Articaine for Supplemental Buccal Mandibular Infiltration Anesthesia in Patients with Irreversible Pulpitis When the Inferior Alveolar Nerve Block Fails

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Abstract

The purpose of this prospective study was to determine the anesthetic efficacy of the supplemental buccal infiltration injection of a cartridge of 4% articaine with 1:100,000 epinephrine in mandibular posterior teeth diagnosed with irreversible pulpitis when the conventional inferior alveolar nerve (IAN) block failed. Fifty-five emergency patients, diagnosed with irreversible pulpitis of a mandibular posterior tooth, received an IAN block and had moderate to severe pain on endodontic access. An infiltration of a cartridge of 4% articaine with 1:100,000 epinephrine was administered buccal to the tooth requiring endodontic treatment. Success of the infiltration injection was defined as no pain or mild pain on endodontic access or instrumentation. The results showed that anesthetic success was obtained in 58% of the mandibular posterior teeth. We can conclude that when the IAN block fails to provide profound pulpal anesthesia, the supplemental buccal infiltration injection of a cartridge of 4% articaine with 1:100,000 epinephrine would be successful 58% of the time for mandibular posterior teeth in patients presenting with irreversible pulpitis. Unfortunately, the modest success rate would not provide predictable pulpal anesthesia for all patients requiring profound anesthesia. *(J Endod 2009;35:343–346)*

Key Words

Articaine, infiltration anesthesia, irreversible pulpitis

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Supplemental injections are essential when, as frequently occurs in patients diagnosed with irreversible pulpitis, pulpal anesthesia from the inferior alveolar nerve (IAN) block is inadequate, and the pain is too severe for the endodontist to proceed. Previous studies (1–6) have shown success rates of only 19%–56% for IAN blocks in patients with irreversible pulpitis. Therefore, practitioners need to consider supplemental techniques when an IAN block fails to provide pulpal anesthesia for patients with irreversible pulpitis.

In April 2000, articaine was introduced in the United States (7). Haas et al (8, 9) compared infiltrations of 4% articaine and 4% prilocaine formulations in the mandibular canines and second molars of asymptomatic subjects. They found no statistical differences between the 2 anesthetic formulations. The success rates (achieving a pulp test reading of 80) were 65% for the canine infiltration and 63% for the second molar infiltration with a 4% articaine formulation. Kanaa et al (10) compared a cartridge of 2% lidocaine with 1:100,000 epinephrine with a cartridge of 4% articaine with 1:100,000 epinephrine for buccal infiltration anesthesia of the mandibular first molar in asymptomatic subjects. The articaine formulation had a significantly higher success rate (achieving 2 consecutive pulp test readings of 80) of 64% when compared with the lidocaine formulation's 39% success rate. Three additional studies (11–13) also used infiltration anesthesia in asymptomatic mandibular first molars. Jung et al (11) found a success rate (achieving 2 consecutive pulp test readings of 80) of 54% by using a buccal infiltration of 4% articaine with 1:100,000 epinephrine in mandibular first molars. Corbett et al (12) found success rates (achieving 2 consecutive pulp test readings of 80) ranged from 64%–70% when using articaine as a buccal infiltration of the mandibular first molar. They did not find a difference between buccal and buccal plus lingual infiltrations with articaine. Robertson et al (13) compared the degree of pulpal anesthesia achieved with mandibular first molar buccal infiltrations of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine. With a lidocaine formulation, they found successful pulpal anesthesia (achieving 2 consecutive pulp test readings of 80) was 57% for the first molar. With the articaine formulation, successful pulpal anesthesia was 87%. There was a significant difference ($P < .05$) between the 2% lidocaine and 4% articaine formulations. Therefore, 4% articaine with 1:100,000 epinephrine is superior to 2% lidocaine with 1:100,000 epinephrine in mandibular buccal infiltration of the first molar in asymptomatic subjects.

Another study by Haase et al (14) added an infiltration of either articaine or lidocaine in the mandibular first molar after an IAN block in asymptomatic subjects. They found statistically higher success rates (2 consecutive 80 readings were obtained within 10 minutes after the IAN block plus infiltration injections, and the 80 reading was continuously sustained through the 60th minute) of 88% with the articaine formulation compared with 71% for the lidocaine formulation.

Although all these studies demonstrated the superiority of articaine over lidocaine, none of the studies were performed in patients with irreversible pulpitis. Rosenberg et al (15) compared articaine with lidocaine for supplemental buccal infiltration in maxillary and mandibular teeth in patients presenting with irreversible pulpitis. For the 26 mandibular teeth (13 articaine and 13 lidocaine) receiving buccal infiltrations after the IAN block failed, there was no significant difference between the 2 solutions. However, success was evaluated by using a visual analogue scale (VAS) rather than

performing endodontic treatment to evaluate anesthesia. As the authors stated, "…the use of a standard VAS pain scale does not fully predict the clinical efficacy of different anesthetics." Therefore, the study of the supplemental buccal infiltration of articaine in patients with irreversible pulpitis needs further investigation to ensure its appropriate clinical use.

The purpose of this prospective study was to determine the anesthetic efficacy of the supplemental buccal infiltration injection of a cartridge of 4% articaine with 1:100,000 epinephrine in mandibular posterior teeth diagnosed with irreversible pulpitis when the conventional IAN block failed.

Materials and Methods

Eighty-two initial adult patients participated in this study. All were emergency patients of the College of Dentistry and were in good health as determined by a health history and oral questioning. Exclusion criteria were as follows: younger than 18 years of age, allergies to local anesthetics or sulfites, pregnancy, history of significant medical conditions, taking any medications that might affect anesthetic assessment, active sites of pathosis in area of injection, and inability to give informed consent. The Ohio State University Human Subjects Review Committee approved both the protocol and informed consent document, and written informed consent was obtained from each patient.

To qualify for the study, each patient had a vital mandibular posterior tooth (molar or premolar) that was actively experiencing moderate to severe pain and had a prolonged response to cold testing with 1,1,1,2 tetrafluoroethane (Endo-ice; Hygenic Corp, Akron, OH). Patients with no response to cold testing or periradicular pathosis (other than a widened periodontal ligament) were excluded from the study. Therefore, each patient had a tooth that fulfilled the criteria for a clinical diagnosis of irreversible pulpitis. All teeth had vital coronal pulp tissue on endodontic access.

Patients were administered standard IAN blocks and long buccal injections by using 2% lidocaine with 1:100,000 epinephrine (Xylocaine; Astra Zeneca LP, York, PA) by the senior author (R.M.). The patient was asked every minute for 15 minutes whether they were experiencing lip numbness. All patients used for data analysis reported profound lip numbness. At 15 minutes after the IAN block, the teeth were isolated with a rubber dam, and access was performed. The patients were instructed to definitively rate any discomfort during access by using a Heft-Parker VAS (16). The VAS was divided into 4 categories. No pain corresponded to 0 mm. Mild pain was defined as greater than 0 mm and less than or equal to 54 mm. Mild pain included the descriptors of faint, weak, and mild pain. Moderate pain was defined as greater than 54 mm and less than 114 mm and only included the descriptor of moderate pain. Severe pain was defined as equal to or greater than 114 mm. Severe pain included the descriptors of strong, intense, and maximum possible.

The 55 patients who had moderate or severe pain (VAS rating greater than 54 mm) during access into dentin or when entering the pulp chamber received supplemental buccal infiltration injections with a cartridge of 4% articaine with 1:100,000 epinephrine (Septocaine; Septodont Inc, New Castle, DE). For the 27 patients with successful IAN blocks, endodontic treatment was successfully performed (none or mild pain) without the need for any supplemental injections.

After removal of the rubber dam, a standard infiltration injection was administered buccal to the tooth under treatment. The 27-gauge short needle was gently placed into the alveolar mucosa (needle insertion phase) and advanced until the needle was estimated to be at or just superior to the apex (apices) of the tooth (needle placement phase). The anesthetic solution was deposited during a period of 1 minute (solution deposition phase). All infiltrations were given by the senior author (R.M.).

TABLE 1. Percentages and Number of Subjects Who Experienced Anesthetic Success with the Supplemental Buccal Infiltration of Articaine

Tooth	Anesthetic success	95% Confidence interval
First molar	58% (15/26)	37%–77%
Second molar	48% (11/23)	27%–69%
Second premolar	100% (3/3)	29%–100%
First premolar	100% (3/3)	29%–100%
Total	58% (32/55)	44%–71%

n = 55.

Before administering the infiltration injection, the subjects were instructed to rate the pain of needle insertion, needle placement, and solution deposition by using the Heft-Parker VAS.

After waiting 5 minutes for the infiltration to take effect, the rubber dam was replaced, and endodontic access was continued. The success of the supplemental buccal infiltration injection was defined as the ability to access the pulp chamber, place initial files, and instrument the tooth without pain (VAS score of 0) or mild pain (VAS rating less than or equal to 54 mm). If the patient had moderate to severe pain (VAS rating greater than 54 mm) during access or initial instrumentation, the infiltration injection was judged as a failure, and an intraosseous or intrapulpal injection was administered.

The data were statistically analyzed. Ninety-five percent confidence intervals were calculated for anesthetic success of the supplemental infiltration. There are 2 basic statistical methods used to assess the role of chance, hypothesis testing (which results in a *P* value) and confidence intervals (usually set at 95%). Both methods use the same fundamental inputs. The confidence interval reports a range of results. With a success rate of 50% for the supplemental infiltration, 47 subjects would be required to provide a 95% confidence interval of ± 20 percentage points. When considering individual teeth, the confidence intervals would increase to ± 30 percentage points for an N of 20 subjects.

Results

Eighty-two adult patients, 42 men and 40 women, from age 18–71 years with an average age of 35 years participated in the initial IAN block. Forty-one of the mandibular teeth were first molars, 29 were second molars, 6 were second premolars, and 6 were first premolars. Overall anesthetic success of all teeth was 33% (27/82). Successes for the teeth were first molar, 37% (15/41); second molar, 21% (6/29); second premolar, 50% (3/6); and first premolar, 50% (3/6).

Fifty-five adult patients, 29 men and 26 women, from age 18–71 years with an average age of 33 years participated in the supplemental infiltration of articaine. Twenty-six of the mandibular teeth were first molars, 23 were second molars, 3 were second premolars, and 3 were first premolars (Table 1).

Anesthetic success of the buccal infiltration injection of articaine is presented in Table 1. Discomfort ratings of the infiltration injection are presented in Table 2.

Discussion

The purpose of the current study was to look at supplemental buccal infiltrations of articaine in failed IAN blocks. We could have designed the study to give all patients IAN blocks plus supplemental buccal infiltrations. However, there would be no way to know how many of the