Local anesthesia in pediatric dentistry

It is generally agreed that one of the most important aspects of child behavior guidance is the control of pain. If children experience pain during restorative or surgical procedures, their future as dental patients may be damaged. Therefore it is important at each visit to reduce discomfort to a minimum and to control painful situations.

There are many pharmacologic pain control strategies to help children cope with these situations, both preoperatively and postoperatively. Most of these strategies involve the use of local anesthetics and/or analgesics.

Because there is usually some discomfort associated with the procedure, use of a local anesthetic is generally indicated when operative work is to be performed on the permanent teeth, and the same is true of cavity preparations in primary teeth. Dental procedures can be carried out more effectively if the child is comfortable and free of pain. The local anesthetic can prevent discomfort that may be associated with placing a rubber dam clamp, ligating teeth, and cutting tooth structure. Even the youngest child treated in the dental office

normally presents no contraindications for the use of a local anesthetic.

Local anesthesia can be defined as transient loss of a sensation in circumscribed area of the body caused by depression of excitation in nerve endings or an inhibition of conduction process in peripheral nerves.

Difference between child and adult patient

Density and calcification of maxillary and mandibular Bone

Anatomical structure

Depth of penetration of needle

Emotional aspect

TOPICAL ANESTHETICS

Topical anesthetics reduce the slight discomfort that may be associated with the insertion of the needle before the injection of the local anesthetic. Some topical anesthetics, however, present a disadvantage if they have a disagreeable taste to the child. Also, the additional time required to apply them may allow the child to become apprehensive concerning the approaching procedure.

Topical anesthetics are available in gel, liquid, ointment, and pressurized spray forms. However, the pleasant-tasting and quick-acting liquid, gel, or ointment preparations seem to be preferred by most dentists. These agents are applied to the oral mucous

membranes with a cotton-tipped applicator. A variety of anesthetic agents have been used in topical anesthetic preparations, including ethyl aminobenzoate, butacaine sulfate, lidocaine, and tetracaine.
The mucosa at the site of the intended needle insertion is dried with gauze, and a small amount of the topical anesthetic agent is applied to the tissue with a cotton swab. Topical anesthesia should be produced in approximately 30 seconds.

LOCAL ANESTHESIA BY CONVENTIONAL INJECTION

It is generally agreed that the anesthetic solution should be injected slowly and that the dentist should watch the patient closely for any evidence of an unexpected reaction.

ANESTHETIZATION OF MANDIBULAR TEETH AND SOFT TISSUE

INFERIOR ALVEOLAR NERVE BLOCK (CONVENTIONALMANDIBULAR BLOCK)
When deep operative or surgical procedures are undertaken for the mandibular primary or permanent teeth, the inferior alveolar nerve must be blocked. The supraperiosteal injection technique may sometimes be useful in anesthetizing primary incisors, but it is not as reliable for complete anesthesia of the mandibular primary or permanent molars.
The mandibular foramen is situated at a level lower than the occlusal plane of the primary teeth of the pediatric patient.' Therefore the injection must be made slightly

lower and more posteriorly than for an adult patient. An accepted technique is one in which the thumb is laid on the occlusal surface of the molars, with the tip of the thumb resting on the internal oblique ridge. Firm support during the injection procedure can be given when the ball of the middle finger is resting on the posterior border of the mandible. The
barrel of the syringe should be directed on a plane between the two primary molars on the opposite side of the arch. It is advisable to inject a small amount of the solution as soon as the tissue is penetrated and to continue to inject minute quantities as the needle is directed toward the mandibular foramen.
The depth of insertion averages about 15 mm but varies with the size of the mandible and its changing proportions depending on the age of the patient. Approximately 1 ml of the solution should be deposited around the inferior alveolar nerve.

LINGUAL NERVE BLOCK
The lingual nerve can be blocked by bringing the syringe to the opposite side with the injection of a small quantity of the solution as the needle is withdrawn. If small amounts of anesthetic are injected during insertion and withdrawal of the needle for the inferior

alveolar nerve block, the lingual nerve will invariably be anesthetized as well.

LONG BUCCAL NERVE BLOCK

For the removal of mandibular permanent molars or sometimes for the placement of a rubber dam clamp on these teeth, it is necessary to anesthetize the long buccal nerve. A small quantity of the solution may be deposited in the mucobuccal fold at a point distal and buccal to the indicated tooth.

All facial mandibular gingival tissue on the side that has been injected will be anesthetized for operative procedures, with the possible exception of the tissue facial to the central and lateral incisors, which may receive innervation from overlapping nerve fibers from the opposite side.

INFILTRATION ANESTHESIA FOR MANDIBULAR PRIMARY MOLARS

INFILTRATION FOR MANDIBULAR INCISORS

The terminal ends of the inferior alveolar nerves cross over the mandibular midline slightly and provide conjoined innervation of the mandibular incisors. Therefore a single inferior alveolar nerve block may not be adequate for operative or surgical procedures on the incisors, even on the side of the block anesthesia. The labial cortical bone overlying the mandibular incisors is usually thin enough for supraperiosteal anesthesia techniques to be effective.

If only superficial caries excavation of mandibular incisors is needed or if the removal of a partially exfoliated primary incisor is planned, infiltration anesthesia alone may be adequate. Incisor infiltration is most useful as an adjunct to an inferior alveolar nerve block when total anesthesia of the quadrant is desired. In this case the infiltration injection is made close to the mid-line on the side of the block anesthesia, but the solution is deposited labial to the incisors on the opposite side of the midline.

ANESTHETIZATION OF MAXILLARY PRIMARY AND PERMANENT INCISORS AND CANINES

SUPRAPERIOSTEAL TECHNIQUE (LOCAL INFILTRATION)

Local infiltration (supraperiosteal technique) is used to anesthetize the primary anterior teeth. The injection should be made closer to the gingival margin than in the patient with permanent teeth, and the solution should be deposited close to the bone. After the needle tip has penetrated the soft tissue at the mucobuccal fold, it needs little advancement before the solution is deposited (2 mm at most) because the apices of the maxillary primary anterior teeth are essentially at the level of the mucobuccal fold.

Some dentists prefer to pull the upper lip down over the needle tip to penetrate the tissue rather than advancing the needle upward. This approach works quite well for the maxillary anterior region

In anesthetizing of the permanent central incisor teeth the puncture site is at the mucobuccal fold, so that the solution may be deposited slowly and slightly above and close to the apex of the tooth. Because nerve fibers may be extending from the opposite side, it may be necessary to deposit a small amount of the anesthetic solution adjacent to the apex of the other central incisor to obtain adequate anesthesia in either primary or permanent teeth. If a rubber dam is to be applied, it is advisable to inject a drop or two of anesthetic solution into the lingual free marginal tissue to prevent the discomfort associated with the placement of the rubber

dam clamp and ligatures.
Before extraction of the incisors or canines in either the primary or permanent dentition, it will be necessary to anesthetize the palatal soft tissues. The nasopalatine injection provides adequate anesthesia for the palatal

tissues of all four incisors and at least partial anesthesia of the canine areas. Nerve fibers from the greater (anterior) palatine nerve usually extend to the canine area as well. If only a single anterior tooth is to be removed, adequate palatal anesthesia may also be obtained when anesthetic solution is deposited in the attached palatal gingiva adjacent to the tooth to be removed. If it is observed that the patient does not have profound anesthesia of anterior teeth during the operative procedures with the supraperiosteal technique, a nasopalatine injection is advisable.

ANESTHETIZATION OF MAXILLARY PRIMARY MOLARS AND PREMOLARS

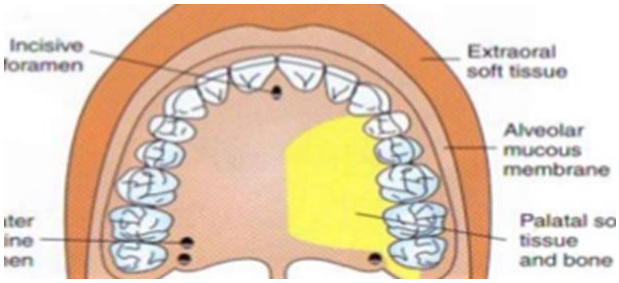
The middle superior alveolar nerve supplies the

maxillary primary molars, the premolars, and the mesiobuccal root of the first permanent molar.

The bone overlying the first primary molar is thin, and this tooth can be adequately anesthetized by injection of anesthetic solution opposite the apices of the roots However, the thick zygomatic process overlies the buccal roots of the second primary and first permanent molars in the primary and early mixed dentition. This thickness of bone renders the supraperiosteal injection at the apices of the roots of the second primary molar much less effective; the injection should be supplemented with a second injection superior to the maxillary tuberosity area to block the posterior superior alveolar nerve as has been traditionally taught for permanent molars.

This supplemental injection helps compensate for the additional bone thickness and the posterior middle superior alveolar nerve plexus in the area of the second primary molar, which compromise the anesthesia obtained by injection at the apices only.
To anesthetize the maxillary first or second premolar, a single injection is made at the mucobuccal fold to allow the solution to be deposited slightly above the apex of the tooth. Because of the horizontal and vertical growth of the maxilla that has occurred by the time the premolars erupt, the buccal cortical bone overlying their roots is thin enough to permit good anesthesia with this method. The injection should be made slowly, and the

solution should be deposited close to the bone; these recommendations hold true for all supraperiosteal and block anesthesia techniques in dentistry.
Before operative procedures for maxillary primary molars and maxillary premolars, the appropriate injection technique(s) for the buccal tissues, as just described, should be performed. If the rubber dam clamp impinges on the palatal tissue, injection of a drop or two of the anesthetic solution into the free marginal tissue lingual to the clamped tooth will alleviate the discomfort and will be less painful than the true greater (anterior) palatine injection. The greater palatine injection is indicated if maxillary primary molars or premolars are to be extracted or if palatal tissue surgery is planned.



PERIODONTAL LIGAMENT INJECTION (INTRALIGAMENTARY INJECTION)
The periodontal ligament injection has been used for many years as an adjunctive method of obtaining more

complete anesthesia when supraperiosteal or block techniques failed to provide adequate anesthesia. This technique has also gained credibility as a good method of obtaining primary anesthesia for one or two teeth. The technique is simple, requires only small quantities of anesthetic solution, and produces anesthesia almost instantly. The needle is placed in the gingival sulcus, usually on the mesial surface, and advanced along the root surface until resistance is met. Then approximately 0.2 ml of anesthetic is deposited into the periodontal ligament. For multirooted teeth, injections are made both mesially and distally. Considerable pressure is necessary to express the anesthetic solution.

A conventional dental syringe may be used for this technique. However, the great pressure required to express the anesthetic makes it desirable to use a syringe with a closed barrel to offer protection in case of anesthetic cartridge breaks.

Syringes designed specifically for the periodontal ligament injection technique have been developed. One syringe, the Peri-Press, is designed with a lever-action " trigger" that enables the dentist to deliver the necessary injection pressure conveniently. The Peri-Press syringe has a solid metal barrel and is calibrated to deliver 0.14 ml of anesthetic solution each time the trigger is completely activated.

The periodontal ligament injection offers the following advantages for either primary or adjunctive anesthesia:

1. It provides reliable pain control rapidly and easily.
2. It provides pulpal anesthesia for 30 to 45 minutes, long enough for many single-tooth procedures without an extended period of postoperative anesthesia.
3. It is no more uncomfortable than other local anesthesia techniques.
4. It is completely painless if used adjunctively.
5. It requires very small quantities of anesthetic solution.
6. It does not require aspiration before injection.
7. It may be performed without removal of the rubber dam.
8. It may be useful in patients with bleeding disorders that contraindicate use of other injections.
9. It may be useful in young or disabled patients in

whom the possibility of postoperative trauma to the lips or tongue is a concern.

INTRAOSSEOUS INJECTION, INTERSEPTAL INJECTION, AND INTRAPULPAL INJECTION

Intraosseous, interseptal, and intrapulpal injection techniques have been known for many years, but they have recently received renewed attention. The intrapulpal injection is an adjunctive anesthesia technique designed to obtain profound pulpal anesthesia during direct pulp therapy when other local anesthesia attempts have failed.

The intrapulpal injection often provides the desired anesthesia, but the technique has the disadvantage of being painful initially, although the onset of anesthesia is usually rapid. Intraosseous injection techniques (of which the interseptal injection is one type) require the deposition of local anesthetic solution in the porous alveolar bone. Its done by forcing a needle through the cortical plate and into the cancellous alveolar bone, or a small round bur may be used to make an access in the bone for the needle. A small, reinforced intraosseous needle may be used to penetrate the cortical plate more easily. This procedure is not particularly difficult in children because they have less dense cortical bone than adults. The intraosseous techniques have been advocated for both primary anesthesia and adjunctive anesthesia when other local injections have failed to produce adequate anesthesia, however it is

contraindicated by infection in the periodontal ligament space.

Maximum Recommended Doses:

4.4 mg/kg body weight with vasoconstrictor.

Dose Calculation:

2% lidocaine = 20 mg/ ml

1 carpule = 1.8ml

Amount of LA in 1 carpule = 20X 1.8 = 36mg/carpule.

Example:

20 Kg child can tolerate a maximum dose of 2% lidocaine with vasoconstrictor of LA ----------

4.4 X 20= 88 mg = 2.4carpules.

COMPLICATIONS AFTER A LOCAL ANESTHETIC

1. ANESTHETIC TOXICITY

Systemic toxic reactions from the anesthetics are rarely observed in adults. However, young children are more likely to experience toxic reactions because of their lower body weight. Young children are also often sedated with pharmacologic agents before the treatment. The potential for toxic reactions increases when local anesthetics are used in conjunction with sedation medications.

MANIFESTATION OF TOXICITY

- ▶ Cardiac depression
- ▶ Coma convulsion
- ▶ Unconsciousness
- ▶ Muscular twitching
- ▶ Visual and auditory disturbance
- ▶ Headache
- ▶ Numbness of tongue

2. TRAUMA TO SOFT TISSUE

Parents of children who receive regional local anesthesia in the dental office should be warned that the soft tissue in the area will be without sensation for a period of 1 hour or more. These children should be observed carefully so that they will not bite the tissue. Children who receive an inferior alveolar injection for routine

operative procedures may bite the lip, tongue, or inner surface of the cheek.

Sometimes a parent calls the dentist's office an hour or two after a dental appointment to report an injury to the child's oral mucous membrane. The parent may wonder if the accident occurred during the dental appointment; in all probability the child has chewed the area, and the result 24 hours later is an ulceration, often termed a traumatic ulcer. Complications after a self-inflicted injury of this type are rare. However, the child should be seen in 24 hours, and a warm saline mouth rinse is helpful in keeping the area clean.

3. SYNCOPE

- ▶ Pale and cold
- ▶ Dilated pupil or constricted
- ▶ Rapid pulse
- ▶ Drop of blood pressure

4. ALLERGIC REACTION