

Local Anesthesia in Pediatric Dentistry-How Much is Enough?

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Abstract

Aim: To evaluate the doses of local anesthesia (LA) during routine dental treatment of children, used by specialists in pediatric dentistry (SPDs), residents in pediatric dentistry (RPDs) and general practitioners (GPs) and suggest recommendations for using minimal doses.

Study design: A prospective research. 120 LA cartridges were collected after provided dental treatment of children by 4 specialists (SPD-55 cartridges), 5 residents in pediatric dentistry (RPD-43 cartridges) and 3 general practitioners (GPs-22 cartridges). The doses of the used solution were measured by deducting the remains in the cartridge from the original 1.8ml.

Results: A significantly lower dose of LA solution was used by specialists and residents compared to GPs, (0.786/0.746 ml ± 0.4 Vs. 1.65 ml ± 0.3, P<0.001).

Discussion: LA guidelines intend to achieve optimal effect, increase safety and reduce side effects. Various dentists have different training and experience, as well as personality and habits, which may affect their use of LA. This prospective study evaluated these factors.

Conclusions: The dentist training is a valuable predictor for the LA dose being injected to a child during dental treatment. The mean dose used in the study by specialists and residents was less than half compared to GPs, but effective enough for successful dental treatment, regardless of the number of treated teeth, the site, the type of the treatment and the patient's age. We suggest increasing the awareness of using minimal effective dose of LA in pediatric dentistry.

Keywords Pediatric dentistry; Local anaesthesia; Lidocaine; Mepivacaine; Dental treatment

Introduction

Pain prevention in pediatric dentistry is crucial for achieving positive experience of a child during dental treatment, building trust and cooperation and establishing a compliant dental adult. One of the main methods to prevent pain is local anesthesia [1-3].

Local anesthesia is achieved by injecting a chemical that diffuses in tissue, reaches nerve cells, binds to receptors located on the cell membrane and causes a temporary blockage of the sensory nerve conduction at the injection site [3-5]. The amount of injected material can influence the onset, duration, manifestations of toxicity and side effects of anesthesia during and after treatment.

The time before the onset and the duration of anesthesia are influenced by the specific tissue reaction to the injected solution [3,5], the amount injected [6,7], the type of the local anesthetic solution [8], the individual reaction of the patient, the anatomical variations and the injection technique [3,9].

Toxicity of local anesthetic substance develops when the level of the substance in the blood is higher than permitted. The causes of toxicity include: injecting into blood vessels, injecting too quickly, or injecting a larger amount of solution than allowed [3,4,10,11]. The toxicity is

diagnosed by the suppression of the central and cardiovascular nervous system, with a range of symptoms including mild tremor, dizziness and paralysis until tonic-clonic contractions and a slight decrease in blood pressure and cardiac output [3,9].

Postoperative side effects include injury of soft oral tissues due to biting post treatment and it is most common in children and physically or mentally handicapped [12]. To prevent this, it is recommended to provide local anesthesia for as short time as possible [3,8].

In adults, there is a recommendation for effective minimum doses according to the different anesthesia techniques and dental procedures [3]. In children, anatomy, physiology, and metabolism are different, which requires different recommendations [3,5].

The logic behind the assumption to use a minimal amount of anesthetic solution allowing treatment of children includes:

- Smaller general body mass and blood volume in children than in adults. Therefore, a reduced amount of material may reach the level of toxicity [5-7].
- The numbness after injection of local anesthetic in children is stressful [13-15]. Therefore, a minimal amount should be used in order to reduce the chance of soft tissue damage following a bite or lip chewing [12,16,17].

The question is how much is effective? The answer is not clear. Insufficient anesthesia may affect the cooperation of the child and his

behavior during and after treatment [6,7,18]. The pediatric literature showed extensive documentation of toxicity following doses that were too high [3,5,19-26], but for the minimum amount, there are no clear guidelines or recommendations [12].

The aim of the study was to establish current situation by:

- Analyzing prospectively the amount of local anesthetic solution injected by specialists and residents in pediatric dentistry and to compare it to general practitioners that treat children on a daily basis.
- Correlating between the dental procedures performed and the amount of local anesthetic solution needed.

Materials and Methods

Twelve dentists that treat children on a daily basis were included in the research: 4 specialists in pediatric dentistry (SPDs), 5 residents in pediatric dentistry (RPDs) and 3 general practitioners (GPs). Each dentist filled a questionnaire containing the age of the child, the treatment performed and the post-operative symptoms. The local anesthetic cartridge was attached to each questionnaire.

Only treatments of healthy children were included. 8-24 hours after treatment a dental assistant called the parents and interviewed them regarding the post-operative symptoms. The period of the research was 12 months.

The amount of local anesthetic solution injected was calculated by reducing the amount that remained in the cartridge from the basic 1.8 ml.

Statistical analyses included uni-variate ANOVA to determine the effect of kind of local anesthesia (local infiltration Vs mandibular block), the treatment performed, gender and age of the patient, use of inhaled sedation, use of topical anesthesia, and training of the dentist on the amount of local anesthetic solution injected. The results were significantly different if P value was <0.05.

Results

Local anesthesia for dental treatment in children is one of the most important steps for achieving cooperative behavior during treatment and for positive reaction after treatment. There are no specific guidelines regarding the minimal amount of local anesthesia solution to be injected in children. We know the maximal amount to be injected by weight and we know that the success rate of good anesthesia differs with regards to the jaw to be treated and the injection technique used [18,27]. The maximal amount of injected solution is well established by weight and the success rate of good anesthesia differs with regards to the jaw to be treated and the injection technique used [18,27]. The amount of local anesthetic solution injected has to be suitable to complete the treatment in a positive way and to reduce the time of post-treatment numbness, in order to minimize the possibility of self-induced trauma [27]. For local anesthesia in adults some recommendations were published: 1-1.5ml for mandibular block [28,29] and 0.5-2.0 ml for local infiltration [3]. In young children the bone density is reduced and the diffusion rate is higher [3] and the amount of local anesthetic solution can be reduced. SPDs and RPDs injected less than half of the amount of local anesthetic solution than GPs that treated children on a daily basis. The maximum recommended dose for 2% lidocaine with 1:100,000 epinephrine to be injected is 7.0mg/kg, and for 3% mepivacaine is 6.6 mg/kg. One

cartridge of 2% lidocaine contains 36 mg and should be used for children with weight of more than 5.2 kg, while for mepivacaine 1 cartridge contains 54 mg and the minimum weight for 1 cartridge is 8.2 kg [28]. The weight of the children was not reported but the youngest child was 2.5 years old and treated by a specialist using only 0.72 ml of 2% lidocaine, so the maximum recommended dose was never reached. The use of 2% lidocaine with epinephrine in pediatric dentistry is more common for better and longer anesthesia [11,17,29]. The use of inhalation sedation reduced the amount of local anesthetic solution injected. The reports of post treatment pain were few (22.5%), and only half of them required analgesics.

In conclusion, 3 factors influenced the amount of local anesthetic solution injected: SPDs/RPDs Vs GPs, 2% lidocaine Vs 3% mepivacaine and the use of inhalation sedation. The effect of less than half of one cartridge of local anesthetic solution was good enough for treatment of all kind of dental procedures in children. Dentists should be trained to use minimal amount of local anesthetic solution in children in order to minimize the post-operative aversive conditions and to build a good relation between the dentist and the child.

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