Anesthesia In Endodontics – Facts & Myths

Dr. V. Gopi Krishna
Dr. V. Gopi Krishna, MDS, FISDR is a clinician, researcher and academician of national acclaim. He is the Co-Editor of Grossman’s Endodontic Practice - 12th Edition (Wolters Kluwer - Lipincott) and Editor of Preclinical Manual of Conservative Dentistry (Elsevier). He is also the Editor-in-Chief of the Journal of Conservative Dentistry (www.jcd.org.in) and is working as Professor, Dept. of Conservative Dentistry & Endodontics at Thai Moogambigai Dental College. He is the Founder - Director of the Root Canal Centre - an exclusive endodontic training and treatment centre at Chennai, which mentors more than 100 dentists every year in improving their endodontic skills. For more information on microscope aided clinical endodontic training modules with live patient demonstrations you can contact Dr. Gopi Krishna at hi_gopikrishna@hotmail.com (Ph: 91-9840218818) and at www.rootcanalcentre.com or Facebook Page --> Root Canal Centre

"For there was never yet a Philosopher who could endure the toothache patiently"
- William Shakespeare, Much Ado About Nothing, Act V

This quote by Shakespeare aptly describes the relationship of Dentistry with pain, which has been synonymous with each other. The field of Endodontics has contributed immensely in our endeavor to conserve and restore endodontically involved teeth. However, this procedure is perceived to be painful and evokes anxiety amongst patients. Fear of the dentist plagues more than 80% adults; and more than half say that “fear” may keep them from going to see the dentist, according to a new survey by the American Association of Endodontists (AAE). While fear of pain is the top reason adults avoid the dentist, root canal treatment is the most feared dental procedure, according to the AAE survey. This is reflected by surveys, which show that more than 50% of the general public is of the opinion that root canal therapy is "extremely painful". In fact, adults are afraid of getting a root canal procedure (54%) as they are of flying on an airplane during a storm (57%) and are more fearful of the procedure than of speaking in public or interviewing for a job (42%).

In my opinion, the twin philosophies that contribute towards endodontic excellence are in making the treatment “Painless” in the patient’s perspective and attaining “Precision” in the dentists perspective. Making the patient comfortable with good communication skills and achieving profound anesthetic effect are of paramount importance. This section of Grossman’s Corner will deal with dispelling the myths surrounding local anesthesia and providing evidence based approach in achieving anesthetic success.

Topical Anesthesia

The most important but often the most neglected phase in pain management is in the application of a topical anesthetic. A topical anesthetic helps us in two ways. Primarily the pain caused at the point of insertion of the needle into the tissue is greatly minimized. Moreover, it is a powerful placebo in making the patient feel more secure and helps in alleviation of the needle phobia. The two most commonly employed topical anesthetics are (Fig. 1)

i. Benzocaine Gel

ii. Lidocaine 5% ointment

Clinical Note:

i. The use of a topical spray is also recommended but clinically I find that the spray normally trickles down the site and may cause inadvertent numbness of the tongue and the palate.

ii. It is imperative that one gives the topical anesthetic at least 60 seconds to work prior to the insertion of the needle.

Local Anesthesia

At the start of root canal therapy, local anesthesia is used. Anesthesia should not be administered without a thorough knowledge of the patient’s medical and dental history. Any prior allergic reactions or untoward episodes during dental treatment must be investigated and evaluated, to avoid any future reaction to medication. The most commonly employed anesthetic agents in endodontics are:

i. 2% Lignocaine with 1:100,000 or with 1: 200,000 epinephrine: It is the most commonly employed local anesthetic agent. (Fig. 2a)
iv. **3% Mepivacaine with 1: 20,000 Levonorfedrin:** The clinical efficacy and systemic effects are similar to 2% Lidocaine with 1:100,000 epinephrine.

**Clinical Note:**
The Committee on Medical Education of the American Heart Association and the Council on Dental Therapeutics of the American Dental Association have approved a report of a conference at which it was stated that: “The concentrations of vasoconstrictors normally used in dental local anesthetic solutions are not contraindicated in patients with cardiovascular disease when administered carefully and with preliminary aspiration.”

• **Infiltration Anesthesia**

Infiltration anesthesia is the injection of a local anesthetic into the soft tissues in the region of the root apex. This technique is preferred to achieve anesthesia for any of the maxillary teeth. Infiltration is probably the simplest, safest and fastest method of producing anesthesia for removal of a dental pulp in maxillary teeth. The injection of an anesthetic stops any pain and makes pulp removal possible. The injection is made as for removal of a tooth; one inserts the needle into the mucobuccal fold slightly mesial of the tooth to be anesthetized and carries it toward the root apex until bone is encountered.

Generally, one capsule of the anesthetic solution (1.8 ml) is sufficient, but administration of more anesthetic solution is often required for pulp extration than for extraction of a tooth.

**Clinical Note:**

i. A palatal injection for maxillary teeth is unnecessary and is one of the common errors in endodontic anesthesia.

ii. The palatal Greater palatine block is given for the soft tissue anesthesia of the palate, which is needed during the extraction of a tooth and not during an endodontic procedure. The cancellous maxillary bone is porous enough for the buccal infiltration to anesthetize the palatal root for the maxillary teeth.

• **Block (Conduction) Anesthesia**

Because of the dense buccal alveolar plate, infiltration anesthesia is ineffective in the mandibular posterior region of the mouth, particularly for the removal of pulps in molar and premolar teeth. In such cases, inferior alveolar block, or conduction anesthesia of the inferior alveolar nerve should be used. At times, however, the inferior alveolar nerve may be difficult to anesthetize because of its anomalous distribution; for example, it may give off a branch that runs anterior to the mandibular foramen and enters the mandible through an opening anterior and inferior to the foramen. When the injection is properly executed, (Fig 3a) it is probably the most effective method for producing the anesthesia necessary for removal of the tooth.
A modified technique for injecting the inferior alveolar nerve by inserting the needle about half an inch higher than the place of the conventional injection has also been used. It has been reported that complete anesthesia was obtained in all cases with this technique. Because the buccal nerve is above the level of the inferior alveolar nerve, it is possible to anesthetize both nerves by diffusion of solution from one injection.

The Gow-Gate mandibular block is another type of mandibular block anesthesia. It differs from the inferior alveolar block in that the anesthesia is deposited in the lateral aspect of the neck of the condyle below the insertion of the lateral pterygoid muscle instead of in the mandibular sulcus. Advocates of the Gow-Gate technique claim a higher success rate than with the conventional technique, although the onset of anesthesia is slower. This technique can be used either routinely or when the conventional technique fails to produce anesthesia.

The following are some of the myths associated with the failure of the inferior alveolar nerve block injection:

**Myth I: Accessory innervation from the nerve to mylohyoid**

Studies done by Clark et al compared the inferior alveolar nerve block alone to a combination injection of the inferior alveolar nerve block plus the mylohyoid nerve block, which was aided by the use of a peripheral nerve stimulator. The investigators found that the mylohyoid injection did not significantly enhance pulpal anesthesia of the inferior alveolar nerve block.

**Myth II: Accuracy of the Injection Site**

Common sense suggests that positioning of the needle as close to the site of the nerve would increase the efficacy of the inferior alveolar nerve block. However, ultrasound studies found that in spite of an accurate block, it did not result in more successful pulpal anesthesia. The authors speculated that migration of the anesthetic solution followed the path of least resistance and this was determined by fascial planes and structures encountered in the pterygomandibular space. These studies provide an important clinical point—the lack of pulpal anesthesia is not necessarily due to an inaccurate injection.

**Myth III: Deflection of needle from optimal site of deposition of anesthetic**

There is a theory that needle deflection during insertion might be the cause of failure of a block. This theory proposes that beveled needles, when passing through substances of varying densities, will deflect toward the nonbeveled side. To overcome this, a bidirectional needle rotation technique using the computer-assisted Wand® (CompuDent, Milestone Scientific Inc., Deerfield, IL) was developed. The bidirectional technique rotates the Wand® handpiece assembly and needle in a manner similar to rotation of an endodontic hand file. The technique was found to reduce needle deflection during needle insertion. However, studies have found no significant difference in the anesthetic success in patients with irreversible pulps.

**Myth IV: Direction of the needle bevel**

Commercial needle with markers on the base of a needle to indicate the bevel were developed; so that the operator is able to orient the beveled side during the injection. However, studies have found the orientation of the needle bevel (away or toward the mandibular ramus) for an inferior alveolar nerve block did not affect anesthetic success or failure.

The scientific cause of failure of the inferior alveolar nerve block in spite of profound lip anesthesia could be due to the following reasons:

i. Lack of sufficient quantity of the anesthetic to block the sodium channels in the axons. Tetrodotoxin-resistant (TTXr) class of sodium channels that have been shown to be resistant to the action of local anesthetics and there is increased expression of these channels in inflamed pulps.

ii. Wide variation in the course of the inferior alveolar nerve.

iii. Accessory path for innervation from contralateral inferior alveolar nerve especially in relation to the mandibular anterior teeth.

iv. At times, it is difficult to obtain adequate anesthesia with an injection of a local anesthetic solution because of the inflamed state of the pulp. The reason for the inefficiency of the anesthetic solution in areas of inflammation may be the increase in peripheral nerve activity, or a decrease in pH of the
inflamed tissues that allows few anesthetic molecules to reach the nerves and thereby prevents full anesthesia.

**Clinical Note:**
If the patient has profound lip numbness and experiences pain upon endodontic access, repeating the inferior alveolar nerve block does not help the problem. Clinicians may think that another injection is helpful because the patient sometimes achieves pulpal anesthesia after the second injection. However, the patient may just be experiencing slow onset of pulpal anesthesia. That is, the second injection does not provide additional anesthesia-the first injection is just “catching up” due to the slow onset of pulpal anesthesia.

When infiltration or block anesthesia fails, supplemental techniques can be used to induce complete anesthesia. The following section would highlight the various techniques available.

**Techniques to Augment Infiltration and Conduction Anesthesia**

The following supplemental techniques may be considered whenever the primary anesthetic technique is inadequate.

- **Intrapulpal Anesthesia**

  If sensitivity of the tooth persists following infiltration or block anesthesia, intrapulpal anesthesia may be administered. This direct injection into the body of the exposed pulp can be done only if the exposure of the pulp is large enough to admit a hypodermic needle. Too large an exposure, however, may cause a back-flow of solution, with little or no solution entering the pulp to anesthetize it.

  This problem can be prevented by introducing the needle into the root canal until it binds and by forcing the anesthetic solution into the radicular pulp (Fig. 4).

  In many cases, it is necessary to bend the needle, to penetrate the root canals. A drop or two of anesthetic solution is quickly discharged into the pulp and the resulting anesthesia is effective and immediate.

In a double-blind study, Birchfield and Rosenberg found that it was immaterial whether a local anesthetic or sterile saline solution was used for intrapulpal anesthesia, provided the syringe needle fitted tightly into the cavity and penetrated the pulp.

**Clinical Note:**
Although the intrapulpal anesthetic is a highly effective supplemental technique it is very painful procedure. In my experience I have had patients complaining of an “electric shock” like effect and it is a procedure that I do not recommend as it goes against my core philosophy of doing root canals painlessly.

- **Periodontal Ligament Injection**

  The periodontal ligament or intraligamentary injection is used to augment incomplete dental anesthesia. It is considered an intrasseous injection because of the distribution of the anesthetic in the medullary spaces adjacent to the periodontal ligament. In some patients, it causes a transient decrease in blood pressure and an increase in heart rate. These cardiovascular changes are manifested clinically as palpitations and anxiety. This injection is not recommended for patients with cardiovascular diseases.

  The objective of this injection is to anesthetize the periodontal ligament of the tooth undergoing endodontic therapy and thereby to block the pulpal nerves. Damage to the periodontal ligament from this injection is minimal and is usually confined to the crestal area where the needle penetrates.

  Special pressure syringes have been developed for the intraligamentary injection (Fig. 5).

  **Fig. 5 Special pressure syringes developed for intraligamentary injection:** Vibraject (Courtesy: Miltex Inc, USA)

  These syringes are manufactured to deliver a preset volume of anesthetic (0.14 to 0.22 ml) with minimal effort and without breaking the anesthetic carpule. A short 27-or 30-gauge needle is inserted inter-proximally with positive pressure as deeply as possible.
along the root of the tooth, with the bevel of the needle toward the crestal bone. In posterior teeth, the needle is bent to a convenient angle and the trigger is squeezed, to deliver around 0.2 ml intra-ligamentally alongside the mesial and distal roots of multirooted teeth. The onset of anesthesia is immediate and the effect lasts an average of 30 minutes when using 2% lidocaine containing epinephrine 1:50,000.

Newer computer assisted local anesthetic delivery systems known as Wand or Compudent (CompuDent®, Milestone Scientific Inc., Deerfield, IL) have been recently developed. (Fig. 6) These are modifications of the intraligamentary supplemental injection. It accommodates a standard local anesthetic agent, which is attached to a disposable hand held handpiece with a Luer - Lok needle attached to the end. A foot control activates and controls the rate of infusion.

Clinical note:
1. This technique is most frequently used in mandibular molars. Cohen et al studied endodontic patients with irreversible pulps and found that a supplemental intraligamentary injection was 74% successful. Re-injection increased success to 96%.
2. The intraligamentary injection will not be successful in mandibular anterior teeth.
3. The ability to anesthetize a single tooth makes this technique invaluable in the diagnosis of diffuse pain of unknown origin (anesthetic test).
4. The clinician should be aware that this technique is more painful and produces mild post-injection pain in majority of the patients.

Conclusion
Apart from striving to achieve precision in endodontics the goal of every practitioner should also be to do the endodontic procedure in a painless manner. Achieving optimal anesthesia is mandatory especially when the patient is suffering from severe pain. The patient paradigm is simple “No pain during the procedure and no pain after the procedure!!”

A clinician should be aware of the following clinical considerations in order to avoid failure in administering local anesthesia. These include:

Table I : Clinical Considerations for Inferior Alveolar Nerve Block

- Proper knowledge of the anatomy of the inferior alveolar nerve.
- Lip paresthesia occurs within 90 seconds after injection. If the patient requires more than 10 minutes for achieving this, a supplemental or repeat injection is required.
- Although lip paresthesia does not always indicate effective pulpal anesthesia, the absence of lip sign indicates a failed inferior alveolar nerve block injection prompting a second injection.
- Use of supplemental intraligamentary or intraosseous injection significantly enhances the efficacy of the inferior alveolar nerve block.
- A slower inferior alveolar nerve block injection (60 seconds) results in higher success rates than a rapid injection (15 seconds).

DR. GOPIKRISHNA WILL CONDUCT A FULL DAY HANDS ON WORKSHOP ON ENDO RETREATMENT AT FAMDENT SHOW 2012 - MUMBAI CHECK PAGES 24 & 25 FOR DETAILS
COMPREHENSIVE COURSE IN MODERN ENDODONTICS

Twin Module hands-on course with live patient demonstrations by Dr Gopikrishna V

MODULE I - ESSENTIAL ENDODONTICS:
This three-day module would equip a clinician with skills to perform quality endodontic therapy using both hand and rotary instrumentation in molar teeth.

MODULE II - ADVANCED ENDODONTICS:
This two-day module would enhance your clinical acumen in endodontics with hands-on training in post and core placement, crown preparation and rotary retreatment systems.

The course is mentored by Dr Gopi Krishna and the curriculum has been designed in a precise, concise and clinically oriented manner keeping in mind the needs of the practitioner today. It has well-structured lectures, LIVE patient demonstrations and laboratory hands on exercises assessed under a Dental Operating Microscope (DOM) conducted under one roof. The Root Canal Centre has modern equipments and treatment facilities inclusive of DOM, Dental chairs, Digital radiography, Apex locators, Rotary motors, Lasers and Thermoplasticized obturation systems. A fully equipped preclinical training area with airotor modules and a mini lecture hall equipped with A-V facilities to show live video feed from the microscope is also available.

For more details contact
Root Canal Centre / Dr Gopi Krishna:
www.rootcanalcentre.com facebook : root canal centre
Phone : 044-42171813
e-mail : rootcanalcentre@live.com / hi_gopikrishna@hotmail.com