



Comparing the Efficacy of Articaine and Lignocaine in Maxillary Irreversible Pulpitis: A Randomized Triple Blind Study

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ABSTRACT

Introduction: Effective pain control during endodontic treatment is a mandatory component of patient care. The most commonly used anesthetic agent is lignocaine.

Aims & Objectives: The objective of this study is to compare the efficacy of Articaine and Lignocaine in maxillary irreversible pulpitis cases in terms of pain management.

Place and Duration of Study: The study was conducted in the outpatient department of Operatives Dentistry, Azra Naheed Dental College, The Superior University Lahore, Pakistan during 2023.

Material & Method: The present study is a triple-blind, randomized controlled trial in which 75 patients were selected by non-probability sampling. Patients were randomized into Group A and Group B. For both groups, the drugs were delivered using a standard aspirating syringe with a sterile single-use 27G 0.40 X 21mm disposable dental needle. For buccal vestibular local infiltration, the drug was administered at the buccal vestibule supra periosteal adjacent to the tooth to be endodontically treated at a rate of approximately 1ml. Ethical approval was taken from the IRB. Data was analyzed through SPSS version 24.

Results: A significant difference in anesthetic effect between 4% Articaine and 2% Lignocaine following an infiltration injection for maxillary first molars with irreversible pulpitis was found with a p-value of <0.001.

Conclusion: 4% Articaine is more efficacious than 2% lignocaine in irreversible pulpitis cases and can be used to produce desired analgesic effect.

Key words: Endodontics, irreversible pulpitis, efficacy

INTRODUCTION

Endodontics is a division of dentistry that addresses the etiology, diagnosis, prophylaxis, and management of illnesses affecting the dental pulp; often involves extracting pulp tissue from the pulp cavity and replacing it with an appropriate restorative substance; also referred to as pulp canal therapy or root canal therapy¹. Because pain is multifaceted, there are numerous ways to address it, either individually or in combination². No pain management strategy will work if the underlying cause of the pain is not treated. Therefore, a precise

diagnosis is essential. If the stimuli are removed, the nerve terminals won't be stimulated, which means that no impulses will be produced³. As endodontics therapy is a painful procedure so then local anesthetics agents are essential for successful endodontic procedures, and their pharmacologic properties play special role in the treatment of painful, acutely or chronically-inflamed or necrotic teeth. The dosage of local anesthetic agents must be limited to prevent toxicity, which may be enhanced by the co administration of sedative drugs or narcotic drugs which affect hepatic drug metabolism^{4,5}. Irreversible pulpitis is an endodontic emergency that requires immediate endodontic treatment since they exhibit severe, acute pain that is hard to manage with oral medications⁶⁻⁸. Data from the objective clinical examinations (palpation, percussion, examination, and probing) and x-ray investigation are used to make the diagnosis. Examining finds several serious carious flaws. The teeth's ability to function is compromised. The x-ray studies reveal no signs of periapical alterations and the emergence of carious processes close to the tooth pulp⁶. Vasoconstrictors must be used in

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conjunction with additional and conventional injection methods, such as intraosseous injections, in order to extend the duration of the local anesthetic effect⁵.

Although many endodontists focus on drugs for pain control. Several studies indicated that various clinical procedures provide significant benefit in relieving odontogenic pain to make pain free procedure. In contrast, similar cases may respond equally good to different treatments⁹.

The success rate of anesthesia also significantly impacted by pulpal status as periapical and pulpal diseases at the time of the operation¹⁰. One of the inclusion criteria for this study was the pulp status, and a tooth had to bleed when the pulp was accessible in order to be considered for the study.¹¹ According to the classification of the several pulp phases and periapical illnesses, individuals may exhibit symptomatic or asymptomatic irreversible pulpitis at presentation^{12,13}.

The teeth considered in this investigation solely had asymptomatic irreversible pulpitis. The rationale stems from the inconsistent findings of earlier studies that employed premedication with NSAIDs to assess their impact on anesthesia success¹⁴⁻¹⁶. When comparing local anesthetic solutions, a number of factors need to be taken into account. There are many ways in which the validity and quality of data from various research differ, and it can occasionally be quite difficult to identify these discrepancies. When comparing the fundamental characteristics of articaine and lidocaine medications, start with the former. Relatively few notable variations exist. One fundamental distinction is that, unlike lidocaine, which has a benzene ring, articaine has a thiophene ring¹⁷. A substantial amount of studies have been done recently to compare the effectiveness of 4% articaine with 2% lidocaine. Comparing the efficacy of these two anesthetics in difficult scenarios, including their capacity to anaesthetize maxillary teeth with permanent pulpitis, is a popular research issue. Contradictory results have been found in several trials comparing the effectiveness of 4% articaine and 2% lidocaine¹⁸⁻²⁰. According to one such study, the anesthetic success rate of 4% articaine was 1.59 to 3.76 times increase than that of 2% lidocaine, and it was 3.81 times higher when administered as an infiltration. Similarly, when administered as a maxillary buccal infiltration to patients with irreversible pulpitis, 4% articaine with 1:100,000 epinephrine proved to be more effective than 2% lidocaine with 1:100,000 epinephrine in a different trial²¹.

In other research, the effectiveness of 2% lidocaine (1:100,000) and 4% articaine (1:100,000) in producing anesthesia in maxillary teeth with irreversible pulpitis was found to be similar. According to a study by Jason Kung, articaine was more successful than lidocaine in achieving anesthesia for combined studies (2.21; 95% CI, 1.41–3.47; P = .0006; I2 = 40%)²².

Articaine was substantially more effective than lidocaine when administered as a supplemental infiltration next to the successful mandibular block anesthesia (3.55; 95%, 1.97–6.39; P < .0001; I2 = 9%)²³. As an alternative, research on the use of articaine anesthetic during endodontic treatments in maxillary posterior teeth has demonstrated its superiority over lignocaine²⁴.

Therefore present study aimed to evaluate the anesthetic efficacy of 4 % lidocaine versus 2 % articaine buccal infiltration when it came to maxillary teeth with irreversible pulpitis. The objective of the present research was to compare efficacy of 4% articaine and 2% lignocaine in maxillary irreversible pulpitis cases in terms of pain management.

MATERIAL AND METHODS

The present study is a randomized controlled trial in which 75 patients were selected by non-probability sampling. The study was conducted in the outpatient department of Operatives Dentistry, Azra Naheed Dental College, The Superior University Lahore, Pakistan. Six months after Ethical approval (ANDC/RAC/2023/17). Sample size calculated from WINPEPI ver:11.15, with a significance level of 5%, Power of study 80%, assumed proportion in Group A (articaine injection)100% and assumed proportion in Group B (Lidocaine injection) 80%²³. Patients were divided into Group A and Group B. For both groups, the drugs were delivered using a standard aspirating syringe (Aspirating Dental Syringe) with sterile single-use 27G 0.40 X 21mm disposable dental needle (Septojet, Septodont Saint-Maur-des-Fossés, France). For buccal vestibular local infiltration, the drug was administered at the buccal vestibule supra periosteal adjacent to the tooth to be endodontically treated at a rate of approximately 1ml/min. Inclusion criteria was maxillary first molar teeth patients with age range male and female 25-45 years and diagnosed with symptomatic irreversible pulpitis (clinically, radiographically and with sensibility tests by an expert endodontist). Exclusion criteria was any contraindication to local anesthesia, e.g. known allergy, any local acute infection (diagnosed

clinically, radiographically by an expert endodontist), Periapical abscess diagnosed clinically and radiographically by an expert endodontist) and Necrotic tooth (diagnosed clinically and radiographically by an expert endodontist)

Data collection procedure:

The study has been approved from IRB (ANDC/RAC/2023/17) of the hospital. Every patient who agreed to take part in the trial gave written, informed consent. Sociodemographic information and symptoms were noted, patients were checked for symptoms, and pertinent tests (radiograms and sensitivity tests) were performed. By using a straightforward coin toss approach, two groups, A and B, were randomly assigned to the patients. By taking the medication labels off of the cartridges and encoding one drug as drug A and the other as drug B, the study was triple blinded. The kind of anesthetic used during the procedure was kept a secret from the patients, the investigator, and the statistical analyzer. Standard aspirating syringes (Aspirating Dental Syringes) with sterile, single-use 27G 0.40 X 21mm disposable dental needles were used to administer the medication to both groups (Septojet, Septodont Saint-Maur-des-Fossés, France). The medication was injected at the buccal vestibule supra periosteal near the neighboring tooth for buccal vestibular local infiltration at a rate of about 1 ml/min for endodontic treatment. Following a five-minute wait for each group an electric pulp test was carried out with electric pulp tester usage (Sybron Endo The Kerr Vitality Scanner 2006). If the patient had outward indications of pain (such as eye blinking or altered facial expressions), the test was considered affirmative. If these indicators were absent, the test was deemed negative. In the event that the test was positive, additionally, intra-ligamentary 0.2–0.4 ml of the same regional anesthesia was given. Two minutes later, the exam was administered once more. Until an unfavorable outcome was obtained, this process was repeated. When the electric pulp tester values were greater than 80 without causing pain, we deemed the pulpal anesthesia to be effective.

During endodontic therapy, the Standard Visual Analogue Score (VAS) was done to evaluate the subjective amount of pain after surgery. It was scored 10-centimeter scale, # The patient was asked to select the number that most accurately described their level of pain throughout the procedure. During this whole procedure, patient’s comfort was adequately taken care of. A female dental surgery

assistant was present at chairside for young female patients.

Data analysis procedure:

Data was entered and analyzed by using SPSS version 23. For descriptive analysis mean and standard deviation were reported for age and individual pain score and standard deviation of VAS values were calculated for both drug A and B. Efficacy and gender were presented as frequency and percentage. Efficacy in both groups was compared by chi-square. The data was stratified for age, gender, baseline pain score and educational status. Post-stratification chi-square test was applied taking p-value < 0.05 as significant.

RESULTS

Although a patient from the lidocaine group was eliminated because partial necrotization of the pulp was observed following pulp exposure, patients in the articaine and lidocaine groups were not excluded because the pulp was not exposed. Following the administration of anesthesia, none of the patients experienced any negative effects.

There were 14.67% of participants fall in age range 18-25, 29.33% who fall in age range 26-33, 38.67% fall in the age range 34-42, and 17.33% fall in the age range 43-50. (Figure-1)

Figure 1: Age-Wise Information of Participants

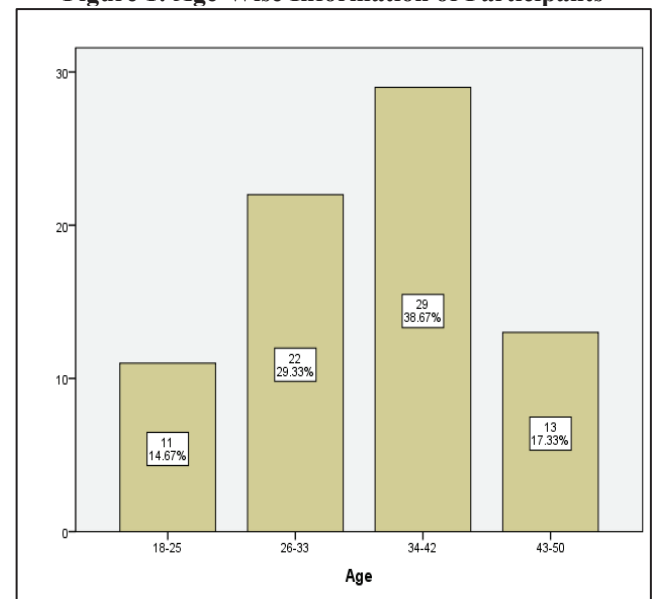
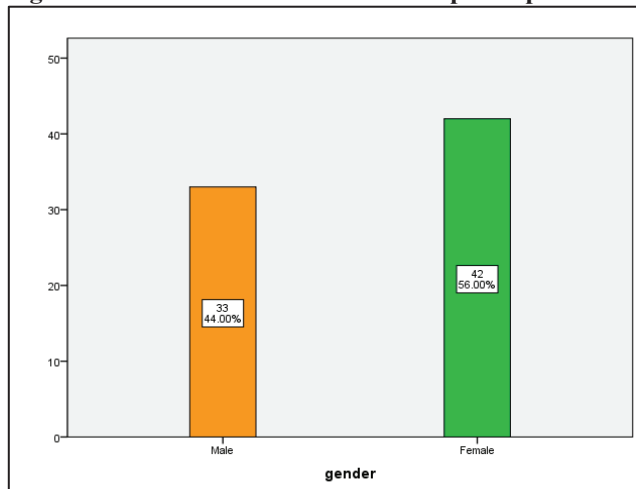


Table # 1: Mean age of participants

| Drug | N | Mean | Std. Deviation | Std. Error Mean |
|-------------|----|---------|----------------|-----------------|
| Group A age | 40 | 36.5250 | 7.85440 | 1.24189 |
| Group B age | 35 | 32.5714 | 7.78492 | 1.31589 |

Figure# 2: Gender wise information of participants



There were 44% male patients and 56% female patients participated in the study. (Figure-2)

Table-2: Pain status during Per Operatively

| Drug | Per OP | | | P-value |
|--------------|---------|---------------------|------------------------|---------|
| | No Pain | Moderate pain (1-5) | Unbearable pain (6-10) | |
| Drug A | 2 | 34 | 4 | <0.001 |
| Drug B | 22 | 13 | 0 | |
| Total | 75 | 24 | 47 | 4 |

As p-value is greater than 0.05 which indicated that no specific age range defined for getting severe or moderate pain. (Table-2). No statistical articaine was found between age and severity of pain.

Table-3 Comparing Efficacy of Drug A and B per Operatively

| Drug Efficacy Crosstabulation | | | | |
|-------------------------------|----------|-----|-------|---------|
| | Efficacy | | Total | P-value |
| | No | Yes | | |
| Lignocaine | 38 | 2 | 40 | <0.001 |
| Articaine | 13 | 22 | 35 | |
| Total | 51 | 24 | 75 | |

Articaine showed better per operative control in maxillary irreversible pulpitis cases. Absence of pain per operatively is defined as efficacy of the drug. The less the pain with the drug the more the efficacy it holds.

DISCUSSION

The current study's findings demonstrated a significant difference (>0.05) in anesthetic success between 4% articaine and 2% lidocaine after an infiltration injection for upper first molars having Irreversible pulpitis. When evaluating the effectiveness of anesthesia, the moment the anesthesia takes effect is crucial. Infiltration

injection and inferior alveolar nerve block have variable anesthetic onset times.^{3,21} After anesthesia is administered, maxillary teeth often experience anesthesia within five to seven minutes^{18,25,26}.

To test the injection's efficacy, an electric pulp test was thus conducted in the current study five minutes after anesthesia was administered. Theoretically, the needle should make a deep enough incision in the buccal tissues to position the anesthetic medicine as close to the root apex as is practicable in order to maximize the success of the anesthetic injection into maxillary molars. This method can be used with teeth that have a single root very easily²⁷. There have been studies suggesting that a single buccal infusion may not be sufficient to produce anesthesia of the palatal roots of maxillary molars^{28,29}.

It has been reported that a single buccal infusion may not be sufficient to produce anesthesia of the palatal roots of maxillary molars. Numerous studies have been conducted to assess the effectiveness of anesthesia for maxillary molars^{24,26,30}. Only one buccal injection of the evaluated anesthetic drugs was employed in the current investigation due to the pain and discomfort that patients experience from palatal injection. According to past research discernible change in buccal infiltration effectiveness alone versus buccal plus palatal injections in earlier studies³¹.

This study's findings differed from two other meta-analyses that evaluated the effectiveness of lidocaine and articaine after infiltration injection. These meta-analyses, however, contained two significant flaws. First off, these analyses merged information from research on the anesthesia of normal pulps and irreversible pulpitis. It also been stated that teeth with irreversible pulpitis have a significantly increase anesthesia chance failure, than teeth with healthy pulps. Second, both meta-analyses included studies using articaine for injections used for mandibular and maxillary infiltration.

Furthermore, the current study's findings corroborated those of two prior studies that found no discernible variance in effectiveness of articaine and lidocaine for maxillary first molars anesthesia in irreversible pulpitis¹⁸. When NSAIDs were employed as a premedication, Previous research yielded inconsistent results about the effectiveness of pulpal anesthesia in individuals with and without pain that comes on its own^{14,34}.

Limitations and implication of study:

With qualities similar to other widely used local anesthetics, articaine is a safe and efficient medication that can be used as an anesthetic in patients of all ages. Consequently, it may be concluded that the

option to use articaine will depend more on the preferences of specific physicians than on any solid proof that it is better than other LA medications.

Anesthesia administered is highly dependent on the expertise and experience of the operator³⁵. Moreover, the difficulties linked to anesthesia are greater than those related with buccal infiltration. Given that buccal infiltration is the preferable method for first molars, it is best to investigate its superiority across racial groups as success may change depending on racial differences in bone density and porosity.

CONCLUSION

It is concluded that the efficacy of anesthesia with lidocaine and articaine in terms of pain management was significant different. With qualities similar to other widely used local anesthetics, articaine is a safe and efficient medication that can be used as an anesthetic in patients of all ages. Consequently, it may be concluded that the option to use articaine will depend more on the preferences of specific physicians than on any solid proof that it is better than other LA medications.

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