

Painless Anesthesia in Pediatric Dentistry: A Review

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Abstract

Pain management is one of the most commonly faced problem for dentists while handling of pediatric patients. A positive dental attitude can be instilled in a child if pain is handled properly. In recent times, various advancements and research have been made in the field of local anesthesia. These techniques along with the conventional ones can be utilized for better handling of pain and to get better apprehension from patients. This review article is to discuss recent advancements in painless anesthetic techniques and to improve the quality of treatment regarding pain in pediatric dentistry. As management of pain is of paramount importance to instill a positive attitude about dentistry in children.

Keywords: Local anesthesia, Painless dentistry, Eutectic mixtures, Jet injection, Pediatric dentistry.

Introduction

Karl Koller discovered local anesthesia in the year 1884. Since then local anesthesia has been a boon to the medical and dental field as it allows to carry out various surgical processes painlessly. Pain control and pain management is greatly enhanced by the use of local anesthesia. The recent advancements in the field of anesthesia have made it possible to profession to make tremendous therapeutic advances which would not have been possible otherwise. For administration of local anesthesia one should have knowledge of anatomical structures, devices and method to be used, neuroanatomy, etc. A dental practitioner carries out various procedures like extraction, root canal treatment, scaling. In one or other procedures patients always have to overcome some amount of pain. To avoid that, local anesthesia is administered through syringes and needles via conventional techniques.¹

This method in itself increase the fear and anxiety of the patient before even commencement of the procedures. Managing a child patient is in itself difficult. So, to avoid the above-mentioned procedures, it is essential to know the latest local anesthetic delivery techniques that will ensure painless treatment to the patient.²

Local Anesthesia Delivery Systems:

Various traditional method are available for the delivery of local anesthesia. But many newer advances have come to ensure painless dentistry via:

Computer-controlled local anesthesia delivery, vibrotactile systems,, jet injectors intraosseous anesthesia, etc.

Computer-controlled local anesthesia delivery (CCLAD) system: Computer-controlled local anesthesia delivery systems enable the rate of flow regulation of the local anesthetic using computers and hence reduces pain by slow delivering of anesthesia at a constant speed. The operator should look at the design of the system which includes parameters like infection management, weight, mode of drug injection, speed, possibility of aspiration, etc before choosing a suitable one to avoid infection. The first CCLAD used was the Wand system (introduced in 1997) and some subsequent versions around Plus and Compu Dent. Comfort Control Syringe (introduced in

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2001) is different from the Wand system in a way that it does not possess a foot control.³

A. Wand System: This technique helps to deliver the local anesthesia by placing a needle at the site to be anesthetized with fingertip accuracy with better control. It administers local anesthesia at a constant rate and is controlled by a foot activator. For better tactile sensations held with a pen-type grasp and is lightweight so easy to handle

It is one of the most popular and commonly used CCLAD. Advantage of this being its operator friendliness and its circumference that is half the size of the conventionally used syringes. As the operator has to hold the device in the area to be anesthetized for a long period thus, lighter devices are preferred over the heavy ones as it helps prevent needle break injuries and muscle fatigue. The cartridges that are used in the Wand system are installed in the main unit and the assistant can change it whenever required but about 0.3 to 0.4 ml of solution may be wasted during the procedure. Initially aspiration time in wand system was 14 seconds which is now reduced to 5 seconds and plus. Feda et al¹³ and Mittal et al¹⁴ reported that CCLAD proved to be advantageous while delivering the palatal anesthesia by reducing the pain.⁴

b. Computer comfort syringe (ccs) system: CCS differs from the wand systems it consists of a base unit, a syringe and no foot control. The syringe itself can be used to control injection and aspiration and the solution deposited to the desired tissues irrespective of the resistance offered. This makes it user friendly for those using conventional techniques. 5 programmed speeds and three buttons are present on the device. The injection can be controlled using these buttons namely start or stop, aspirate and double button to start or stop the anesthetic delivery, aspirate or double the rate of delivery. Digital feedback readouts are present in the base unit which displays the time elapsed, rate and volume of anesthetic injected. It is less desirable than a wand system because of its weight but is quite easier for those using conventional techniques.⁵

C. Jet Injectors: Mechanical energy is used for releasing the pressure, thereby allowing the liquid medication to make its way through a small orifice. A thin column of fluid formation is permitted to be created that will allow the anesthetic solution

deposition into the subcutaneous tissue without using a needle. Merits of Jet injections are minimal tissue damage, fast drug delivery and absorption, and lesser pain. Patients having a fear of needle and apprehension can be best managed by jet injectors. Commonly used brands of jet injections are SyrijetMarkII, MED H JETIII etc.⁶

MED JET H III: This was introduced first in the year of 2011. The advantage of this being the anesthetic solution is deposited with a much smaller orifice that is seven times smaller than the needles with the smallest diameter. This system has almost great accuracy and the solution is delivered at a small pressure and does not compromise with patient comfort and user compliance.⁷

SYRIJET MARK II: This has been used for 4 decades and also have undergone various advancements. 1.8cc syringes are used, which deliver the local anesthetic solution from 0-0.2cc and can be autoclaved hence reusable. It uses a nozzle pressure of 2000 pounds psi and at this pressure the same effect is the same as that seen in a conventional needle piercing 1 cm deep in oral tissues. This can be used for various minor surgical procedures like removal of deciduous anterior teeth and permanent central and lateral incisors, soft tissue procedures, removal of bone spicules, application and removal of arch bars and ligature wires could be carried out with the use of Syrijet alone.⁸

Though it as its advantages, but certain disadvantages are also there. Bleeding from the punctured sites are seen if punctured twice or thrice, the unpleasant taste is also seen. Hence concluding that Syrijet Mark II can be used for certain dental procedures but some it requires adjunctive anesthetic measures.

D. Safety syringe needles: The safety needles provide the prevention of needlestick injuries to the health care provider. These special needles are covered by a sheath as soon as it is removed from the tissues. Some commonly used safety needles are Hyposafety syringe, Ultrasafety plus XL syringe, Ultrasafe syringe, SafetyWand syringe etc. However, these are no better than the conventional syringes and are of inadequate help in preventing needle-stick injuries.⁹

E. Topical anesthetics

1. Lidocaine patches: It consists of a mucoadhesive base and delivers the local anesthetic via the trans-oral delivery route. It

is commonly used before the needle is pricked into the tissue and for superficial mucosal and gingival procedures. Absorption is well into the tissue and effects are seen within 2 minutes and last for 30 minutes after removal of the patch. The demerits being high cost and poor adhesion to the oral mucosa.¹⁰

- 2. EMLA Cream:** EMLA stands for the Eutectic mixture of local anesthetics. It is an emulsion of oil in water which consists of 2.5% prilocaine and 2.5% of lidocaine in the ratio 1:1. It is supplied in various forms like in a tube of 5 to 30g, in disc form or form of anesthetic patch. These are easily absorbed into the oral mucosa and can be used only for minor procedures. These are applied orally for 2 to 5 minutes to provide psychological and pharmacological effects before needle penetration. It shows good results for pediatric use of cream but yet its advantages are to be researched. However, it is contra indicated in patients with methemoglobinemia or those having allergy towards amide-type local anesthesia as can cause allergic dermatitis.¹¹

- 3. Intranasal sprays:** In this anesthetic solution is infiltrated in nostrils through a metered device to anesthetize the maxillary anterior teeth, canines and premolars.¹²

These are a mixture of 3% tetracaine hydrochloride and 0.05% oxymetazoline. It constricts the vessels thereby reducing bleeding and making the operating field favorable for the same.

- 4. Laser analgesia:** This acts by disrupting the sodium-potassium pump temporarily and by changing the behavior of neuronal cells. It thereby produces profound analgesia by blocking the impulses to reach the brain. However, it should be used along with other anesthetic measures to work properly.¹³⁻¹⁶

Conclusion

Management of pain is one of the primary concerns for pediatric dentist. Most of the patients usually have a fear of needle and the pain associated with it. To overcome that, the above-mentioned techniques can be far more useful for better patient apprehension. It will also improve the quality of treatment that the dentist can

provide. These techniques can help to instill a positive attitude towards dental treatment in a child. Though some of the techniques are time-consuming, costly but are proven and successful ones. One has to use it according to the type of treatment, feasibility, and user-friendliness.

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