Pediatric Dentistry

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LOCAL ANESTHESIA AND PAIN CONTROL FOR CHILDREN

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LOCAL ANESTHESIA AND PAIN CONTROL FOR CHILDREN

Local anesthesia has been defined as a loss of sensation in a circumscribed area of the body caused by a depression of excitation in nerve endings or an inhibition of the conduction process in peripheral nerves. It produces the loss of sensation without inducing a loss of consciousness. Local anesthetics are drugs which upon topical application or local injection cause reversible loss of sensory perception especially of pain, in a restricted area of the body. Not only sensory but also motor impulses are interrupted when applied to a mixed nerve, resulting in muscular paralysis and loss of autonomic control as well.

Pain control is one of the most important aspects of behavioral management in children undergoing dental treatment, unpleasant childhood experiences have made many adults acutely phobic with regard to dental treatment.

Special concerns in pediatric dentistry relevant to local anesthetic include anesthetic overdose, complications related to prolonged duration of soft tissue anesthesia, and technique variations related to smaller skulls and differing anatomy of younger patients.

Ideal requirements of acceptable local anesthetic

- *It should have potency sufficient to give complete anesthesia*
- *It should be relatively free from producing allergic reactions*
- *It should be stable in solution and readily undergo biotransformation in the body*
- *It should be sterile or capable of being sterilized by heat without deterioration*
- *It should have low degree of local toxicity*

– *It should not be irritating to the tissue to which it is applied*

– *It should not cause any permanent alteration of nerve structure*

- *It should have low degree of systemic toxicity*
- *It should possess versatility—It must be effective regardless of whether it is injected into the tissue or applied locally to mucous membranes*
- *It should have a rapid onset and be of sufficient duration to be advantageous.*

Differences between a Child and Adult Patient

1. The bone in the maxilla and mandible of the adult is heavier and more compact, whereas in the child it is varyingly less dense and incompletely calcified. So diffusion of the LA agent through the layers of the bone is faster in children.

2. The anatomic structures of the child are naturally smaller than those of the adult, so the depth of penetration of the needle should be less in children.

3. Penetrating too deeply at the area of the tuberosity can produce a hematoma as the pterygoid venus plexus or posterior superior alveolar artery be injured.

4. The depth of the needle penetration must be reduced because the ramus of the mandible is shorter vertically and narrower anteroposteriorly, so the mandibular foramen is located lower and more posteriorly.

5. With an adult, the emotional aspect of the local anesthetic process is seldom a factor. For the child, however, the procedure is very much an emotional issue.

Structure of local anesthetics

The basic components of local anesthetic (LA) structure are

- *A lipophilic aromatic portion*
- *A hydrophilic amine portion*
- *An intermediate hydrocarbon chain containing either an ester or an amide linkage.*

Mode of action of local anesthetics

It is possible for local anesthetics to interfere with the excitation process in a nerve membrane in one or more of the following ways:

- *Altering the basic resting potential of the nerve membrane.*
- *Altering the threshold potential (firing level)*
- *Decreasing the rate of depolarization.*
- *Prolonging the rate of repolarization*

Composition of local anesthetic solution

- ***Local anesthetic agent:*** *Lignocaine, etc.*

- ***Vasoconstrictor***
  - *Decrease blood flow to the site of injection, so decrease bleeding.*
  - *Absorption of the local anesthetic into the cardiovascular system is slowed.*
  - *Decrease the risk of local anesthetic toxicity.*
  - *Higher volume of the local anesthetic agent remains in and around the nerve for longer period, thereby increasing the duration of action.*

- ***Reducing agents:*** *Vasoconstrictors are unstable in solution and may oxidize, especially on a prolonged exposure to sunlight. Sodium metabisulfite which competes for the available oxygen is added in the concentration between 0.05 and 0.1 percent.*
- ***Preservative:*** *Stability of modern local anesthetic solution is maintained by adding Caprylhydrocuprienotoxin and Methyl paraben*
- ***Fungicide:*** *Thymol*
- ***Vehicle:*** *All the above solutions and local anesthetic agent are dissolved in a modified* ***Ringer's*** *solution. This isotonic vehicle minimizes discomfort during injection.*

TOPICAL ANESTHETICS

The topical anesthetics reduce the slight discomfort that may be associated with the insertion of the needle before the injection of local anesthetic. Topical anesthetic agents can anesthetize a 2-3 mm depth of surface tissue when used properly.

Surface anesthesia can be achieved by physical or pharmacological methods (topical anesthetics).

Forms of topical anesthesia

Topical anesthetics are available in forms of gel, liquid, ointment, pressurized spray. Sprays are the least convenient as they are difficult to direct. Some sprays taste unpleasant and can lead to excess salivation if they inadvertently reach the tongue. In addition, unless a metered dose is delivered, the quantity of anesthetic used is poorly controlled. It is important to limit the amount of topical anesthetic used. The active agent is present in

greater concentration in topical preparations than in local anesthetic solutions and uptake from the mucosa is rapid. Systemic uptake is even quicker in damaged tissue.

Indications:

Although the main use of topical anesthetics is as a pre-injection treatment, these agents have been used as

- *The sole means of anesthesia for some intra-oral procedures in children including the extraction of mobile primary teeth*
- *Application of rubber dam clamp and matrices*
- *Teething pain*
- *Diagnostic radiographs*
- *Painful oral mucosal conditions such as, aphthous ulcers and infectious ulcerative mouth conditions such as, gingivostomatitis, ulcerative pharyngitis, or hand-foot-and mouth disease*
- *Reduce the discomfort of dental scaling.*

Demerits

- **If they have a disagreeable taste to the child.**
- **The additional time required to apply them may allow the child to become apprehensive concerning the approaching procedure.**

Topical Anesthetic Agents

- *Ethyl aminobenzoate butacaine sulfate*
- *Cocaine*
- *Dyclonine*
- *Lidocaine (lignocaine)*
- *Benzocaine*
- *Tetracaine.*

Application

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 tissue with a cotton swab for sufficient time and limited area. This is especially important in children as this may be their initial experience of intra-oral pain-control techniques.

During the application of the topical anesthetic, the dentist should prepare the child for injection. The explanation should not necessarily be a detailed description but simply an indication that the tooth is going to be put to sleep so that the treatment can proceed without discomfort.

Controlled-release devices

The use of topically active agents incorporated into materials that adhere to mucosa and allow the slow release of the agent is a potential growth area in the field of local anesthetic delivery. Such techniques might prove to be of value in pediatric dentistry. Clinical studies investigating the release of lidocaine from intra-oral patches have shown some promise.

Jet injectors

Jet injectors belong in a category somewhere between topical anaesthesia and LA. These devices allow anesthesia of the surface to a depth of over 1cm without the use of a needle. They deliver a jet of solution through the tissue under high pressure

Conventional local anesthetic solutions are used in specialized syringes and have been successful in children with bleeding diatheses where deep injection is contraindicated. Jet injection has been used both as the sole means of achieving LA and prior to conventional techniques. This method of anesthesia has been used alone and in combination with sedation to allow the pain-free extraction of primary teeth. The use of jet injection is not widespread for a number of reasons:

- *Expensive equipment is required*
- *Soft tissue damage can be produced if a careless technique is employed*
- *The specialized syringes can be frightening to children because of both their appearance and the sound produced during anesthetic delivery.*
- *The unpleasant taste of the anesthetic solution can be off-putting.*

PHYSICAL PAIN CONTROL

Non-pharmacological methods of pain control offer two advantages:

1. *Systemic toxicity will not occur*
2. *The soft tissue anesthesia resolves at the end of the procedure. This reduces the chances of self-inflicted trauma.*

- ***The use of refrigeration*** *which employs the application of volatile liquids such as ethyl chloride. The latent heat of evaporation of this material reduces the temperature of the surface tissue and this produces anesthesia. This method is rarely used in children as it is difficult to direct the stream of liquid accurately without contacting associated sensitive structures such as teeth. In addition, the general anesthetic action of ethyl chloride should not be forgotten.*
- ***Hypnosis*** *can be used as an adjunct to LA in children by decreasing the pulse rate and the incidence of crying. It appears to be most effective in young children.*
- ***Some lasers*** *have the potential to produce LA as dental hard tissue can be removed painlessly by such devices.*
- ***Electronic Dental Anesthesia***
  - ✓ *Provides pain control for administration of LA. And excellent soft tissue anesthesia*
  - ✓ *Effective for pain control in needle phobics*
  - ✓ *Aids in reversing local anesthetic effect.*
  - ✓ *Used in the management of chronic pain and acute pain*
  - ✓ *No drug is used*

Contraindications are patients with cardiac pacemaker, neurological disorders, pregnancy, very young pediatric patients.

Disadvantages are cost of the unit, extensive training and the presence of intraoral electrodes.