# Comparison of Preoperative Oral Ketorolac on Anesthetic Efficacy of Inferior Alveolar Nerve Block and Buccal and Lingual Infiltration with Articaine and Lidocaine in Patients with Irreversible Pulpitis: A Prospective, Randomized, Controlled, Double-blind Study

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## Abstract

**Introduction:** Irreversible pulpitis (IP) commonly results in decreased anesthetic efficacy of the inferior alveolar nerve block (IANB) for mandibular molar. It has been shown that supplementary buccal and/or lingual infiltration as well as premedication with ketorolac result in improved efficacy of the IANB. **Methods:** One hundred fifty emergency patients who had their lower first or/and second molar diagnosed with IP participated in the study. All patients were randomly divided into 2 major IANB groups: 1 group received 4% articaine with 1:100,000 epinephrine, and the other group received 2% lidocaine with 1:80,000 epinephrine. Each group was further divided into 3 subgroups of 25 each: (1) buccal and lingual infiltration with articaine and lidocaine, respectively; (2) preoperative oral medication of ketorolac; and (3) preoperative oral medication of ketorolac followed by buccal and lingual infiltration with articaine and lidocaine, respectively. Endodontic access was initiated 15 minutes after solution deposition, and all patients were required to have profound lip numbness. Success of the anesthetic was defined as none or mild pain on endodontic access and initial instrumentation. **Results:** Statistical analysis was performed using multiple-comparison analysis of variance (Kruskal-Wallis) and *t* tests. Articaine IANB with infiltrations plus oral ketorolac premedication significantly increased the success rate to 76%. The success rate after the administration of an articaine IANB with infiltration injections was 64%, whereas with lidocaine it was 32% ($P < .05$). **Conclusions:** Premedication with ketorolac significantly increases the anesthetic efficacy of articaine IANB plus infiltration in mandibular molars with IP. *(J Endod 2015;41:1773–1777)*

## Key Words

Articaine, inferior alveolar nerve block, irreversible pulpitis, ketorolac, lidocaine

It is often difficult to anesthetize teeth with irreversible pulpitis (IP) (1). Various clinical trials have studied anesthetic success in teeth with IP (1–18). In healthy mandibular molars, a supplemental buccal infiltration (BI) with 4% articaine after an inferior alveolar nerve block (IANB) increased pulpal anesthetic success (19, 20). Supplementing a failed IANB with BI of 4% articaine raises the anesthetic success of mandibular molars with IP (5, 6).

Many researchers have identified inflammation as an important component in the pathogenesis of hyperalgesia and failure of local anesthesia (15–21). During endodontic procedures, oral premedication with nonsteroidal anti-inflammatory drugs (NSAIDs) resulted in an increased success rate (39%) of IANBs in teeth with IP because NSAIDs reduce nociceptor activation by decreasing the levels of inflammatory mediators (22). The primary purpose of this prospective randomized, controlled, double-blind study was the comparison of preoperative oral medication (ie, ketorolac) on anesthetic efficacy of IANBs and buccal and lingual infiltration (LI) with articaine and lidocaine in patients with IP. To the best of our knowledge, no previous study has compared an articaine and lidocaine IANB with BI and LI and oral premedication with ketorolac.

## Materials and Methods

One hundred fifty adult patients from P.D.M Dental College and Research Institute, Haryana, India, participated in this study. The patients' age, sex, tooth type, and initial pain were not significantly different between groups at the start of the study; therefore, the effect of these variables on the results was expected to be minimal. The patients were in good health with no previous history of allergy to any kind of local anesthesia, sulfites, or other drugs, and none were taking any medication that would alter pain perception. The ethics committee of the institution approved the protocol for the study. Informed written consent was obtained from each patient. Preoperative radiographs were obtained.

Inclusion criteria for the study were active pain in a mandibular first or/and second molar, prolonged response to cold testing with Endo-frost (Roeko,

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0099-2399/$ - see front matter



http://dx.doi.org/10.1016/j.joen.2015.06.008

Langenau, Germany), absence of any periapical radiolucency on periapical radiographs, and a vital coronal pulp on access opening. Before initiating the treatment, the patients were asked to rate their pain on a Heft-Parker visual analog scale (HP VAS). An HP VAS with a 170-mm line marked with various terms describing the levels of pain was used (22). The millimeter marks were removed from the scale, and the scale was divided into 4 categories: "no pain" corresponded to 0 mm; "faint, weak, or mild" pain corresponded to 0–54 mm; "moderate" pain corresponded to 55–114 mm; and "strong, intense, and maximum possible" pain corresponded to greater than 114 mm (3). All patients were randomly divided into 2 major groups: the first group of 75 patients received standard IANB injections using 1.8 mL 4% articaine with 1:100,000 epinephrine, and the second group of 75 patients received 1.8 mL 2% lidocaine with 1:80,000 epinephrine (Septodont, Saint-Maur-des-Fosses Cedex, France). The anesthetic solution was injected by the first author using self-aspirating syringes (Septodont) and 27-G long needles (Septoject, Septodont). They were further divided into 3 subgroups of 25 patients each receiving the following:

1. 0.9 mL BI and 0.9 mL LI with either articaine or lidocaine
2. Preoperative oral medication of ketorolac (10 mg)
3. Preoperative oral medication of ketorolac (10 mg) followed by BI and LI (0.9 mL each) with either articaine or lidocaine

The labels of the solutions were removed, and unique 3-digit numeric values were coded on them; the results were recorded according to those values only.

After 15 minutes of the initial IANB, each patient was asked if his or her lip was numb. If profound lip numbness was not recorded within 15 minutes, the block was considered unsuccessful, and the patients were excluded from the study. If lip numbness was recorded, the patients were further given BI and LI. When the full lip numbness appeared, the involved teeth were isolated with a rubber dam, and a conventional access opening was initiated. Patients were instructed to raise their hand if any pain was felt during the procedure. In case of pain during the treatment, the procedure was stopped, and patients were asked to rate the pain on the HP VAS. The extent of access preparation and/or instrumentation was recorded as "within pulpal space" and "instrumentation of canals." The success was defined as "no pain" or "weak/mild" pain during endodontic access preparation or instrumentation (2). The findings were recorded for statistical analysis. Multiple-comparison analysis of variance (Kruskal-Wallis) and $t$ tests were used to determine significant differences at $P < .05$.

## Results

One hundred sixty adult patients, 72 women and 78 men, aged 20–35 years who reported with IP were selected for the prospective, randomized, double-blind study.

Table 1 shows the distribution of the study population on the basis of sex, mean age, HP VAS pain score, and tooth type. There was no significant difference in age, sex, or initial HP VAS score between the groups.

Success rates and group characteristics of the overall and randomized IANB, supplemental BI and LI, and ketorolac groups are presented in Table 2.

An articaine IANB and infiltrations with ketorolac (group E) had a highly significant success rate of 76% compared with 48%, 40%, and 32% with an articaine IANB and ketorolac (group D), a lidocaine IANB and ketorolac (group A), and a lidocaine IANB and infiltrations (group C), respectively. We also found a significantly higher success rate of 64% with an articaine IANB and infiltrations (group F) compared with 32% with a lidocaine IANB and infiltrations (group C) (Table 3). A lidocaine IANB with keterolac (group A) and lidocaine IANB with infiltration and keterolac (group B) were found to be significantly more effective on first molars compared with second molars ($P < .05$) (Table 2).

Ketorolac premedication followed by an articaine IANB and infiltrations had a higher success rate compared with ketorolac premedication followed by a lidocaine IANB and infiltrations of 76% and 56%, respectively, but the result was statistically not significant. There were no significant differences detected between men and women regarding the success rate of 2 anesthetics ($P < .05$). None of the techniques of anesthesia and their combinations gave a 100% success rate.

## Discussion

Our investigation aimed to determine the best anesthetic (articaine/lidocaine and IANB/infiltration) combination with or without ketorolac premedication in symptomatic mandibular molars. The mean initial pain rating was not significantly different for patients in both groups. All the patients presented with symptomatic IP for emergency

**TABLE 1.** Patient/Tooth Characteristics in the Groups

| | Lidocaine ($n$ = 75) | | | Articaine ($n$ = 75) | | |
|---|---|---|---|---|---|---|
| | Group A ($n$ = 25) | Group B ($n$ = 25) | Group C ($n$ = 25) | Group D ($n$ = 25) | Group E ($n$ = 25) | Group F ($n$ = 25) |
| Age, mean ± SD | 30 ± 7.6 | 28.9 ± 7.8 | 31.6 ± 9.5 | 28.2 ± 6.1 | 28.8 ± 6.7 | 30 ± 7.9 |
| Sex | | | | | | |
| Female, $n$ (%) | 13 (52) | 13 (52) | 12 (48) | 12 (48) | 11 (44) | 11 (44) |
| Male, $n$ (%) | 12 (48) | 12 (48) | 13 (52) | 13 (52) | 14 (56) | 14 (56) |
| Tooth type | | | | | | |
| First molar, $n$ (%) | 15 (60) | 14 (56) | 13 (52) | 14 (56) | 14 (56) | 13 (52) |
| Second molar, $n$ (%) | 10 (40) | 11 (44) | 12 (48) | 11 (44) | 11 (44) | 12 (48) |
| Mean initial VAS score ± SD | | | | | | |
| Total (mean VAS) | 118 ± 13 | 116.5 ± 11.5 | 117.7 ± 12 | 116.8 ± 14.2 | 124.2 ± 12.8 | 121 ± 10 |
| Sex (mean VAS) | | | | | | |
| Female | 114.9 ± 10 | 115.6 ± 12.7 | 112.5 ± 10.9 | 115 ± 14 | 119 ± 14 | 121.4 ± 11 |
| Male | 119.7 ± 15.1 | 117.5 ± 10.4 | 122.5 ± 11.5 | 118.4 ± 14.7 | 128 ± 10 | 121 ± 9.6 |
| Tooth type (mean VAS) | | | | | | |
| First molar | 117 ± 12.3 | 112.4 ± 10.4 | 116.5 ± 12.2 | 116 ± 13.5 | 123.5 ± 10.9 | 123.5 ± 9.2 |
| Second molar | 119.7 ± 15.1 | 121.8 ± 11 | 118.3 ± 12.5 | 117.7 ± 15.7 | 124 ± 12.3 | 119 ± 10 |

SD, standard deviation; VAS, visual analog scale.