ORIGINAL RESEARCH

To Compare the Efficacy of Preoperative Oral Medication of Ibuprofen and Ketorolac on Anesthetic Efficacy of Maxillary Buccal Infiltration Using Buffered 2% Lidocaine with 1:100,000 Adrenaline with Irreversible Symptomatic Pulpitis: A Prospective Clinical Study

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Received on: 20 October 2023; *Accepted on:* 15 January 2024; *Published on:* XX XXXX XX

Abstract

Aim: To assess the effects of ibuprofen and ketorolac, two preoperative oral medications on the effectiveness of anesthesia for maxillary buccal infiltration with buffered 2% lidocaine and 1:100,000 adrenaline in patients with irreversible symptomatic pulpitis.

Materials and methods: In the endodontics and conservative dentistry department, a prospective clinical trial was conducted. About 45 participants participated in the trial and were divided into three groups. The patients were divided into three groups at random and given one of three drugs, including ibuprofen, ketorolac, and placebo, an hour before local anesthesia. All patients received a maximal buccal infiltration of buffered 2% lidocaine with 1:200,000 epinephrine. After 15 minutes of administration of maxillary buccal infiltration, endodontic access preparation was started. Pain felt during therapy was noted using a Heft Parker visual analogue scale. Success was deemed to be the absence of pain or only mild discomfort.

Results: A nonparametric c2 test statistical analysis revealed that the placebo had a 30% success rate. Ibuprofen premedication had a success rate of 32.5%, while ketorolac premedication had a success rate of 37.5%. The three groups did not significantly differ from one another.

Conclusion: Ibuprofen or ketorolac preoperative administration has no appreciable impact on the success rate of maxillary buccal infiltration in patients with irreversible pulpitis.

Keywords: Buffered lidocaine, Maxillary buccal infiltration, Sodium bicarbonate.

Dental Journal of Advance Studies (2024): 10.5005/djas-11014-0031

Introduction

Adequate endodontic therapy is dependent on adequate pain control. The complicated phenomena of pain is impacted by a number of biological and psychological elements. From a biological perspective, pain is a multidimensional phenomenon that begins with the detection of stimuli by peripheral nerves. The sensations are subsequently processed by the medullary spinal cord, and higher brain areas like the cerebral cortex perceive them as pain. Both endogenous and external factors may have an impact on this process, changing how painful stimuli are perceived.[1]

The management of pain during endodontic treatments is crucially dependent on local anesthesia. However, it can be difficult to achieve sufficient anesthesia in teeth with symptomatic irreversible pulpitis. Even after showing clinical indicators of analgesia with maxillary buccal infiltration anesthesia, many patients still experience pain during endodontic treatment.[2]

Because they contribute to neuronal hypersensitivity which plays an important role in inflammatory conditions.[3] Nonsteroidal anti-inflammatory medicines (NSAIDs) have been shown to reduce inflammation at different stages of the inflammatory process by inhibiting the cyclooxygenase enzyme that makes prostaglandins, which cause inflammation.[4]

Lidocaine is the maximum utilized local anesthetic in dentistry among all amides and esters.[4] In comparison to other local anesthetics in the market, it is quite effective and has a low systemic toxicity.[5] However, in order to extend their shelf life, local anesthetic solutions are frequently made with a low pH. This low pH can cause a burning sensation at the injection site and a delayed onset of anesthesia, decreasing their clinical efficacy.[6–8]

To address these issues, buffering agents such as sodium bicarbonate are added to local anesthetic solutions in various concentrations. These buffering substances aid in alkalinizing the

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How to cite this article: Menrai N, Makkar S, Gupta S, *et al*. To Compare the Efficacy of Preoperative Oral Medication of Ibuprofen and Ketorolac on Anesthetic Efficacy of Maxillary Buccal Infiltration Using Buffered 2% Lidocaine with 1:100,000 Adrenaline with Irreversible Symptomatic Pulpitis: A Prospective Clinical Study. Dent J Adv Stud 2024;xx(x):xx–xx.

Source of support: Nil

Conflict of interest: None

solution and reducing the negative effects of the local anesthetic solution's acidic pH.[9] By speeding up the local anesthetic molecule's rate of dissociation, buffering the local anesthetic solutions help patients experience better pain management. This enhances the availability of the anesthetic's uncharged base form, which can pass through the nerve membrane and act at the intraneuronal location.[10–11]

Gupta et al.'s 2013 study[12] established the validity of the sodium bicarbonate addition to local anesthetics. The study came to the conclusion that adding sodium bicarbonate to local anesthetic solutions causes these solutions' pH values to rise, increasing the local anesthetic's effectiveness in an acidic environment.

Prior research[4–7] examined the impact of NSAID premedication on the effectiveness of IANB anesthesia. However, these investigations concentrated on situations in which irreversible pulpitis-related inflammation was treated with local anesthesia elsewhere. Because local anesthesia is applied to the periapical region of the tooth with irreversible pulpitis during maxillary infiltration anesthesia, additional research is required to assess the efficiency of premedication with NSAIDs. This prospective, randomized, clinical trial aims to evaluate and compare the efficacy of oral premedication with ibuprofen, ketorolac, and placebo in enhancing the outcome of maxillary infiltration anesthesia in patients with irreversible pulpitis.

Materials and Methods

The Department of Conservative Dentistry and Endodontics carried out this prospective clinical investigation. In this study, 45 patients who needed root canal therapy were enrolled. Exclusion from the study criteria included being pregnant, under the age of 18, unable to give informed consent, allergic to local anesthetics or sulfites, taking any medications that could affect the anesthetic assessment, and having a history of serious medical conditions.

The patients were randomized into three groups based on the type of premedication administered:

1. Group I ($n = 15$): Ibuprofen group
2. Group II ($n = 15$): Ketorolac group
3. Group III ($n = 15$): Placebo group

To prevent patients from learning that they were taking placebo or NSAIDs, the capsules were made to look identical in size, color, and form. By requesting the patient to place a mark on the 170 mm long line of the Heft Parker visual analogue scale (VAS), the preoperative pain score was recorded. An electric pulp tester (EPT) was used to examine the pulp's responsiveness. Four categories were used to categorize the scale. No pain was equal to 0 mm, faint, weak, or mild pain was equal to 1–54 mm; moderate-to-severe pain was equal to 55–114 mm, and the strongest, most intense pain was equal to more than 114 mm.[7] The patient receives one of the medications from group A, group B, or group C orally depending on the group that was randomly assigned to them. Before starting treatment, the patient was asked to wait for an hour.

A buffered lidocaine solution preparation was completed chairside. Using an insulin syringe (Dispo Van, HMD, Haryana), 0.2 mL of 8.4% sodium bicarbonate (Sodac, Neon, Rudrapur, Uttarakhand) was drawn under sterile conditions from a 2 mL cartridge of buffered 2% lidocaine with 1:100,000 epinephrine solution. After inverting the cartridge five times to mix the solution, there was no precipitation.

Using a 26-gauge needle and buffered 2% lidocaine in a 1:80,000 concentration, 1.5 mL of buccal infiltration was delivered. Numbness was assessed after 5 minutes. The EPT values were obtained at 2, 6, 10, and 15 minutes. And patients who failed to experience numbness as a result of a procedural error were to be excluded from the trial. With the use of a rubber dam, numbing and isolation were achieved before the preparation of the access cavity began. The patients used a VAS to assess their level of pain. A successful anesthetic is defined as having no or mild pain.

Statistical Analysis

For the statistical analysis, statistical package for the social sciences (SPSS, SPSS Inc., v.16) was utilized. The mean and standard deviation were used to produce descriptive statistics for continuous data, and frequency and percentage were used to calculate them for categorical data. The data were tested for normality using the Shapiro–Wilk test before analysis, and the findings indicated that they were ($p > 0.05$). To compare the EPT scores at different time points, Tukey's *post hoc* test for multiple comparisons and ANOVA were used. The VAS ratings and anesthesia data were compared using the Chi-square test. Less than 0.05 was designated as the *p*-value criterion for the current study's level of significance.

Results

The EPT values were noted following the injection of local anesthesia. Following the application of local anesthesia, the VAS scale rating was also noted.

EPT at 2 Minutes

The analysis demonstrated that the differences in EPT scores were not statistically significant in the three study groups at 2 minutes ($p = 0.367$).

EPT at 6 Minutes

The analysis demonstrated that the differences in EPT scores were not statistically significant in the three study groups at 6 minutes ($p = 0.086$).

EPT at 10 Minutes

The analysis presented that there was a statistically significant difference in EPT scores in the three study groups at 10 minutes ($p = 0.044$).

Multiple comparisons showed that the statistically significant difference in EPT score at 10 minutes was detected between placebo group and ketorolac group ($p = 0.035$). Other differences were not statistically significant ($p > 0.05$).

EPT at 15 Minutes

The analysis exhibited that significant difference was not there in EPT scores in the three study groups at 15 minutes ($p = 0.164$).

Table 1 shows the EPT readings of all the three groups at 2, 6, 10, and 15 minutes.

Visual Analogue Scale (VAS) Scores

The comparison of VAS observations is given in Table 2. The analysis presented that statistically significant difference was not there in VAS scores among the three study groups ($p = 0.320$).

Outcome

The comparison of outcome is given in Table 3. The analysis demonstrated that the differences in the outcome of anesthesia were not statistically significant in the three study groups ($p = 0.207$).

Table 1: EPT readings at 2, 6, 10, and 15 minutes

Premedication	*Mean value of EPT at 2 min*	*Mean value of EPT at 6 min*	*Mean value of EPT at 10 min*	*Mean value of EPT at 15 min*
Ketorol	11.33	35.20	63.26	74.53
Ibuprofen	11.20	36.40	58.00	72.66
Placebo	9.8	28.93	51.33	68.13

Table 2: VAS readings

	Group			
	Placebo	*ketorol*	*Ibuprofen*	*Total*
VAS				
None				
Count	8	13	10	31
%	25.8%	41.9%	32.3%	100.0%
Mild				
Count	4	2	3	9
%	44.4%	22.2%	33.3%	100.0%
Moderate				
Count	3	0	2	5
%	60.0%	0.0%	40.0%	100.0%
Total				
Count	15	15	15	45
%	33.3%	33.3%	33.3%	100.0%

Pearson Chi-square = 4.692, $p = 0.320$

Table 3: Outcome of all the three groups

	Group			
	Placebo	*Ketorol*	*Ibuprofen*	*Total*
Outcome				
Success				
Count	12	15	13	40
% within outcome	30.0%	37.5%	32.5%	100.0%
Failure				
Count	3	0	2	5
% within outcome	60.0%	0.0%	40.0%	100.0%
Total				
Count	15	15	15	45
% within outcome	33.3%	33.3%	33.3%	100.0%

Pearson Chi-square = 3.150, $p = 0.207$

Discussion

In endodontics, local anesthesia is the primary technique utilized to relieve pain. Local anesthetics alleviate pain through lowering the frequency of nerve impulses that travel to the brain by limiting the permeability of sodium channels in peripheral nerves.[13] The most crucial elements that have a significant impact on the effectiveness of anesthesia are the type of anesthesia used and the injection techniques. Local anesthetics have been gradually developed in recent years. Since they are both more effective and have significantly lower systemic toxicity than other local anesthetics on the market, lidocaine and articaine are the amides and esters that are most frequently used in dentistry.[14] The short duration of anesthesia, low anesthetic efficiency, and side effects are just a few of the drawbacks that all local anesthetics have.[15]

The pH of the solution determines when anesthesia starts to work and how well it works. The availability of deionized anesthetics is reduced by the acidic pH.[16,17] In order to raise the pH of the solution, sodium bicarbonate, an alkalinizing agent, is added.[18] This increases the uncharged molecule availability of the anesthetic solution, allowing it to penetrate the lipid bilayer and enter the axoplasm of neurons sooner and be more effective.[19,20]

The majority of earlier research has concentrated on the effectiveness of buffered lidocaine or articaine nerve blocks in the mandibular region; however, no comparison study has assessed the outcomes of local anesthetic solution in the cases of maxillary buccal infiltration.

Bicarbonate-buffered lidocaine has been shown by Thompson et al.[21] to boost its bactericidal properties. In a study conducted in 2011, Kashyap et al.[22] found that using buffered anesthetics for intraoral nerve blocks and infiltrations resulted in less pain during injection and a quicker onset of discomfort.

On the other hand, 2% lidocaine and 1:100,000 epinephrine buffered with 5 or 10% sodium bicarbonate did not vary from non-buffered solutions in the onset of anesthesia or the pain of injection in canine maxillary infiltrations, according to Hobeich et al.[17]

Additionally, numerous studies have shown the benefit of administering premedication before local anesthesia. Nonsteroidal anti-inflammatory drugs are the analgesic medicines that are most frequently used as premedication in dentistry. They function by preventing the activity of the cyclooxygenase enzyme, which lowers the production of prostaglandins from the arachidonic acid pathway. Ibuprofen has been specifically chosen because research on the impact of premedication with NSAIDs have either used it as a standalone medication or have compared it with other drugs. Premedicating people with spontaneous pain, according to Parirokh et al.[23] is ineffective because the prostaglandins, which cause the establishment of TTX-resistant receptors and anesthetic failure, have already been produced.

In this study, we contrasted the premedication of maxillary teeth with symptomatic irreversible pulpitis with either ketorolac or ibuprofen. According to the findings of our study, no statistically significant distinction could be found between the EPT readings for the groups receiving ibuprofen and ketorolac at 2, 6, and 15 minutes. Additionally, the VAS scale comparison showed no statistically significant difference between ibuprofen group and the ketorolac group in terms of analgesic impact.

Conclusion

The chance of successful maxillary infiltration anesthesia in patients with irreversible pulpitis is not significantly increased by oral premedication with 400 mg of ibuprofen and 10 mg of ketorolac.

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