The Efficacy of IntraFlow Intraosseous Injection as a Primary Anesthesia Technique

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Abstract

The purpose of this study was to compare the efficacy of intraosseous injection and inferior alveolar (IA) nerve block in anesthetizing mandibular posterior teeth with irreversible pulpitis. Thirty human subjects were randomly assigned to receive either intraosseous injection using the IntraFlow system (Pro-Dex Inc, Santa Ana, CA) or IA block as the primary anesthesia method. Pulpal anesthesia was evaluated via electric pulp testing at 4-minute intervals for 20 minutes. Two consecutive 80/80 readings were considered successful pulpal anesthesia. Anesthesia success or failure was recorded and groups compared. Intraosseous injection provided successful anesthesia in 13 of 15 subjects (87%). The IA block provided successful anesthesia in 9 of 15 subjects (60%). Although this difference was not statistically significant ($p = 0.2148$), the results of this preliminary study indicate that the IntraFlow system can be used as the primary anesthesia method in teeth with irreversible pulpitis to achieve predictable pulpal anesthesia. *(J Endod 2008;34:280–283)*

Key Words

Anesthesia, IntraFlow, intraosseous, pulpitis

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Adequate anesthesia is of critical importance when delivering root canal treatment. Inadequate anesthesia may result in increased chair time and undue stress on the patient and clinician, potentially leading to a less than optimum result. Therefore, it is incumbent on the operator to determine the best methodology to achieve this goal.

Anesthesia of mandibular teeth traditionally has been delivered via an inferior alveolar (IA) nerve block (1). Success using this technique has been unpredictable, especially in teeth diagnosed with irreversible pulpitis (2–4). The clinical failure rate of this method when anesthetizing teeth with irreversible pulpitis has been reported to be 44% to 81% (2–6). This irregularity is multifactorial and may be caused by anatomic variation, local inflammatory processes, or neuronal sprouting (7–10). It can also be affected by individual variability in response to anesthetics, patient anxiety, needle deflection, type of anesthetic, and operator technique (6–8, 11). IA blocks are also associated with discomfort during delivery and lingering postoperative anesthesia (12). Variations of this technique have been explored to improve predictability including the Gow-Gates and Vazirani-Akinosi injections. Success rates have been shown to be greater than 90% (13, 14) and 76% to 93% (15–17), respectively.

Intraosseous injection has been reported to be successful as a supplemental technique after failure of the IA block. In teeth exhibiting irreversible pulpitis, success rates range between 71% and 98% (2, 3, 18-20). Intraosseous injection involves perforation of the cortical bone adjacent to the tooth to be operated on. After perforation, a short needle is inserted into the site, and anesthetic is deposited directly into the cancellous bone. The porosity of bone allows for rapid diffusion of the drug and almost immediate onset of profound anesthesia. This technique also claims to be simple, quick, and more comfortable and to have minimal lingering numbness.

Few studies have been performed using intraosseous injection as a primary anesthesia technique for teeth with irreversibly inflamed pulps. In addition, few studies have evaluated the IntraFlow system (Pro-Dex Inc, Santa Ana, CA), a dental handpiece with a perforator in the latch head and an integrated air pressure–driven injection system (Fig. 1). This system allows single-step perforation and deposition of anesthetic through the lumen of the perforator. Other intraosseous systems typically involve two separate steps: perforation with a standard slow-speed handpiece and injection using a standard dental syringe. This may be perceived as more cumbersome and time-consuming. As a result, IntraFlow claims to be more simple and predictable than other intraosseous techniques.

The primary objective of this study was to compare the efficacy of IntraFlow intraosseous injection and IA block when used as the primary anesthesia technique for irreversibly inflamed pulps.

Materials and Methods

All treatment protocols used in this study were approved by the Institutional Review Board of Baylor College of Dentistry, Texas A&M University System Health Science Center. Informed consent was obtained from all human subjects who participated. Inclusion criteria were as follows: (1) adults aged 18 to 65, (2) no major systemic or cardiovascular disease, (3) no history of taking any medication that would alter the inflammatory response of the pulp or provide analgesia for the previous 14 days, and (4) one mandibular posterior tooth diagnosed with irreversible pulpitis. The diagnosis of irreversible pulpitis was made by the application of Endo Ice refrigerant (Hygenic Corp, Akron, OH) to the affected tooth, and the patient reporting lingering pain. Match-

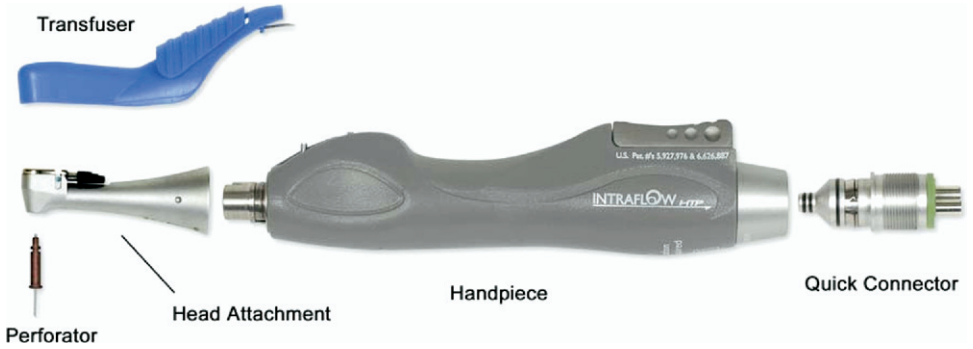

Figure 1. A schematic diagram of the IntraFlow device.

ing contralateral teeth were also tested to ensure an accurate diagnosis and to serve as controls.

Thirty patients scheduled for either endodontic treatment or extraction meeting the inclusion criteria were enrolled in the study. Patients were randomly assigned into 2 groups of 15 (Random Allocation Software, v1.0, Isfahan, Iran): group 1 underwent traditional IA block and group 2 underwent IntraFlow intraosseous injection as the primary anesthesia technique. Matching contralateral teeth served as negative controls and received no anesthetic.

All procedures including diagnosis, injection, and anesthesia evaluation were performed by a single operator. The technique used for the IntraFlow intraosseous system was performed according to the manufacturer's instructions, and the IA block was performed by standard technique. For the IntraFlow group, the site of perforation was selected near the junction of the attached and unattached gingival tissues, immediately distal to the test tooth. Radiographs were used to evaluate root proximity. A small volume of 2% lidocaine with 1:100,000 epinephrine (<0.1 mL) was infiltrated at the perforation site to ensure comfort during the procedure. Perforation was accomplished by operating the IntraFlow handpiece at full speed with the transfuser slider retracted. Constant moderate pressure was maintained until the perforator was felt to "drop" into the cancellous bone. The transfuser slider was then engaged forward, and one carpule (1.8 mL) of 2% lidocaine with 1:100,000 epinephrine was injected over a 60-second period. The transfuser slider was again retracted and, with the perforator rotating, removed from the injection site. The IA block group received the same type and volume of anesthetic.

Efficacy of anesthesia was determined by electric pulp test response at 4-minute intervals for a period of 20 minutes. Baseline readings were obtained before application of the anesthetic. The contralateral tooth was also tested and served as a negative control. No subject response to the electric pulp test (80/80) for two consecutive cycles was the criterion for anesthesia (21). Anesthesia success/failure and time to onset for each technique was recorded. Success/failure was compared between groups by using a Fisher exact test; the time to onset was compared by using the Mann-Whitney *U* test. A p value less than 0.05 was considered statistically significant.

The evaluation of perforators exhibiting leakage was also conducted by using scanning electron microscopy (SEM). Samples were dehydrated in a graded series of ethanol, critical point dried, mounted on 23-mm aluminum SEM stubs with double-sided carbon tape, and subsequently sputter coated with gold palladium. Each sample was examined via scanning electron microscopy (JSM-6300; JEOL, Tokyo, Japan) at magnifications of 27×, 45×, and 85×. Physical deformation and debris clogging the lumen were recorded.

Results

The age of tests subjects ranged from 19 to 62 years (mean, 39 years). Gender distribution was 53% male and 47% female. The distribution of tooth type was 10% second premolar, 53% first molar, and 37% second molar. No intraoperative or postoperative complications were reported during the procedure or at follow-up visits. Control teeth all responded normally to both thermal and electric pulp testing throughout the test period.

Group 1 (IA block) was successful in 9 of the 15 cases attempted (60%). The time to onset of profound anesthesia averaged 8.5 minutes (standard deviation ± 3.96). If anesthesia was successful, the minimum amount of time for onset was 4 minutes, and the maximum was 16 minutes (Fig. 2).

Group 2 (intraosseous) was successful in 13 of the 15 cases attempted (87%). The leakage of anesthetic solution was noted from the transfuser assembly in both cases of failure. The time to onset of profound anesthesia averaged 4.6 minutes (standard deviation ± 1.50). The minimum amount of time for onset was less than 4 minutes, and the maximum was 8 minutes (Fig. 2). The time to onset of anesthesia was found to be statistically more rapid than the IA block ($p = 0.017$).

Overall, the use of the IntraFlow system for intraosseous injection was 27% more successful than the traditional IA block (87% vs 60%). This difference, however, was not statistically significant ($p = 0.2148$). Gross SEM evaluation of the two perforators exhibiting leakage during injection revealed partial clogging of the perforator lumen and minor blunting of the perforator tip (Fig. 3).

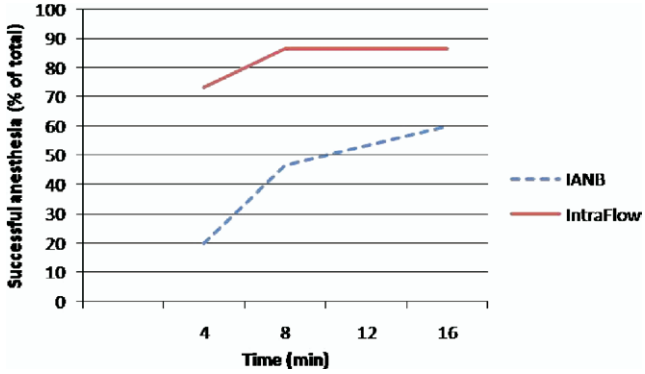

Figure 2. Time response curves for the two injection techniques. IANB, inferior alveolar nerve block.