



Comparison between Pain-Control Using LLLT and NOS Analgesia in Children Being in Need for the Very First Local Anaesthesia

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Abstract

Aim: This was to compare the sensation of pain when the first local anaesthesia (LA) was performed following a LLLT or a NOS local analgesia complementary approach in preschool children.

Study design: Prospective randomised control study

Methods: 156 children were randomly selected for LLLT or NOS group. The LLLT group consisted of 78 children as well as NOS group. The children were aged between 48.0 and 54.0 months with a mean age of 52, 9 months. One operator carried out all local anaesthesia administrations. Pain sensation was rated using Wong-Baker modified facial image scale by the child.

Results: No statistical difference in pain sensation.

Conclusion: There was no difference in pain sensation experienced by children in LLLT protocol group and NOS group. The efficacy of LLLT analgesia and NOS analgesia before the very first local anaesthesia appears to be similar.

Keywords: Very First Local Anesthesia; Pain-Control; LLLT Analgesia; NOS Analgesia; Paediatric Dentistry

Introduction

In an exclusive private paediatric dental office, there are 2 ethical issues:

- The clinician may not be able to charge a fee to the parents if the procedure is not completed. "No cure, no pay" agreement is an old and no-written ethical principle.
- Performing and accomplishing a perfect dental procedure being limited by parental non-acceptance [1] to a narrow range of pharmacologic strategies for the child, there is a substantial risk of harming him by creating fear, or distrust or enforcing the tendency to avoid dental care [2].

Our determination for this study has reasons regarding the critical situations when:

- The parents were anxious about local anaesthesia for their child and they didn't accept relative analgesia (nitrous-oxide conscious sedation NOS for pain control in local anaesthesia as a completion of behavioural strategies
- The children were in need for restorative treatments under local anaesthesia (LA) for the very first time.

- The prevalence index in primary molars ($I_{p_{MT}}$) in Ro is 52, 3 [3] and 1/5 of children have dmft score over 6, it means a severe affection by caries and complications of caries. In this dramatic dental context, performing dental care is a challenge for a dentist without a wide array of behavioural and pharmacologic strategies.

The sensation of pain during local anaesthesia delivery (LA) is a major issue in Paediatric Dentistry especially when used for preschool children [4]. It is because of EAPD current understanding of paediatric oral health [5] that includes absence of dental fear and anxiety as well as healthy oral structures with the aim of forming the basis for good health throughout life. Moreover, the dental treatment and alleviation of dental pain is a basic human right that exist regardless of age. Therefore all children and their parents should expect pain free, high quality dental care. Till the "gold time" of "filling without drilling"- we have to educate and keep the patient capable of- and willing to utilize and cope with the current operative dental services and restorative treatments. Pain is recognised to have 2 dimensions: a sensory dimension (intensity) and an affective dimension (unpleasantness). The major one is mediated by serotonin, bradikinin, proteolysis enzymes and the second one is a sympathetic one (psychological one). NOS works on both components of pain and of great issue is to use NOS ethically and for this reason LLLT has a clinical benefit.

Relative analgesia via NOS is already well known technique throughout Europe. In 2006 the European Academy of Paediatric Dentistry conceived the guidelines on the use of conscious sedation. In Romania the start for studies and implementation of behaviour management and sedation in paediatric dentistry was in 2008 by Statov [6]. In Romania we use the French name MEOPA (mélange équimolaire oxygène - protoxide d'azot) instead of NOS -as a gratitude to the French "Victor Segalen" University who offered us training on this topic. The gas mixture was provided 5 years since 2008 to 2013 in these proportions (50% nitrous oxide, 50% Oxygen) following an official order by Linde Gas Budapest via Linde Gas Timisoara to Cluj Napoca -the city of the study. Nowadays the mixture is provided via Linde Gas Romania. Nitrous oxide is reliable in terms of onset and recovery as long as the patient accepts the nasal hood and breathes through the nose being useful in children 4 years and older as in our study. The objectives for sedation in paediatric dental care consider not just the child needs of but the dentist needs:

The child

- Reduce fear and pain.
- Facilitate coping with the treatment
- Prevent development of dental fear and anxiety

The dentist

- Facilitate accomplishment of dental procedure
- Reduce stress and unpleasant emotions
- Prevent "burn-out" syndrome.

There is a wide range of articles regarding usefulness of NOS in pain management as: [Bergia, JM 2007], [Annie Berthet, 2006, Jacobs., *et al.* 2003], [7]. The mechanisms of action for analgesic effect are acting on the opioid receptors or on $\alpha 2$ adrenergic receptors releasing endorphin peptides. Even the acceptance of nitrous-oxide sedation has increased among parents in recent years [1] in Romania; unfortunately, the socio-economic status or self-anxieties for a new technique are the reasons for often negative parental acceptance.

LLL (Low- Lever Laser Therapy)

Looking for alternative injection pain-control methods-that are under the control of the dentist [7] - we have chosen for a noninvasive, nonpharmaceutical, and economical LLLT application before LA. No side effects of such LLLT application has been reported yet. According to Tuner and Hode [2004] and to Gutknecht., *et al.* [2005] quoted by Olivi., *et al.* [8] LLLT have five main indications in Paediatric Dentistry. We are quoting just one: "A radiation dose of 2 J has a brief analgesic effect of the mucosa, allowing painless injection with a needle". We were inspired and encouraged by other studies regarding good acceptance of laser treatment by G. Olivi and M.D. Genovese [9], Luc Martens [10] and M. Vahid Golpayegany., *et al.* [11] regarding the performance of the pulpotomy in primary teeth using LLLT or LLLT in oncology children [R. Cauwels, [2008]. In 2000 we had acquired BTL 10 class III B

(Prague, Czech Republic) that delivers a large range of frequencies Claus and Nogier and the power is lower than 500mW (figure 3). In daily practice we didn't use this technique for children till these findings above. LLLT is acting by decreasing the local concentration of histamine, serotonin, and bradichinina, proteolysis enzyme-all responsive for pain-and by increasing local circulation. Another mechanism is a biochemical one in the membrane ionic balance: mitochondrial ATP will be increased and the K pump will block Na penetration in the cells. These biochemical modifications will delay the pain transmission to the central level [12]. BTL10 has a wide range of programs (see table 2). We have used the program 01, named "analgesia" in order to accomplish this study. The laser application was in pulsatile mode with a frequency of 10,0; the total energy of the spot, corresponding to two minutes and 25 seconds exposure, was 3.5 J/cm². The laser beam was delivered through a 0.5 mm-diameter optical fiber with the distance from the tip of the fiber to the stump being 1 cm. All patients and clinical staff were requested to wear appropriate eye protection goggles during laser application.

Materials and Methods

- **Study design:** The study was conducted as a prospective randomised control study. A written consent was obtained for every child from either the parent or guardian. Consent was also obtained verbally from the child regarding <sleeping a tooth>.
- **Sample size:** The study population consisted of 156 children aged between 48.0 months-54.0 months with the mean age 50.00 months. The MEOPA group consisted of 78 children (39 boys and 39 girls) and the LLLT group consisted of 78 children (39 boys and 39 girls).
- **Inclusion criteria:** There were children with no previous dental experience, in need of at least one restoration on the upper primary molars requiring LA, mentally capable of communication, satisfying the criteria of group I of the ASA guidelines as issued by the American Association of Anaesthesiologists [13].
- **Exclusion criteria:** These included medically and mentally compromised children, children with previous dental experience and children without consent from the parent or guardian.
- **Selection of the subjects:** Even our team prefers to use nitrous oxide conscious sedation in order to perform efficiently, successfully and psychologically safety for the child especially the first operative dental care session in children without previous dental experiences, we were compelled by circumstances to renounce many times in favour of other complementary pain-control methods as LLLT. In our clinic most patients are referred to us by a general dentist (without previous negative experiences) or with a dental trauma history. The children were positive (no any previous negative dental trauma) being in need for analgesia via local anaesthesia because dental treatments may be painful. Children were cooperating children

-they were familiar with dental. It is because emotions influence children's behaviour and play an important role in pain perception [14] However, paradoxically, patients often fear pain caused by anesthetic injections more than pain from dental treatment itself. Appropriate local anesthesia is necessary to reduce treatment-pain. In this study LLLT or NOS assisted Local anaesthesia is used in order to prevent local anesthesia-pain and however any negative experience.

All the children were all ASA I or ASA II –with normal pulmonary capacity

During 1 year we have selected the children without any previous negative experience following the attending order to our clinic- according with criteria above. However this selection could be of great aid to eliminate other factors controlling the pain components and put both methods fairly balanced in observation.

- **Parents issue:** In this study all the Parents manifest anxieties toward local anaesthesia procedure for their children.
- **Selection of the site:** The best chance of pain free injection is during the first injection, which should be given slowly at a "pain free" site (maxillary buccal infiltration) following the use of a topical analgesia [7]. Consequently, we have selected only maxillary teeth for LA.
- **Selection and conceiving the LA protocols:** The LA was performed by the same operator (the first author) with Articaine. Lidocaine is probably the most widely-used anaesthesia in dentistry but both articaine and lidocaine have demonstrated an adequate and similar safety and tolerability profile. However articaine is widely-used local anaesthesia solution in pediatric dentistry and faster in achieving the first signs of numbness. Because behaviour management techniques must always accompany the pharmacopoeia [2] we conceived a 2 sessions- plan in order to accomplish the treatment (Table 1). For the NOS group (figure 1) we have followed 2 sessions and 2x11 different sequences [15]. For the LLLT (figure 2) group we have followed 2 sessions, one of 11 sequences and another one of 12 sequences.



Figure 2: Pain Control for LA using Nitrous Oxide Sedation.



Figure 3: Pain Control for LA using LLLT.



Figure 1: BTL 10.

Session nr:	Protocol 1 : NOS group	Protocol 2 : LLLT group
Session 1	1. General introduction	1. General introduction
General introduction	2. Placement in the dental chair	2. Placement in the dental chair
	3. Tooth brushing	3. Tooth brushing
	4. Presentation of the instruments	4. Presentation of the instruments
	5. Presentation of the dental machine including the nasal hood for conscious sedation (as happy air)	5. Presentation of the dental machine including BTL 10 for LLLT (as a magic light)
	6. Habituation to the machine	6. Habituation to the machine
	7. Cleaning of all teeth with a rubber cup	7. Cleaning of all teeth with a rubber cup
	8. Caries recording	8. Caries recording
	9. Topical fluoride application	9. Topical fluoride application
	10. Radiography of a maxillar tooth being in need of restoration	10. Radiography of a maxillar tooth being in need of restoration
	11. Cas evaluation/form consent.	11. Cas evaluation/form consent.

Table 1: LA Protocols.

BTL 10 has a wide range of programs (See Table 2). We used the program 01, named “analgesia” in order to accomplish this study.

Program name	Pro no.	Density J/cm ²	Freq. Hz
Alveolitis	00	3.0	6.0
Analgia	01	3,5	10,0
Angulus infectiosus	02	1,6	5,2
Stomatitis afhtosa (1)	03	3.0	cont
Stomatitis afhtosa (2)	04	3,0	5,2
Caries dentis	05	2,0	3,3
Cicatrix cheloidum	06	3,0	5,0
Cicatrix recens (1)	07	4,0	cont
Cicatrix recens (2)	08	4,0	5,0
Contusio	09	3,0	10,0
Decubitus	10	2,0	6,0
Dentitio difficil.	11	3,0	5,0
Fractura analgezia	12	4,0	10
Gingivitis	13	3,0	5,0
Herpes (1)	14	3,0	cont
Herpes (2)	15	3,0	5,0
Hyperemia Pulpae	16	4,0	3,5
Hypersensibilita dentinae	17	2,0	9,0
M. Temporo.	18	4,0	9,0
Neuralgia n. trigem.	19	2,0	5,0
Parodontotis	20	3,0	5,0
Periodontitis	21	4,0	9,0
Postextractio	22	3,0	10,0
Preparatio	23	1,0	8,0
Pulpa aperta	24	4,0	3,5
Pulpitis	25	3,0	10,0
Sanatio postoperator	26	3,0	5,0

Table 2: BTL 10 Programs list for Dentistry.

The laser application was in pulsatile mode with a frequency of 10,0; the total energy of the spot, corresponding to two minutes and 25 seconds exposure, was 3.5 J/cm². The laser beam was delivered through a 0.5 mm-diameter optical fiber with the distance from the tip of the fiber to the stump being 1 cm. All patients and clinical staff were requested to wear appropriate eye protection goggles during laser application.

Rating the pain sensation

The Wong-Baker Faces Pain Scale [Wong DL, Baker CM. 1988] was used to rate each patient’s pain sensation (Figure 4). Children were instructed immediately after the injection to mark the face that express his/her discomfort from the injection and every child completed the test after LA. (table 3). This scale was used for a study regarding the laser acceptance of hard and soft tissue therapy in paediatric dentistry M.D.Genovese, G Olivi [9].

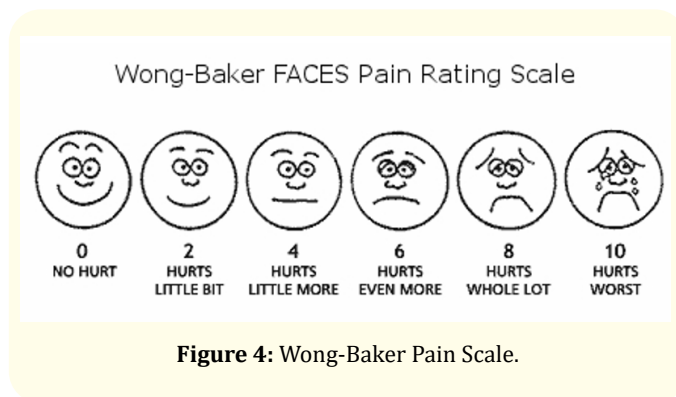


Figure 4: Wong-Baker Pain Scale.

Statistical analysis

Descriptive statistics was used. The two sample t-test was used in statistical analysis of data to compare the mean value of variables pain sensation for two groups. Data was entered into the SPSS statistical program version 11.00.

Results

General results

Each child rated his/her perception of pain using the Wong-Baker Pain Scale. See the table 3.

Wong-Bank FACE PAIN SCALE	Protocols		
	LLLТ	NOS	Total
0	61	58	119
2	14	16	30
4	2	4	6
6	1	0	1
8	0	0	0
10	0	0	0
TOTAL	78	78	156

Table 3: Pain sensation.

Pearson coefficient 0,1089 confirms no relation between protocols and pain sensation.

Discussions

Althought the two groups in this study were not sex mached- the results showed no difference in pain sensation between boys and girls. Ram and Perez findings [2002, 2003] quoted by Tahmassebi [4] are similar. When comparing the pain sensation between groups- no statistical difference was found (Figure 5).

Sources of bias and commentaries

- The dialogue even standardized was adapted according the personality of the child.
- The protocols were almost similar but we have spent more time for dialogue (2 dialogue steps more) for each child of LLLT group. We have considered beeing important to prevent and control the pain and anxiety (out-with the issue of this study) in LLLT group by an enjoyable dialogue, sometimes including the parents.

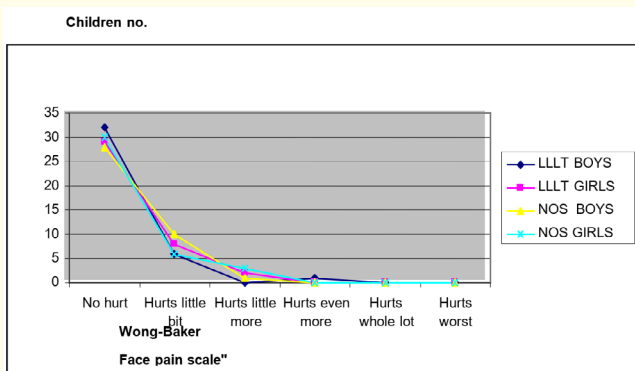


Figure 5: Graph showing children’s pain sensation regarding protocols and children sex.

- However we are convinced that the best moment to prevent pain and anxiety is former not after the intervention. Consequently we have calculated all the possible risks for pain. Pre-injection diffusion is a prudence. Other example: the anaesthesia solution have to be free in epinefrine at least for the initial injection [7] as we have performed.
- For the NOS group we have performed a supplementary treatment and injection in order to perform all the treatments of the quadrant. For the LLLT group we were content to accomplish the restoration just for a tooth.
- In the office rooms were we have performed the protocols are the screens for Cartoons. Sometimes children asked us this special service. It is a kind of behavior management: distraction of attention. However we have chosen to bias the study than to refuse them.
- The homogeneity of the sample was regarding the age and no previous (negative) experiences. Visiting for the first time the dentist at 4 years old is late but we can expect and enjoy from a better cooperation than from a child 3 years old or younger. The question is : can we choose for the LLLT alternative for children 3 years old or younger ?
- The operator who performed the injection has 20 years experience in Dentistry and is graduated in Psychology. The implicit knowledge in psychology could be a bias in dialogues and study [16].
- Some children were tested for anaesthetic solution sensitivity before LA. This test procedure could be a bias for children who rated the pain sensation as „hurts little more“. The anticipation of pain prior LA influences the pain reported [17].
- Some children have asked to be kept in mother’s arms and we allowed them.
- What is happening in Paediatric Dentistry Emergency department regarding this approach? For pain control in local analgesia we can replace conscious sedation with LLLT analgesia?

Considerations

Despite the gaps in knowledge, pain should be treated with the most up-to-date evidence in children. In order to Implement a pain-free clinical practice.

There is important to include all of techniques available within the literature- their rationale, indications and contraindications in order to perform a evidence-based Paediatric Dentistry.

Further research is need to investigate whether or not there is a difference in pain control and sensation during local anaesthesia using the LLLT or NOS protocols [18-23].

Conclusion

There was no difference in pain sensation experiented by children in LLLT protocol group and NOS group.

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No any financial support or sponsorship.

Conflicts of Interest

There are no conflicts of interest.

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