How Effective Is Supplemental Intraseptal Anesthesia in Patients with Symptomatic Irreversible Pulpitis?

Stephen Webster, Jr, DDS, MS, Melissa Drum, DDS, MS,* Al Reader, DDS, MS,* Sara Fowler, DMD, MS,* John Nusstein, DDS, MS,* and Mike Beck, DDS, MA†*

Abstract

Introduction: Previous studies have reported high levels of success with intraseptal injection for various dental procedures but provide limited information on the use of the injection during endodontic treatment. Therefore, the purpose of this prospective study was to determine the anesthetic efficacy of the supplemental intraseptal technique in mandibular posterior teeth diagnosed with symptomatic irreversible pulpitis when the conventional inferior alveolar nerve (IAN) block failed. **Methods:** One hundred patients with a diagnosis of symptomatic irreversible pulpitis in a mandibular posterior tooth were recruited. Following profound lip numbness after the administration of the conventional IAN block, endodontic treatment was initiated. Patients still experiencing moderate to severe pain during treatment were administered mesial and distal supplemental intraseptal injections using 0.7 mL 4% articaine with 1:000,000 epinephrine administered with a computer-controlled local anesthetic delivery unit. Success was defined as the ability to perform endodontic access and instrumentation with mild to no pain. **Results:** Success with the IAN block was achieved in 25% of patients. Supplemental intraseptal injections provided success in 29% of patients. **Conclusions:** Supplemental intraseptal injections achieved profound pulpal anesthesia in 29% of patients when the IAN block failed. This low level of success would not provide predictable levels of anesthesia for patients requiring emergency endodontic treatment for symptomatic irreversible pulpitis in mandibular posterior teeth. *(J Endod 2016;42:1453–1457)*

Key Words

Inferior alveolar nerve block, intraseptal anesthesia, symptomatic irreversible pulpitis

Significance

The supplemental intraseptal injection achieved profound pulpal anesthesia in 29% of patients when the IAN block failed. This injection would not provide predictable levels of anesthesia for patients requiring emergency endodontic treatment for symptomatic irreversible pulpitis in mandibular posterior teeth.

Supplemental injections are essential when pulpal anesthesia from the inferior alveolar nerve (IAN) block is inadequate and the pain is too severe for the endodontist to proceed (1). Several supplemental injection techniques have been studied and include buccal infiltrations, intraosseous injections, and periodontal ligament injections. No study has investigated the efficacy of supplemental intraseptal anesthesia in patients with symptomatic irreversible pulpitis.

Intraseptal anesthesia is the deposition of anesthetic solution directly into the interdental septum allowing solution to flow through the porous crestal alveolar bone and into the cancellous bone surrounding the tooth (2–8). The injection has been described by Saadoun and Malamed (7) as being given in buccal keratinized tissue at a point "located at the center of the papillary triangle … equal distance from the adjacent teeth." In a 2005 review of the injection technique by Woodmansey (8), the author suggests advancing the needle "until it contacts the underlying bone," impaling the osseous crest, and then firmly advancing into the interdental septum where the anesthetic should be delivered. Woodmansey also recommended repeating the intraseptal injection at the mesial and distal aspects of the tooth to gain complete pulpal anesthesia (8). Reported success rates of intraseptal anesthesia have ranged from 76%–90% depending on how success was measured (extractions, restorative procedures, or experimental monitoring with an electric pulp tester) (2–7).

Because the supplemental intraseptal injection has not been studied in endodontics, the purpose of this prospective study was to determine the anesthetic efficacy of the supplemental intraseptal technique in mandibular posterior teeth diagnosed with symptomatic irreversible pulpitis when the conventional IAN block failed. The pain of injection was also assessed.

Materials and Methods

Patients recruited for this study were adult emergency patients of the College of Dentistry, The Ohio State University, Columbus, Ohio, who were deemed to be in good health as determined by a health history and oral questioning. All patients included in this study had to meet the following criteria: 18–65 years of age and in good health (American Society of Anesthesiologists classification I or II). Exclusion criteria were

From the Divisions of *Endodontics and †Oral Biology, The Ohio State University, Columbus, Ohio.

Address requests for reprints to Dr Al Reader, Division of Endodontics, College of Dentistry, The Ohio State University, 305 West 12th Avenue, Columbus, OH 43210. E-mail address: reader.2@osu.edu

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allergy to local anesthetics, history of significant medical problems (American Society of Anesthesiologists classification III or greater), having recently taken central nervous system depressants (including alcohol or any analgesic medications within 6 hours before treatment), pregnancy, lactating, or inability to give informed consent. The Ohio State University Human Subjects Review Committee approved the study, and written informed consent was obtained from each patient. After completion of the medical history and consent form, subjects completed the Corah Dental Anxiety Scale Questionnaire (9).

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

After obtaining informed consent, patients were asked to rate his or her initial pain on a 170-mm Heft-Parker visual analog scale (VAS) (10). The VAS was divided into 4 categories as described previously (11–13).

Patients were given topical anesthetic (20% benzocaine; Benco Dental, Wilkes-Barre, PA) applied for 1 minute. Each patient received a conventional IAN block using 1 cartridge of 2% lidocaine with 1:100,000 epinephrine (Xylocaine; AstraZeneca LP, Dentsply, York, PA) using a conventional syringe and a 27-G needle (Monoject; Sherwood Services, Mansfield, MA). The patient was questioned every 5 minutes for 15 minutes or until lip numbness was apparent. Patients who did not achieve complete lip numbness within 15 minutes were disqualified from participation in the study, but endodontic treatment was still performed after achieving profound anesthesia. After lip numbness, a separate buccal nerve block was administered for the molars using a standard syringe and 0.9 mL 2% lidocaine with 1:100,000 epinephrine.

The tooth was isolated with a rubber dam, and endodontic access was performed. Patients were instructed to definitively rate any pain felt during the endodontic procedure. If the patient felt pain, the treatment was immediately stopped, and the patient rated his or her discomfort using the Heft-Parker VAS (10). If the pain rating was mild, treatment continued. If the pain rating was moderate or greater (55 mm or higher on the VAS), supplemental anesthesia was administered. The extent of access achieved when the patient felt pain was recorded as within dentin, entering the pulp chamber, or initial instrumentation. The success of the IAN block was defined as the ability to access and instrument the tooth with no or mild pain (VAS score of 0 or $\leq$54 mm, respectively). All patients experiencing moderate to severe pain upon access or instrumentation received supplemental intraseptal injections.

After rubber dam removal, the intraseptal injections were administered using 1.4 mL 4% articaine with 1:100,000 epinephrine (Septocaine; Septodont, New Castle, DE). The anesthetic was delivered using a computer-controlled local anesthetic delivery (C-CLAD) system (Milestone Scientific, Deerfield, IL) unit. This system is a microprocessor-driven device that delivers a controlled infusion of anesthetic solution. The unit accepts standard glass dental anesthetic cartridges. The microprocessor monitors and varies the infusion pressure while maintaining a constant flow rate. An electronically driven plunger contacts the rubber plunger in the cartridge and expels the anesthetic solution at a precisely regulated rate. Sterile tubing connects the cartridge receptor to a penlike, handheld plastic wand that is attached to a Luer-Lok needle (Monoject, Sherwood Services, Mansfield, MA), together forming a disposable syringe assembly. A small portion of solution from a standard cartridge is lost during the purge cycle, and some of the solution remains in the cartridge and tubing; thus, only 1.4 mL of the anesthetic solution from a standard cartridge is delivered using the C-CLAD unit. Flow rate, initiation and cessation of flow, and aspiration are controlled with a foot pedal. To prevent cross-contamination, the handpiece, microtubing, and anesthetic cartridge are designed for single patient use only.

The primary author (S.W.) investigated the intraseptal injection clinically on cadaver and live subjects before beginning this study to further assess the appropriate gauge and length of needle to use in order to penetrate the alveolar crestal bone of the interdental septum with enough force to prevent bending. A 25-G ½-inch needle was chosen based on this investigation.

The computer-assisted supplemental intraseptal injection was administered as follows. The patient was placed in a supine position. Before the injection, patients were trained on how to rate the pain of each injection phase (needle insertion, needle placement, and solution deposition), which was reinforced during the injection, using 3 separate Heft-Parker VAS forms. A cartridge of 4% articaine with 1:100,000 epinephrine was placed into the plastic barrel of the C-CLAD unit's handpiece assembly and then placed into the cartridge holder socket with a quarter turn in a counterclockwise direction. A 25-G ½-inch Luer-Lok needle was inserted through the middle of the intradental papilla on the mesial aspect of the involved tooth until bone was contacted (needle insertion phase). The needle was inserted with an approximate 30° angle to the long axis of the tooth in a buccal-lingual plane, and the bevel of the needle was faced inferiorly. The operator then slowly placed the needle into the crestal bone with continuous pressure until it could not be advanced any further (needle placement phase). Approximately 0.7 mL of the anesthetic solution was deposited using the slow rate setting of the C-CLAD (solution deposition phase) (ie, the computer-assisted injection system was activated at a slow rate [by partially depressing the foot pedal] for 8 seconds). By removing the foot from the foot pedal, the computer-assisted injection system unit was activated on continuous flow of anesthetic solution at the slow rate. One chime from the computer-assisted injection system machine corresponded to 1 second, allowing audible monitoring of the elapsed time. Visually monitoring the green lights on the unit and audibly monitoring the corresponding chimes determined when the deposition of solution was complete. The time to administer 0.7 mL of the anesthetic solution was approximately 2 minutes. The author then waited 10 seconds before slowly removing the needle from the injection site. The intraseptal injection was then repeated on the distal aspect of the involved tooth using the same technique and sequence of steps outlined previously, and the patient was asked again to rate the pain of the 3 phases of the injection. The amount of anesthetic solution delivered with the distal injection was 0.7 mL.

For both injection sites, the author had direct vision to monitor if anesthetic solution was expressed from the papilla. If notable solution escaped, depressing the foot pedal briefly stopped the flow of anesthetic solution, and the needle was rotated with firm apical pressure into the papilla. The injection was then continued as outlined earlier.

After completion of the intraseptal injection, the rubber dam was replaced and the endodontic treatment resumed. If the patient felt no pain or mild pain, treatment continued. If the patient felt moderate to severe pain, treatment was again stopped, and the extent of access achieved when the patient felt pain was recorded as within dentin, entering the pulp chamber, or initial instrumentation. Treatment continued using a buccal infiltration of 1.8 mL 4% articaine with 1:100,000 epinephrine followed by an intraosseous injection using 1.8 mL 2% lidocaine with 1:100,000 epinephrine. The success of the supplemental intraseptal injection was defined as the ability to access