp tester to measure pain. A successful outcome was recorded in the absence of pulp sensation on two consecutive maximal pulp tester stimulations; 100% of articaine and 65% of lidocaine infiltrations were successful.

The mean time of onset of pulpal anesthesia was 3.1 min for 4% articaine and 3.6 min for 2% lidocaine. In case of soft tissue anaesthesia 100% of articaine and 90% of lidocaine infiltrations were successful.We have seen there were no statistical differences in induction of both soft tissue and pulpal anaesthesia among the groups.

In the present study it was found that articaine produced shorter onset (3.1 min) greater success rate when compared to lidocaine (3.6 min) but the difference is statistically unsignificant. Reports of articaine's superiority were mainly due to its thiophene ring that enhances lipid solubility essential for penetration of the anesthetic through the lipid nerve membrane and into surrounding tissues.[8] One of the drawbacks of the use of articaine available in the Indian market is a high cost.

Another important parameter that needs to be considered is to administer the local anesthetic as painlessly as possible to create an aura of trust and comfort with the patient. Our study showed significant difference in pain scores during injection on buccal and lingual side between articaine and lignocaine group. The mean pain score for articaine was1.25±0.993 while for lignocaine 2.3±1.301 .

Depth of anesthesia interms of pain during extraction was recorded in both groups using VAS. In articaine group, the mean pain score was 0.95±1.071 and 4.84±1.576 for the lignocaine group. There was highly significant difference observed in pain during operative procedure favouring articaine (p=0.0001).

In our study duration of anaesthesia in the post extraction period was also significantly higher with Articaine than Lignocaine, which was measured in terms of time to require first analgesic agents after extraction. There were 7 cases of failure to achieve local anaesthesia with lignociane, whereas no such was found in Articaine arm. This was also statistically significant. All those seven patients received successful rescue blocks with lignocaine later.

CONCLUSION

The present study asserts that articaine has, longer duration of action, and more depth of anesthesia, so articaine infiltration is more efficacious than lignocaine upto mandibular second premolar, thus can be used as an alternative to gold standard lignocaine. Further studies are required to use an equal concentration of both solution to obtain more accurate results. Comparative clinical trial with larger sample size are desirable to evaluate the safety and clinical efficacy of articaine.

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