

Injection Techniques



DENTALELLE TUTORING

Maxillary Techniques



Supraperiosteal



- This is the most popular injection technique for the pulpal anesthesia of maxillary anterior teeth. Sometimes this injection technique is referred to as infiltration. This injection is ideal for pulpal and soft tissue anesthesia.
- If the whole quadrant is involved, this technique would require many needle insertions and postoperative discomfort might result. A short 25 or 27 gauge needle is recommended for this technique. It is inserted at the height of the mucobuccal fold near the apex of the tooth to be treated. The bevel of the needle should be toward the bone.

Posterior Superior Alveolar Nerve Block



- This is a commonly used technique for achieving anesthesia for the maxillary molars. The short 25 or 27 gauge needle is recommended to decrease the risk of a hematoma. The needle is inserted at the mucobuccal fold by the maxillary second molar with the bevel toward the bone. The needle's route is up, back, and inward towards the PSA nerve.
- The PSA nerve in some patients does not innervate the mesiobuccal root of the first molar, so more anesthetic may be needed for the Middle Superior Alveolar Nerve.

Middle Superior Alveolar Nerve



- Only about 20% of patients will have a middle superior alveolar (MSA) nerve. If the infraorbital nerve block does not provide adequate anesthesia to the teeth distal of the canine or if the PSA injection does not provide anesthesia for the mesiobuccal root of the first molar, an MSA block injection should be administered.
- A 25 gauge short needle is recommended with insertion in the mucobuccal fold by the maxillary second premolar. The bevel of the needle is towards the bone.

Infraorbital Nerve Block



- This will provide anesthesia from the maxillary central incisor to the premolar area in about 70% of patients. It is preferred to multiple supraperiosteal injections because it uses less anesthetic and only one penetration of the needle will be necessary. This injection technique will anesthetize the **anterior superior alveolar nerve, the middle superior alveolar nerve, the inferior palpebral nerve, the lateral nasal nerve, and the superior labial nerve.**

Palatal Anesthetic



- Strict adherence to proper technique will result in the most pleasant palatal injection possible.
- Deposit the solution slowly so it diffuses through the tissue rather than tearing or bruising. Confident, careful administration of local anesthetic into the palate can be atraumatic, regardless of the density of the tissue and the bad reputation earned by rough pumping of anesthetic by some practitioners.

Greater Palatine Nerve



- The greater palatine nerve innervates the palatal tissues and bone distal of the canine on the side anesthetized. Use a 27 gauge short needle with the bevel toward the palate. Palpate the palate until the depression of the foramen is felt (usually somewhere medial to the second molar).

Nasopalatine Nerve



- The nasopalatine nerve innervates the anterior of the hard palate from the mesial of the first premolar bilaterally. The technique is the same as for the greater palatine nerve block, but the site of injection is just posterior to the incisive papillae. The pressure on the cotton tipped applicator is delivered on the incisive papillae. The anterior area may be anesthetized first to diminish the discomfort of the palatal injection. Infiltrate in the mucobuccal fold near the frenum, then infiltrate the papillae between the incisors, then perform the nasopalatine injection. The main drawback of this technique is that it takes more local anesthetic, but the labial injections are often needed anyway.
- Different areas of the palate can be anesthetized by local infiltration into the papillae as well, especially if the procedure involves only one or two teeth.

Maxillary Nerve Block



- The maxillary (V_2) nerve innervates half of the maxilla, including the buccal and palatal aspects. This injection technique is used especially in quadrant surgery or when extensive treatment is indicated for a single appointment. It is also used when another site of injection has failed or if there is an infection in the area. This technique is used more with adult patients. Administration through the buccal aspect involves the possibility for hematoma. The long 25 gauge needle is recommended with the bevel of the needle facing the bone. The needle is inserted at the mucobuccal fold near the distal of the second molar after the usual protocol of tissue preparation. The path of the needle is similar to that of the PSA nerve block, but is inserted approximately 30 mm to the pterygopalatine fossa.
- This nerve may also be accessed through the greater palatine foramen on the palate. A 25 gauge long needle is recommended, and the same technique is used as for the greater palatine injection.

Mandibular Anesthetic



Keep in mind



- The success rates for mandibular anesthesia are significantly lower than with maxillary anesthesia. The bone is more dense around the mandibular apices, which inhibits the diffusion of the anesthetic.

Inferior Alveolar Nerve Block



- The inferior alveolar nerve block is the most commonly used injection in mandibular anesthesia. It provides anesthesia to the mandibular teeth to the midline on the side injected as well as the body of the mandible, the buccal mucosa and bone of the teeth anterior to the mandibular first molar, the anterior two thirds of the tongue and floor of the mouth, and the mucosa and bone lingual to the mandibular teeth on the side of injection. Use a 25 gauge long needle. A 27 or 30 gauge needle tends to be deflected or bent by the tissues and the anesthetic may end up being deposited off target.

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- The tissue should be penetrated at the medial border of the mandibular ramus at the height of the coronoid notch at the pterygomandibular raphe. The puncture point should be about 1.5 cm above the mandibular occlusal plane with the bevel toward the bone. The barrel of the needle should be parallel with the occlusal plane of the mandibular molars, and come across the premolars of the opposite quadrant.

Buccal Nerve Block



- The buccal nerve is not anesthetized by an inferior alveolar nerve block. This nerve innervates the tissues and periosteum buccal to the molars, so if these soft tissues are involved in treatment, the buccal nerve should be injected as well. The additional injection is unnecessary when treating only the teeth. A 25 gauge long needle is recommended (because the injection usually follows an inferior alveolar nerve block, so the same needle can be used after more anesthetic is loaded). The needle is inserted in the mucous membrane distal buccal to the last molar with the bevel of the needle facing towards the bone after the tissue has been prepared with antiseptic and topical.

Mental Nerve Block



- The mental nerve innervates the soft tissues anterior to the foramen, which is usually located at the apices of the premolars. It does not anesthetize the teeth. This technique is useful for curettage or biopsy.
- When a maxillary or inferior alveolar nerve block is successful, there should be no need for this injection. A 25 gauge short needle is inserted (after proper tissue preparation with antiseptic and topical) in the mucobuccal fold near the mental foramen with the bevel of the needle oriented toward the bone. The foramen can be palpated or is visible on x-rays and is usually near the apices of the premolars. The patient may feel soreness when the nerve is palpated in the foramen.

Incisive Nerve Block



- The incisive nerve innervates the lower teeth anterior to the mental foramen to the midline. The anesthetic solution should be deposited in the same area as the mental block, but the incisive nerve runs inside the foramen, so the needle is directed into the foramen. The anesthetic must diffuse into the foramen to affect the incisive nerve. Pressure applied to the injection site after needle withdrawal may help to guide the solution into the foramen.

Periodontal Ligament Injection



- All techniques previously described anesthetize regions of the mandible. When only a single tooth is to be treated, the practitioner has the option to selectively anesthetize the tooth and its surrounding tissues without involving the other teeth, tongue, and lip. Periodontal ligament injections can be useful for maxillary as well as mandibular teeth, but is more often used in the mandible because the bone is too dense for good diffusion of anesthetic with a supraperiosteal injection. This technique can provide anesthesia for the tooth, bone, soft tissue, apex, and pulpal tissues in the area of injection. The technique can also be used as an adjunct to other blocks that are only partially successful. The solution diffuses apically through marrow spaces in the intraseptal bone. Use a 27 gauge short needle (30 gauge tends to bend too easily) and insert it into the gingival sulcus of the tooth to be anesthetized. In some posterior regions it may be necessary to bend the needle to gain access to the area. The barrel of the syringe should be parallel with the long axis of the tooth.
- The procedure should be performed for all roots of the tooth. (Multirooted teeth receive 0.2 ml of solution per root.) Duration of anesthesia is variable.

Intraseptal Injection



- The intraseptal injection is used for hemostasis, soft tissue anesthesia, and osseous anesthesia. Prepare the tissues of the site with antiseptic and topical. Use a 27 gauge short needle and insert it into the papilla of the area to be anesthetized at an angle of 90° to the tissue.

Intraosseous Injection



- Anesthetic deposited into the local tissues is effected by the conditions present in the tissue. When the anesthetic is injected in the bone through a hole in the cortical plate, the tissue will not affect it, and it anesthetizes only the area of treatment, not the quadrant. A small amount of anesthetic is injected into the mucous membrane in the area to be perforated. A needle of 0.4 mm. (27 gauge) is inserted. One cartridge of anesthetic is the maximum per visit using this technique. The needle must be placed in the prepared hole at the same angulation and depth or the anesthetic will leak out with no resulting anesthesia.
- Onset of anesthesia is quick (30 seconds) and profound without numbing the tongue and lips. This will allow for restorative work to begin almost immediately after injection and bilateral mandibular anesthesia can be achieved. No palatal injection is required for maxillary anesthesia. Patients report the injection is painless and less time is spent waiting for anesthesia.

Endodontically Involved Teeth



- Infection at the apex of an endodontically involved tooth lowers the pH of the area and the anesthetic is neutralized and rendered less effective. The low pH in the extracellular space reduces the proportion of anesthetic in the lipophilic, free base form and reduces the anesthetic's ability to cross the nerve sheath and membrane. The anesthetic should be deposited away from the area of infection, further up the nerve where the pH is normal. Infiltration injection is usually reliable if there is no infection present. A regional nerve block should be used if abscess is present. An intrapulpal injection can be used when the pulp chamber has been exposed. Use a 25 gauge needle, (bent if necessary) and insert it into the pulp chamber firmly. A periodontal ligament injection can be used as an adjunct procedure to make anesthesia more profound. An intraosseous injection may allow access to the pulp chamber. The area is anesthetized with an infiltration injection, then an incision is made at the apex of the tooth to be treated.
- Nitrous oxide or conscious sedation may be considered as adjuncts during endodontic procedures if anesthesia is difficult to achieve. Once the pulp chamber is opened, the intrapulpal injection will usually be effective.

Pain



- An injection technique that is too rough, a dull needle, or rapid deposition of solution can cause pain. Confident and compassionate practitioners can deliver dental anesthesia with little to no discomfort. If a needle is used for more than 3 penetrations or if it comes into contact with bone, check it for dullness and change it if necessary.
- A mild burning sensation during administration may be due to the pH of the solution, contamination of the local anesthetic, or a solution that has been warmed too much. The mild burning of the acidic local anesthetic solution is unavoidable, and will dissipate as the anesthetic takes effect. If the cartridge is soaked in solutions, the semipermeable membrane will allow diffusion into the anesthetic. Contaminated solution can lead to trismus or infection.

Paresthesia



- If the needle passes through a nerve in the area of injection, it may damage the nerve and cause paresthesia. **The injury is usually not long term or permanent.** Make a note in the chart if the patient reports a shooting feeling during the injection that would indicate needle contact with the nerve. A local anesthetic that has been contaminated by alcohol or a sterilizing solution may cause tissue irritation and edema, which will in turn constrict the nerve and lead to paresthesia. Proper injection protocol and care of the dental cartridges will reduce the incidence of paresthesia, but it can still occur.
- If the patient calls reporting paresthesia, explain to them that it is not an uncommon result of an injection and make an appointment for examination. Make a note of the conversation in the patient's chart. The condition may resolve itself within 2 months without treatment. Examine the patient and schedule them for re-examination every 2 months until sensation returns. If the paresthesia continues after one year, refer the patient to a neurologist or oral surgeon for a consultation. If further dental treatment is required in the area, use an alternate local anesthetic technique to avoid further trauma to the nerve.

Hematoma



- The needle can nick vessels as it passes through highly vascular tissues. A nicked artery will usually result in a rapid hematoma, while a nicked vein may or may not result in a hematoma.
- Hematomas most often occur during a **posterior superior alveolar** or **inferior alveolar nerve blocks**. Use a short needle for the PSA and be conscious of depth of penetration for these injections. The swelling occurs after a significant amount of blood has diffused, so direct pressure is often useless. Apply external ice.
- Make a note of the hematoma on the patient's chart and advise them of possible soreness. If soreness develops, prescribe analgesics, but do not apply heat to the area for at least 4 to 6 hours. Heat therapy may begin the following day.
- The hematoma will disperse within 7 to 14 days with or without treatment. Avoid dental therapy in the area until the tissue is healed.

Trismus



- Trismus is a motor disturbance of the **trigeminal** nerve and results in a spasm of the masticatory muscles causing difficulty in opening the mouth. Trismus can be caused by trauma to muscles or blood vessels in the infratemporal fossa, injection of alcohol or sterilizing solution contaminated local anesthetic causing irritation to the tissues, hemorrhage, large volumes of anesthetic solution deposited in one area, or infection. Use of disposable needles, antiseptic cleansing of the injection site, aseptic technique, and atraumatic injection technique will help prevent trismus.
- Recommended treatment for trismus includes heat therapy with moist hot towels 20 minutes every hour, analgesics, and muscle relaxants if necessary. The patient should be instructed to exercise the area by opening, closing, and lateral excursions of the mandible for 5 minutes every 3 to 4 hours. The patient can chew sugarless gum to facilitate lateral movement of the TMJ.
- Continue therapy until the patient has no symptoms. If the pain continues over 48 hours, an infection may be present. Antibiotic therapy for 7 full days is indicated. If there is no improvement after 2 to 3 days without antibiotics or 7 to 10 days with antibiotics, refer the patient to an oral surgeon for evaluation.

Infection



- Infection from a dental injection has become rare due to the use of sterile disposable needles and one-patient use cartridges. The needle will always be contaminated when it comes in contact with the patient's mucosa. Proper tissue preparation and sterile technique will virtually eliminate infection at the injection site.
- If the patient reports post injection pain and dysfunction one or more days following treatment, manage as with trismus. If the symptoms do not resolve within three days, prescribe a seven day course of antibiotic therapy.

Facial Nerve Paralysis



- If the local is injected into the parotid gland, it will affect the facial nerve and the patient will notice facial drooping and will not be able to close their eye. If the needle is directed too posteriorly during an inferior alveolar nerve block, the parotid gland may be anesthetized. Bone should be contacted before deposition of solution in the inferior alveolar nerve block to make sure the tip of the needle is not in the parotid gland. Inferior alveolar nerve anesthesia will not develop if the solution is in the parotid gland.
- This is also self-limiting, and symptoms will diminish as the anesthetic effect wears off. The tear ducts in the eye will still function, but remove a contact lens if present. Explain the situation to the patient and give them the option of reinjection and continuing treatment or postponing treatment until another day.

Vasoconstrictors



- The vasodilation activity of local anesthetics produce an increased rate of absorption. This results in decreased effectiveness, short duration of anesthesia, and a higher risk of toxicity. Bleeding in the area of injection is increased. Vasoconstrictors are clinically useful in counteracting these effects. Vasoconstrictors are added to local anesthetics to decrease the absorption of the drug and prolong the anesthetic effect that produces anesthesia that is more profound. The vasoconstrictor also serves to reduce the risk of toxicity because it is more slowly absorbed by the circulatory system. The length of the procedure, desired level of hemostasis, and the medical health of the patient must all be considered when selecting an appropriate vasoconstrictor.
- Epinephrine is the most commonly used vasoconstrictors in dentistry. Epinephrine is sensitive to heat and can be inactivated if left too warm for too long. Store local in cool areas and never autoclave the cartridges. If a warmer is used, rotate new cartridges in regularly and don't leave the warmer on over night.

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- Epinephrine is available in concentrations of 1:50,000 for better hemostasis. Many studies have shown that clinically, there is not much difference in the hemostasis of 1:200,000 over 1:50,000. The anesthetic effect lasts much longer with the 1:50,000 concentration. Vasoconstrictors are effective in producing hemostasis, but after they wear off, it may lead to increased postoperative bleeding (rebound effect). This is especially true in higher concentrations.
- The use of vasoconstrictors should be carefully weighed against the risks for patients that are medically compromised by high blood pressure, cardiovascular disease, or hyperthyroidism. If the patient's condition is controlled with medication, slow administration with sure negative aspiration may be acceptable. No more than 2 cartridges of lidocaine with 1:100,000 epinephrine should be used on epinephrine sensitive patients.

Topical



- Topical anesthetics are used prior to the administration of local anesthetics and for some procedures like scaling or removal of a very loose primary tooth. The concentration of topical anesthetics is higher and the absorption is greater, so toxic levels are more easily reached. The anesthesia is effective only about 2-3 mm of depth into the tissues on which it is applied.
- Topical anesthetic is available in **gel or spray form**. The gel type of topical is recommended because it can be dispensed in premeasured doses. It is too difficult to measure the dose of the spray type, the patient may aspirate the spray, and the can is difficult to sterilize. **Benzocaine** is a commonly used topical anesthetic. It is an ester, so localized allergic reactions may be noted. Lidocaine is available in topical form, but the maximum recommended dose in this form is 200 mg.

Anesthetics



Agent	Approx. Duration of Anesthesia *
<i>Bupivacaine hydrochloride</i> 0.5% with epinephrine 1:200,000	> 90 min.
<i>Etidocaine hydrochloride</i> 1.5% with epinephrine 1:200,000	> 90 min.
<i>Lidocaine hydrochloride</i> 2% without vasoconstrictor 2% with epinephrine 1:50,000 2% with epinephrine 1:100,000	30 min. 60 min. 60 min.
<i>Mepivacaine hydrochloride</i> 3% without vasoconstrictor 2% with levonordefrin 1:20,000	30 to 60 min. 60 min.
<i>Prilocaine hydrochloride</i> 4% without vasoconstrictor 4% with epinephrine 1:200,000	30 min. 90 min.

* for pulpal anesthesia, soft tissue longer

Types



- **Lidocaine** is the most commonly chosen anesthetic today. The most popular contains epinephrine 1:100,000. Lidocaine with epinephrine 1:50,000 is used for hemostasis, but because of the rebound effect noted earlier, it should be used sparingly.
- 3% Mepivacaine without a vasoconstrictor is used as anesthetic for patients who cannot take a vasoconstrictor or for short procedures. 2% Mepivacaine with vasoconstrictor provides pulpal anesthesia that is similar to lidocaine with epinephrine, but hemostasis is not as intense.
- The action of prilocaine plain varies with the area injected (longer with a nerve block), but usually provides anesthesia similar to lidocaine and mepivacaine with vasoconstrictor. Prilocaine with vasoconstrictor gives good anesthetic effect and uses a 1:200,000 concentration of epinephrine. Bupivacaine is used when pulpal anesthesia is desired for longer appointments and when postoperative pain is anticipated.

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- Articaine is a newer anesthetic typically given in a 4% solution with 1:100,000 epinephrine. It is widely used in Europe and has recently gained popularity in the U.S. Articaine reportedly is more potent than Lidocaine and, therefore, requires less to achieve a similar state of anesthesia.
- Practitioners reported rarely missing a inferior alveolar nerve block with Articaine. However, concern has arisen about its potential for tissue necrosis and persistent nerve parasthesia.

Toxicity



- Use the smallest dose that will produce adequate anesthesia. Toxicity can be reached for any anesthetic by administering too much of the drug (especially as related to the patient's body weight), administering the drug to a sensitive individual, administering the drug into a blood vessel, or by improper drug combinations.
- Local anesthetic drugs affect the cardiovascular system, the nervous system, and local tissues. If the level of the drug is too high, it can become toxic causing a dangerous reaction in the nervous system, cardiovascular system, or in the local tissues. The rate of absorption and elimination of the drug is directly related to its toxic effects. The faster it is absorbed by the bloodstream and the slower the metabolism of the drug, the more toxic it is to the body.

Toxicity Equations



- mg per cc. \times 1.8 = mg per cartridge
patient weight \times toxic limit for the drug = toxic limit in mg
toxic limit in mg \div mg in cartridge = **maximum cartridges allowed**
- Administer Less Than Maximum Cartridges Allowed or Less Than Maximum Dosage Allowed, Whichever Is Less.
- *Always take the weight of the patient into account.*

Limits



- Injection of even a small amount of anesthetic solution directly into a blood vessel can result in an immediate toxic level. It is critical to aspirate each time an anesthetic is administered into an area that is very vascular, but negative aspiration does not guarantee that the bevel of the needle is not in the vessel. However, if the practitioner aspirates multiple times during the slow injection of anesthetic, chances of injection into a vessel are reduced.
- Toxic limits are for normal, healthy patients. Some patients will be more sensitive to drugs so they may react to an even smaller dose than someone else regardless of their weight. If the patient is overly sleepy or lethargic after administration of the local anesthetic, it may be a symptom of toxicity.



- Any time the patient is taking another CNS depressant, the mixture of the drugs will reduce the toxic level for the anesthetic. Patients should be questioned as tactfully as possible prior to anesthetic administration if there have been any drugs (prescription, over the counter, or street contraband) ingested recently. If the dentist prescribes preoperative anxiety relieving drugs such as Valium or Demerol, the dose of local anesthetic should be monitored even more carefully.



- Signs and symptoms of local anesthetic toxicity include: slurred speech, excitement, shivering, muscular twitching, and tremor of facial muscles and extremities. The patient may also feel numbness of the tongue (on the opposite side of a mandibular block or in maxillary anesthesia), warm, flushed skin, light-headedness, dizziness, diminished sight, tinnitus, and disorientation.
- These signs and symptoms may not be present when using lidocaine and prilocaine. Toxic levels of these anesthetics usually produce mild sedation or drowsiness. If the patient indicates an excitement reaction, observation is usually all that is necessary. As the concentration of anesthetic in the bloodstream increases, the patient may go into a seizure. As with all seizures, the most important first aid measure is to place the patient in a position where they will not be hurt and move all dental instruments away from the area. Watch the patient's vital signs, they may go into respiratory arrest. Usually if the patient is properly ventilated, the effect of the anesthetic will wear off and the patient should be able to breathe on his or her own after about 15 minutes.

Toxic Limits and Maximum



Drug	Toxic Limit	Maximum
2% Lidocaine (Xylocaine)	2 mg/lb	300 mg
3% Carbocaine(Mepivacaine)	2 mg/lb	300 mg
4% Citanest (Prilocaine)	2.7 mg/lb	400 mg
1.5% Duranest (Etidocaine)	3.6 mg/lb	400 mg
0.5% Marcaine (Bupivacaine)	0.6 mg/lb	90 mg

Administration



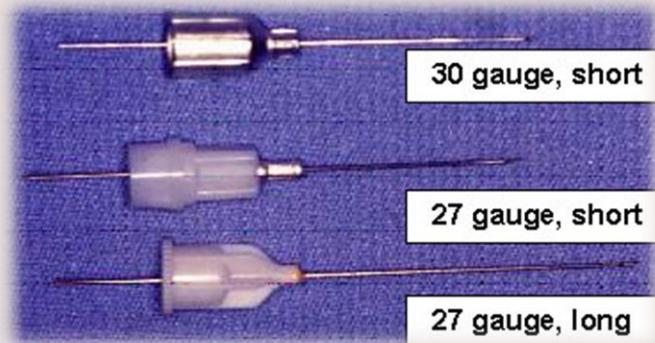
- Before administering any anesthetic, calibrate the dose of anesthetic in the cartridge. The percent of the solution is the indicator of concentration.
- For example, 2% lidocaine is 20 mg of xylocaine per cc of the drug. Multiply this number by 1.8 (because of the cartridge containing 1.8 cc. of solution). 2% xylocaine is 20 mg per cc x 1.8cc = 36 mg per cartridge. So for a 180 lb patient the maximum dose is 2 mg/lb x 180 divided by 36 mg in the cartridge = 10 cartridges.
- But the maximum dose for this drug is 300 mg which is **8 cartridges**. In the same patient, the maximum dose for Citanest would be 5.5 cartridges.
- Children have a smaller body weight, so the toxic level will be reached faster. Remember to take the patient's weight into account when figuring the maximum dose of any local anesthetic. For a 50 lb. child, using 2% lidocaine: **2 mg/lb x 50 divided by 36 mg in the cartridge = 2.7 cartridges.**

Epinephrine Overdose



- Symptoms of epinephrine overdose include: fear, anxiety, restlessness, headache, tenseness, perspiration, dizziness, tremor of limbs, palpitation, and weakness. The patient's blood pressure and heart rate will be elevated.
- Patients with weakened hearts are especially at risk because their cardiovascular system is already compromised.
- Position the patient comfortably and administer oxygen. If the patient's blood pressure is elevated and signs of a cerebrovascular incident occur, summon medical assistance. The patient should gradually recover. If there are no symptoms of cerebrovascular problems, the patient can be dismissed home. Otherwise they should go to their physician or the emergency room depending on the seriousness of the episode.

Needles



Syringe



- The syringe should be removed from its sterile wrap after autoclaving. The cartridge is inserted into the syringe. The **harpoon** is engaged with gentle, steady finger pressure with the plunger until the rubber stopper is embedded. Some practitioners embed the harpoon by slamming the ring with their palm. This can lead to fractures of the cartridge glass and the cartridge may break and cause injury to the patient or practitioner.
- After the harpoon is engaged, the needle is then attached to the hub and a few drops of anesthetic expelled to test the flow. A self-aspirating syringe should be loaded with the cartridge and then the needle attached to the hub.