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Updates of Local Anesthesia in Pediatric Dentistry: A Review

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Abstract

Local anesthesia is the commonest administered drug in the dental field, which considered the best advancement in dentistry in the last century. Especially in the pediatric dental clinic, the main factor for refusing the dental visit by children is fear or anxiety and the main source of it is the injection. By using the terms fear and anxiety in children, local anesthesia and recent advances the data was collected. Original research paper with human studies and lab studies as well as their cross-references were used to review this paper. The purpose of the present review is to discuss the current methods available in the administration of local anesthesia used for pediatric dental patients.

Keywords: Local anesthesia, Jet injection, Wand system, Vibratory Devices, Kovanaze.

Introduction

Dentistry is a unique specialty because it deals with multiple branches such as surgery, medicine, pediatrics and geriatrics. Local anesthesia is the commonest administered drug in the dental field, which considered the best advancement in dentistry in the last century [1]. Especially in the pediatric dental clinic, the main factor for refusing the dental visit by children is fear or anxiety and the main source of it is the injection [2]. Although, there are continuous researches and newer devices appeared which try to administer the local anesthesia with less invasive and painless technique than conventional painful injection. This review aims to find out the updates of local anesthesia in pediatric dental practice.

Safety of local anesthesia

The known local anesthetic agents have excellent safety with minimal tissue irritation, low chance of allergic reaction and completely reversible [3].

According to Clark's rule, the dose of local anesthesia for the child should depend on body weight not on age, so the amount of local anesthesia to be used in a child should be reduced. As well as, the new recommendation from the American Academy of Pediatric Dentistry (2015) suggest to use body mass index (BMI) for calculation.
Dose = [Child weight/Adult weight] * [Adult dose]

Due to the different concentrations of local anesthetic agents in each cartridge (2% or 3%), the amount of delivered local anesthesia should be separately calculated for each agent used. The number of the cartridge to be delivered should be determined by the maximum dose of local anesthesia and by the maximum dose of epinephrine.

The maximum number of the cartridge to be given to the patient is expressed as:
Maximum Cartridge Number = [(Z * Y)/18X] cartridge.
The Z value representing the patient weight, Y for the maximum dose and X for the percentage of concentration [4].

Child Behavior management

Profound local anesthesia is mandatory for pain control which is the most critical aspect of child behavior management. Before local anesthesia administration, establish communication with the child to know more about your patient, which may relax the child. Verbal communication can be started complimentary comments followed by both open the closed questions [5].

How to reduce pain and anxiety

In managing child behavior, topical anesthesia has a great advantage in reducing the first painful impression of the local anesthesia needle.

Role of the speed of injection:
Many studies show that the slowly delivered local anesthesia increases patient comfort than rapid injections. Malamed suggested the speed of delivering local anesthesia to be 1 ml/min [6], which need approximately 100 seconds for a 1.8 cartridgewhere the studies by Kanaa et al., and Whiteworth et al., recommend 1 cartridge per minute is the ideal speed of injection [7,8].

Role of syringe design:
The Camouflage Syringe is one of the methods for reducing child fear and anxiety; it comes with different shapes like a jet engine, fish, butterfly or doll. Ujaoney et al., and Anjana et al., concluded the high efficiency of the camouflaged syringe in reducing fear and anxiety in children [9,10]. New local anesthesia techniques and devices.

Jet injection:
These injectors emerge for clinical usage in 1947 after the first introduction by John F. Roberts in 1933 [11], it is also known as a needleless injection. It can provide anesthesia by enforcing the local anesthesia to mechanically infiltrate the mucosa under a high compressive force with advantages in preventing the site infection that may result from the usual needle [12]. However, one of the biggest drawbacks is the limited amount of local anesthesia can be delivered (0 - 0.2 ml) which is only enough for soft tissue anesthesia not for pulpal anesthesia. The current usage of this technique is preferred only by the pedodontist because of less bone density in their patient [12].

It has been studied and concluded that conventional needle injection is still effective and preferred one for local anesthesia injection [12]. However, more clinical studies are still needed to evaluate the efficiency of jet injection.

Electronic Dental Anesthesia (EDA)

Since introduced in the 1980s, the effectiveness of EDA increased in pediatric dentistry [7,13]. It acts by applying an electric current to the nerve to anesthetize and loading that nerve by the electric current until the pain pathway blocked. Clark et al., concluded the success of EDA in endodontic treatment [14]. Bishop TS concluded almost 93% of success when using EDA in restorative treatments [15]. Quarnstorm F. has concluded the success of EDA in all pediatric procedures.[16] However, Multiple contraindications should be considered

before using ED according to Quarnstorm F. [16], such as:

1. Patient with a pacemaker since it can interrupt the function of the pacemaker.
2. Patients having cerebrovascular disease since it can increase the peripheral blood flow.
3. Patients with a seizure disorder since the pulses of EDA tend to trigger a seizure episode.
4. In pregnant patients since it is not approved by the FDA, however, there is no specific side effect.
5. Unknown acute pain since it can affect the final diagnosis.

Computerized local anesthetic delivery systems:

In mid of the 1990s work started on this technology by Milestone Scientific. It is characterized by injecting the local anesthesia solution at a slow rate with stable pressure to overcome the painful traditional injection. Wand system was the first device that used this technology, it came with a computer unit and a hand-piece component for delivering the local anesthesia solution [17].

A significant reduction in the pain threshold was the conclusion by Palm et al. and Annelyse et al., [1,18]. Furthermore, the hand-piece shape is away from the usual fearful traditional needle shape, which can be added to advantages for reducing fear and anxiety, especially in the pediatric patient.

Allen and associates demonstrate the fewer behavior changes in preschool-age patients while using the Wand system [19]. However, Kandiah and Tahmassebi found that there was no difference in pain perception when the Wand system was compared with traditional injection. This conflicting results between studies may be due to study design or patient anxiety during the injection [20].

Vibratory Devices

VibraJect (Miltex Inc, York, PA) [21] and Syringe micro vibrator (SMV) by Shahidi Bonjar are newly introduced devices that imply on "Gate-control" theory which describing the reduced pain and itching sensation due to activation of a large-diameter nerve fiber by vibration [22,23]. These devices are sharing the same concept and differ in design. However, Roeber B et al., concluded the non-efficiency of ViraJect for reducing the injection pain when studied in children [23].

Kovanaze

It is a nasal spray (St Renatus, Fort Collins, CO) that gained FDA approval in 2016 for adult and children, is composed of 3% tetratetracaine with 0.05% oxymetazoline used to anesthetize the anterior maxillary teeth up to 2nd premolar by infiltrating the maxillary sinus and anesthetizing the anterior superior alveolar (ASA) nerve and middle superior alveolar (MSA) nerve [24,25].

Success rates up to 90% were concluded in restorative treatments [24], and significantly lower success rate (22% - 37%) when compared to conventional lidocaine infiltration (89% - 91%) in endodontic treatments [25].

Conclusion

Local anesthesia in dentistry is the cornerstone of most dental procedures. In pediatric dentistry, there is some special demand for avoiding the invasive and painful nature of the traditional technique. However, advances in devices and techniques for delivering local anesthesia to overcome the drawbacks of traditional technique is still having own drawbacks which render the traditional one the method of choice. These special demands in pediatric dentistry are a highly fertile field for future advances.

Conflicts of Interest: The authors declared no conflict of interest.

References

1. Alanko, O., et al., A longitudinal study of changes in psychosocial well-being during orthognathic treatment. International journal of oral and maxillofacial surgery, 2017. 46(11): p. 1380-1386.
2. Silva, I., et al., Stability after maxillary segmentation for correction of anterior open bite: a cohort study of 33 cases. Journal of Cranio-Maxillofacial Surgery, 2013. 41(7): p. e154-e158.

3. Hassan, T., F.B. Naini, and D.S. Gill, The effects of orthognathic surgery on speech: a review. Journal of Oral and Maxillofacial Surgery, 2007. 65(12): p. 2536-2543.

4. Murphy, C., et al., The clinical relevance of orthognathic surgery on quality of life. International journal of oral and maxillofacial surgery, 2011. 40(9): p. 926-930.

5. Soh, C. and V. Narayanan, Quality of life assessment in patients with dentofacial deformity undergoing orthognathic surgery—a systematic review. International journal of oral and maxillofacial surgery, 2013. 42(8): p. 974-980.

6. Göelzer, J., et al., Assessing change in quality of life using the Oral Health Impact Profile (OHIP) in patients with different dentofacial deformities undergoing orthognathic surgery: a before and after comparison. International journal of oral and maxillofacial surgery, 2014. 43(11): p. 1352-1359.

7. Rustemeyer, J. and J. Gregersen, Quality of life in orthognathic surgery patients: post-surgical improvements in aesthetics and self-confidence. Journal of Cranio-Maxillofacial Surgery, 2012. 40(5): p. 400-404.

8. Bailey, L.T.J., L.H. Cevidanes, and W.R. Proffit, Stability and predictability of orthognathic surgery. American Journal of Orthodontics and Dentofacial Orthopedics, 2004. 126(3): p. 273-277.

9. Nocini, P.F., L. Chiarini, and D. Bertossi, Cosmetic procedures in orthognathic surgery. Journal of Oral and Maxillofacial Surgery, 2011. 69(3): p. 716-723.

10. Øland, J., J. Jensen, and B. Melsen, Factors of importance for the functional outcome in orthognathic surgery patients: a prospective study of 118 patients. Journal of Oral and Maxillofacial Surgery, 2010. 68(9): p. 2221-2231.

11. Lohr, K., et al., C16. Evaluating quality-of-life and health status instruments: development of scientific review criteria. Clinical Therapeutics, 1996. 18: p. 30.

12. Feu, D., et al., Oral health-related quality of life changes in patients with severe Class III malocclusion treated with the 2-jaw surgery-first approach. American Journal of Orthodontics and Dentofacial Orthopedics, 2017. 151(6): p. 1048-1057.

13. Ni, J., S. Song, and N. Zhou, Impact of surgical orthodontic treatment on quality of life in Chinese young adults with class III malocclusion: a longitudinal study. BMC Oral Health, 2019. 19(1): p. 1-7.

14. Tachiki, C., et al., Condition-specific Quality of Life Assessment at Each Stage of Class III Surgical Orthodontic Treatment—A Prospective Study—. The Bulletin of Tokyo Dental College, 2018. 59(1): p. 1-14.

15. Geramy, A., et al., Oral health-related quality of life following orthognathic surgery for class III correction its relationship with cephalometric changes. International journal of oral and maxillofacial surgery, 2019. 48(11): p. 1434-1439.

16. Nicodemo, D., M. Pereira, and L. Ferreira, Effect of orthognathic surgery for class III correction on quality of life as measured by SF-36. International journal of oral and maxillofacial surgery, 2008. 37(2): p. 131-134.

17. Rezaei, F., et al., Oral health related quality of life of patients with class III skeletal malocclusion before and after orthognathic surgery. BMC Oral Health, 2019. 19(1): p. 1-6.


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