

Evaluation of pulpal anesthesia in pediatric patients following intraligamentary injection as a primary technique in permanent mandibular molars with irreversible pulpitis: An in vivo study

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Abstract:

Background: Pain management is a crucial aspect of pediatric dentistry. There is a lot of fear and anxiety associated with administration of local anesthesia in children but it is the most exercised and proved to be the most reliable method to manage pain and achieve analgesia in a particular region of the jaw. Use of local anesthesia in children has to be done judiciously right from choosing the local anesthetic drug, amount of local anesthetic used and the technique used to administer local anesthesia. **Methodology:** 24 Patients reporting to the Department of Pediatric and Preventive Dentistry, where 12 patients were administered two site and other 12 patients were administered four site intraligamentary injection as a primary technique in permanent mandibular molars with irreversible pulpitis. **Results:** In this study two different sites for intraligamentary injection were compared and the two site technique did not achieve complete anesthesia and had to be supplemented by inferior alveolar nerve block in all patients. In four site technique 3 out of 12 patients experienced complete anesthesia. The difference in the pain perception in two groups All patients experienced less pain in four site as compared to 2 site injection during RCO. **Conclusion:** Inferior alveolar nerve block still remains the “Gold standard” to treat mandibular molars with irreversible pulpitis. If the IANB is not adequate, it can always be supplemented by the intraligamentary injection (or other supplemental injections) and achieve better pain control when using manual conventional systems.

Keywords: Local anesthesia, Intraligamentary anesthesia, Two site injection technique, four site injection technique, Pharmacological behavior management.

Introduction:

Pain management is a crucial aspect of pediatric dentistry. There is a lot of fear and anxiety associated with administration of local anesthesia in children but it is the most exercised and proved to be the most reliable method to manage pain during endodontic procedures in a particular region of the jaw. The inferior alveolar nerve block (IANB) is the most commonly used as a primary injection technique for achieving local anesthesia of mandibular molars. Inferior alveolar nerve block has proved to have limitation such as incomplete anesthesia and soft tissue injury especially in children. To overcome the limitations of the

inferior alveolar nerve block, supplementary injection technique such as intraligamentary injection technique could be used. The aim of this study is to evaluate pulpal anesthesia in pediatric patients following intraligamentary injection as a primary technique in permanent mandibular molars with irreversible pulpitis.

Materials and Methods:

The study was approved by the Research and The Ethical Committee of Bharati Vidyapeeth Dental College and Hospital, Pune. Written informed consent was obtained from the parents of all the subjects with detailed explanation of the procedure, risks and benefits. 24 Patients within the age group

8-12 years old reporting to the Department of Pediatric and Preventive Dentistry in Bharati Vidyapeeth Dental College and Hospital, Pune were included in this study. The sample was randomly divided into two groups corresponding to the two-site method injection technique and four-site injection technique.

Inclusion Criteria:

- Healthy (ASA class I) patients in the age group 8-12 years.
- Cooperative and able to communicate well (Frankel behavior rating scale 3 or 4)
- Deep carious lesion on the tooth with irreversible pulpitis.
- Positive response to Electric Pulp test.

Exclusion Criteria:

- No response to Electric Pulp test.
- Clinical and radiographic signs of necrosis in the tooth.
- Known allergy to local anesthetic and contents of the solution.
- Medically compromised patients.
- Children on drugs for any type of systemic disease.

Materials used:

Dental aspirating metal syringe (Septodont), 31 gauge ultra-short 10 mm needle (Septodont) ,2% Lignocaine HCL 1:80000 adrenaline cartridges (Septodont)(1.8ml), Benzocaine 20% topical anesthetic gel (Septodont), Cotton tip applicator, Gauge pieces and cotton. (Figure 1)

Clinical procedure:

Patients diagnosed with permanent mandibular molars with irreversible pulpitis will be included in

the study. Clinical and radiographic diagnosis of the concerned molars will be done. Electric pulp test will be performed to check the positive response of the tooth. Patients will be asked to do a 60 seconds betadine mouth rinse. The patients will be randomly divided into two groups according to the type of technique used. Group A: Two site Intraligamentaryinjection technique and Group B: Four site Intraligamentary injection technique

Group A (Two-site intraligamentary injection technique):

- The tooth of concern and soft tissue around it was dried out using cotton gauze piece and then topical anesthesia gel (Figure 2) was applied on the gingiva surrounding the tooth using cotton tip applicator.
- The needle was injected at approximately 30° to the long axis of the tooth at the mesiobuccal and the distobuccal aspect of the roots to maximum penetration, until wedged between the tooth and the crestal bone
- Anesthetic solution (0.4 mL) was injected at each location. (Figure 3)post which patient was asked to rate Pin during injection using Wong Baker FACES pain rating scale.
- Access cavity was prepared after waiting for 1-2 minutes for onset.
- Patients were instructed to report any experience of pain/discomfort during the access cavity preparation.
- Wong Baker FACES pain rating scale (Figure 4)was used and the patient was asked to point out the on the scale their experience.
- The success of the pulpal anesthesia was determined.
- If pulpal anesthesia was achieved further treatment was carried out.
- If pulpal anesthesia was not achieved supplemental anesthesia using IANB was

provided and further treatment was carried out.

- Anesthetic solution injection dosage did not cross Maximum recommended dose calculated for the child

Group B (Four site intraligamentary injection technique):

- Similar steps will be carried out in this group, only 2 additional injection sites were added. The sites where local anesthetic (0.4ml) was injected were mesiobuccal, distobuccal, mesiolingual and distolingual aspect of the roots to maximum penetration, until wedged between the tooth and the crestal bone.



Figure 1: Materials used for the study.





Figure 2: Topical anesthetic gel (20% Benzocaine) application



Figure 3: Intraligamentary injection technique.

Wong-Baker FACES™ Pain Rating Scale



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Figure 4: Wong Baker's FACES Pain Rating Scale.(WBFPRS)**Results:**

A total sample of 24 patients in the age group 8-12 years were selected. The patients were randomly divided into Group A and Group B. Data was obtained and analyzed using SPSS v20 software, keeping the level of significance at 5%. First the comparison between pain on perception of injection was evaluated where mean WBFPRS for 2 site technique was 4 and for 4 site was 4.67. which compared during RCO where in 2 site there was significant increase in 2 site as mean WBFPRS score was 8.17 where in 4 site was 5.83. (Table 1)

Table 1: Evaluation of change in WBFPRS within each group (Wilcoxon signed rank test; * indicates significant difference at $p \leq 0.05$)

Group	During injection		During RCO		Difference	p value
	Mean	SD	Mean	SD		
2 site	4.00	1.91	8.17	1.29	-4.17	0.003*
4 site	4.67	1.78	5.83	3.76	-1.16	0.277 (NS)

In inter group comparison the pain during injection in two site was 4 and four site was 4.67 which indicated no significant difference between pain perception. While during RCO in two site the mean WBFPRS 8.17 and four site was 5.83 which indicates nonsignificant difference in pain perception but also indicates that more pain was felt during RCO in two site technique.

Table 2: Comparison of WBFPRS between two groups (Mann whitney test; NS: Non-significant difference)

Group	2 site PDL Injection		4 site PDL Injection		Difference	p value
	Mean	SD	Mean	SD		
During injection	4.00	1.91	4.67	1.78	-0.67	0.334 (NS)
During RCO	8.17	1.29	5.83	3.76	2.34	0.111 (NS)

In this study two different sites for intraligamentary injection sites were compared and the two site technique did not achieve complete anesthesia and had to be supplemented by inferior alveolar nerve block in all patients. In four site technique 3 out of 12 patients experienced complete anesthesia. The difference in the pain perception in two groups All patients experienced less pain in four site as compared to 2 site injection during RCO.

Table 3: Comparison of supplemental IANB required among two groups (Chi-square test; NS: Non-significant difference)

Group	Supplemental IANB				p value
	Yes		No		
	N	%	N	%	
2 site PDL Injection	12	100	0	0	0.217 (NS)

4 site PDL Injection	9	75	3	25	
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Discussion:

The mandible mainly uses block anesthesia instead of infiltration anesthesia due to close bone mineral density, limited access to the inferior alveolar nerve, and anatomical variation. However, the success rate of conventional inferior alveolar nerve block (IANB) is only 80–85%. (2) As a result, different anesthetic methods have been devised to replace conventional IANB.

The inflamed pulp can be either be acute symptomatic (reversible, irreversible) pulpitis or chronic pulpitis. Among them, treating acute symptomatic irreversible pulpitis (ASIRP) is much more difficult. Local anesthesia can be achieved by two ways either through primary anesthetic techniques such as different nerve blocks or secondary anesthetic techniques like Intraligamentary, (PDL,ILI) intraosseous (IO) intra-pulpal, intra- septal Injections(3) In pediatric patients, to achieve inferior alveolar nerve block is even more difficult in permanent mandibular molars due to inadequate development of apex and the neural innervations. Intraligamentary injection technique otherwise known as(peridental or Periodontal ligament injection) was introduced by Cassamani et al in 1924.Malamed reported a 50% success rate in endodontics when the intraligamentary injection was used as a primary technique while using conventional technique. (4) The intraligamentary injections have proven to have less pain rating scales as compared to inferior alveolar nerve blocks (5,6,7). hence in this study the pain perception and its efficacy in the endodontic procedures were evaluated.

Intraligamentary injection was used as a primary anaesthetic technique to anesthetize 20 vital mandibular molars that needed endodontic treatment and was compared to the pulpal anesthesia of 20 mandibular molars anesthetized using the inferior alveolar nerve block technique. Pain perceived by the patient was recorded based on VAS. Lesser discomfort was associated with the intraligamentary injection technique. Which correspond to our study which also showed less pain scores during injection(7). The success rate of intraligamentary injections (ILI) using a two- or

four-site injection technique. One hundred and fifty-one mandibular molars diagnosed with asymptomatic irreversible pulpitis received ILIThe data were analysed by means of the Fisher's exact and Pearson's chi-square tests. IL anaesthesia was successful for 92.1% of the teeth. Forty-eight teeth (31.8%) were sufficiently anaesthetized using the two-site ILI and 91 teeth (60.3%) following supplemental IL anesthesia in two more sites. The results of this study indicate that the use of four-site IL injections as a primary anesthetic technique may be considered a favorable alternative to the common IANB.(8) In this study a different system of anesthetic technique (C-CLAD) was used hence showed more efficacy than the conventional one in achieving pupal anesthesia. The type of topical anesthetic also makes a difference in discomfort during. The study to compare and evaluate the effectiveness of topical anesthesia on needle insertion pain during administration of local anesthesia. Twenty percent benzocaine showed better results than 2% lignocaine in reducing the needle insertion pain. Hence Benzocaine was preferred over lignocaine in our study.(9)

Since the subjects are children and the reliability of the experience can differ greatly because children may exhibit lower threshold than adults and hence can be justified by the results in our study. It must also be emphasized that the comparisons between different studies are difficult due to variable procedural factors. Factors possibly associated with pain experience during the administration of local anesthetic such as, the type or the amount of local and topical anesthetic solution, apparatus used, temperature of the injection solution, injection rate, site of injection, and the experience of the dentist.(10,11,12)

Conclusion:

Inferior alveolar nerve block still remains the “Gold standard” to treat mandibular molars with irreversible pulpitis. If the IANB is not adequate, it can always be supplemented by the intraligamentary injection (or other supplemental injections) and achieve better pain control when using manual conventional systems. Widely used conventional local anesthetic delivery is far more cost effective and still widely used as compared to

computer assisted expensive anesthesia delivery systems. Ultimate GOAL is to provide good pain control and instill a positive attitude child during any kind of dental treatment.

Conflict of interest:

There are no conflicts of interest.

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