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Comparative evaluation of the effect of IANB and Ancillary Intra- ligamentary injections in pediatric patients with deep carious lesions in permanent mandibular molars

Dinesh kumar[1], Vignesh Ravindran[2]*, Ganesh Jeevanandan[3], Lavanya[4], Rajasekar[5]

[1]Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai 600077.

[2]Reader, Department of Pediatric and Preventive dentistry, Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai 600077.

[3]Reader, Department of Pediatric and Preventive dentistry, Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai 600077.

[4,5]Senior Lecturer, Department of Pediatric and Preventive dentistry, Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Saveetha University, Chennai 600077.

***Corresponding author:** Vignesh Ravindran, Reader, Department of Pediatric and Preventive dentistry, Saveetha Dental College and hospitals, Saveetha Institute of Medical and Technical sciences, Email : vigneshr.sdc@saveetha.com

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ABSTRACT

Aim: The goal of this study was to investigate the effects of three types of preoperative pulpal anesthesia in the deeper lesion permanent mandibular teeth of pediatric patients: (1) inferior alveolar nerve block (IANB); (2) Ancillary intraligamentary injection (SII); and (3) Anaesthetic for the pulp during invasive Dental Surgery.

Materials and methods: In the beginning, IANB is utilized to numb the important permanent mandibular molars that had significant cavities. When the molar failed to respond to sensitivity tests used to gauge the effectiveness of the pretreatment pulpal anesthetic, the procedure was deemed successful. When pretreatment pulpal anesthesia failed, a SII was given and the state of the anesthesia was reviewed. There could be a total of three SIIs. When the patients' assessed Wong-Baker FACES Pain Rating Scale was no higher than four during surgery, pulpal anesthesia was determined.

Results: Patients between the ages of 10.9 sixty molars. Following IANB, 26.7 percent of preoperative pulpal anesthetic procedures were successful. SIIs were used in circumstances where the IANB had failed. Preoperative pulpal anesthesia had an 80 percent total cumulative chances of success. The success rate of Anaesthetic for the pulp during invasive Dental Surgery was 72.9 percent.

Conclusion: In immature permanent teeth with severe cavities, pulpal anesthesia by the inferior alveolar block had a low rate of success. Preoperative pulpal analgesia can be significantly improved with an additional intraligamentary injection, however 27.1 percent of patients reported discomfort throughout treatment.

Keywords: *Lignocaine, Immature permanent teeth, Pulpal anesthesia and IANB*

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INTRODUCTION

Pulpal anesthesia is not always guaranteed by soft tissue anesthetic, and insufficient pulpal anesthesia might lead to an unpleasant, upsetting experience . This could result in patients, especially young ones, developing a bad attitude against receiving further dental care (1,2). The most popular technique for anesthetizing mandibular teeth is inferior alveolar nerve block (IANB), but there is currently little proof that it is effective for numbing juvenile patients' deep carious lesions in the permanent mandibular molars. The majority of earlier investigations on IANB pulpal anesthesia were conducted on persons who are more than 18 years of age with irreversible pulpitis, with success rates ranging from 10 to 75%. However, the efficacy of a pulpal anesthetic may be impacted by variations between juvenile and older permanent teeth(3) . Due to the younger teeth's bigger dentinal tubules, they appear to respond to inflammation more strongly in the pulp than adult teeth (1) . Additionally, because of its increased innervation, the juvenile pulp can be particularly sensitive, and even little injury or inflammation can have an impact on its reactions. According to earlier studies, pulpal anesthesia was attempted to be more effective by adjusting the local anesthetic agents, adding more fluid, using adjunct drugs, and giving additional injections (4). Ancillary intra- ligamentary injections (SII) have received the most investigation for people who failed IANB because of its many advantages (5). First, a SII often begins immediately to rapidly, usually within 30 seconds. In permanent teeth with irreversible pulpitis, SII has been shown to significantly improve pulpal anesthetic success rates, which have been observed to range from 48 to 70%. Additionally, it is practical to deliver a SII under rubber dam isolation, particularly during pulp treatment.

In order to numb a molar, local anesthetic solutions can be administered intraosseously (IO) through into cancellous adjacent to the tooth (6). The anesthesia is just delivered to that specific tooth, therefore the soft tissue surrounding it shouldn't be affected. Success rates have been reported to range from 41% to 96% depending on the tooth, pathologies, treatments, and assessments (7). These studies showed that IO intravenous injection is an effective primary or adjunctive local anesthetic delivery route in individuals with a low risk of self-biting soft tissue trauma (8). Thus, intraosseous injections may also be a useful substitute for conventional infiltration methods in young patients. Anatomical differences, supplementary innervation, and neurovascular physiologic reactivity in conjunction with acute pulpal irritation are the causes of anesthetic failure.

Numerous methods have been employed to raise the performance level of IANBs in these circumstances, including the use of modified methods designed to target specific anatomical landmarks, altering the type and/or quantity of the anesthetic solution, using mepivacaine to circumvent TTX-resistant receptors, prescribing an oral premedication of NSAIDs or corticosteroids, using carbonated solutions, cryotherapy, low-level laser therapy (LLLT), and administering supine (9). Recent systematic reviews including meta-analyses and trial sequencing analyses found that teeth with SIP did not always achieve 100% anesthetic effectiveness, and they advised using additional procedures to induce pulpal anesthesia when IANB failed (10). The goal of this study was to investigate the effects of three types of preoperative pulpal anesthesia in the deeper lesion permanent mandibular teeth of pediatric patients: (1) inferior alveolar nerve block (IANB); (2) Ancillary intraligamentary injection (SII); and (3) Anaesthetic for the pulp during invasive Dental Surgery

MATERIALS AND METHODOLOGY

The Saveetha Dental College's ethics committee in Chennai, Tamil Nadu, gave its approval to this study. Both pediatric patients and their primary caregivers received an explanation of the study's specifics. Patients and primary caregivers signed written consent and assent forms, respectively, if they consented to participate. Our team has extensive knowledge and research experience that has translated into high quality publications(11–20).

Study size

The Study size estimation depends on an investigation in which they observed 32 to 84 % effectiveness using pulpal anesthesia with various supplementary LA techniques after the inability of IANB in healthy individuals aged 18 or older. In the investigation, teeth with irreversible pulpitis were examined. With a 10 percentage difference limit and a 0.05 significance level, 52 to 96 teeth were required. There were 60 teeth in this examination.

Inclusion and Exclusion Criteria

Patients had to meet the following requirements in order to be considered:

(1) they had to be between the ages of six and eighteen;
(2) Did not have any hypersensitivity to Lidocaine or any anesthetic agent components;
(3) Did not consume any analgesic medications on the day of treatment;
(4) Cooperative as well as capable of communicating well (scoring 3 or 4 on Frankl Behavior Rating Scale);
(5) Permanent mandibular teeth with a deep carious lesion that extends into the dentine by at least one-third of its thickness
(6) Cold testing was done using Endo Ice and positive results should be present.

The Facial Image Scale was used to assess each participant's level of fear and anxiety before therapy (FIS). From a highly cheerful face to a very unpleasant one, there are five faces in the FIS. The children were told to point at the face that most accurately depicted their emotions. Four percent articaine with one in 100,000 epinephrine was the anesthetic used throughout the entire experiment. Figure 1 shows a flowchart for the study.

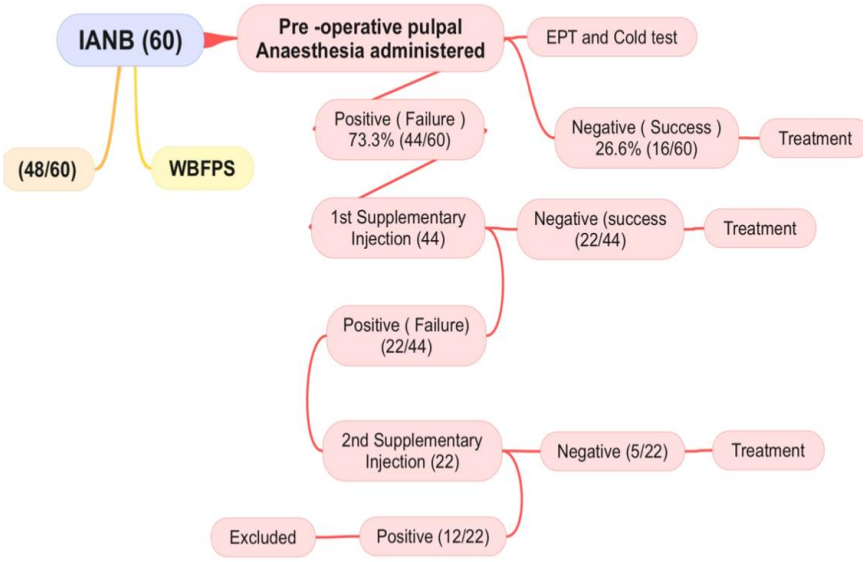

FIGURE 1: Flow Chart of the study

The first anesthetic solution deposit was a three-quarter cartridge. The confirmation of lip and tongue anesthesia came after a 15-minute waiting time. A maximum of two injections of IANB might be administered again if there was no lip and tongue anesthetic. If there was soft tissue anesthesia, Cold test with ENDO ICE and the electrical pulp test were used to further check the molar for preoperative pulpal anesthesia (10). The success of preoperative pulpal anesthesia was determined to be two consecutively negative outcomes for both tests.

When IANB was utilized to achieve preoperative pulpal anesthesia, a prolonged buccal nerve block was employed to inject a one-quarter cartridge of

anesthetic solution, numbing the buccal soft tissue and enabling the application of a rubber dam clamp. After installing the rubber dam clamp, treatments may start (21). If preoperative pulpal anesthesia attempted to occur after this IANB, as demonstrated by a positive response to pulp tests, SIIs were administered using 0.4 ml of anesthetic agent and 0.2 ml at the mesial and distal aspects using a pressurized syringe (22) . The preoperative pulpal anesthesia was then verified once more.

A maximum of 3 SIIs may be given. A lengthy buccal nerve block was used to inject a one-fourth cartridge of anesthetic fluid into the buccal soft tissue after the preoperative pulpal anesthesia was successful. After that, the rubber dam clamp was positioned, and treatment started. Teeth having three SIIs and preoperative pulpal anesthetic failure were eliminated. Then, the preoperative pulpal response was checked again. A maximum of 3 SIIs may be given. A lengthy buccal nerve block was performed to inject a one-fourth cartridge of anesthetic fluid into the buccal soft tissue after the pretreatment pulpal anesthesia was successful. After that, the rubber dam clamp was positioned, and treatment started.

Three SII teeth and failed preoperative pulpal anesthesia were excluded. Successful operational pulpal analgesia was defined as the WBFPS score being four or lower. If the case had failed and the WBFPS score was six or above, additional injections, such as an intrapulpal injection, were given. However, the analgesic solutions must not exceed the upper dose estimate (7 mg per kg but not in excess of 500 mg).

Statistical Analysis

Percentages were used to describe the effectiveness of pre- and intraoperative pulpal anesthesia. A multivariate logistic using generalized estimating equations (GEE) model is employed to ascertain the link between both the volume of administrations and diagnosis and the effectiveness of preoperative pulpal anesthetic. This was carried out because numerous measurable data for further injections were used to evaluate the efficacy of preoperative pulpal anesthetic. The frequency of doses was controlled for potential confounders in multivariate analyses. Fisher's exact test was used to compare intraoperative pulpal anesthesia among different diagnoses with a significant level of P >.05.

RESULTS

In this study, 60 severe pulpal lesion permanent mandibular molars from 53 healthy patients were examined 58 permanent first molars and 2 permanent second molars (27 were men and 26 were females) aged 7 to 18 (mean equals 10.9 years old). 28.3% of the teeth had reversible pulpitis, 23.3% had irreversible pulpitis, and 48.4% of the teeth had normal pulp. The majority of people (84.5%) said they were not worried at all.

Pre-Operative Phase

93.3 percent of IANB soft tissue anesthesia procedures were successful (56 out of 60). In four cases, IANB was re-administered; all patients thereafter experienced tongue and lip numbness before pulpal anesthetic tests. The treatment outcomes of preoperative pulpal anesthesia for various pulpal diagnoses are displayed in Table 1 below. After IANB, 26.7% of pulpal anesthetic procedures were successful. (16 out of 60). Among molars with reversible pulpitis, the preoperative pulpal anesthetic overall performance was 11.8% (two out of 17), for tooth with pulpitis, it was 21.4% (three out of 14), and then for teeth with healthy pulp, it was 37.9% (11 out of 29). The first SII raised the preoperative pulpal anesthetic clinical outcomes for teeth by 36.7 %, 24.2 %, 47.0 %, and 50.0 %, respectively, for all diagnosis, healthy pulp, recoverable pulpitis, and chronic pulpitis. The second SII increased the preoperative pulpal anesthetic rates of success for molars with all diagnoses, normal pulp, and recoverable pulpitis to 8.3%, 6.9%, and 17.6%, respectively. When applied to teeth with irreversible pulpitis, the second SII had no more success.

The third SII increased the preoperative pulpal anesthetic success rates, respectively, to 8.3%, 10.3%, and 11.8 % for molars with all signs, healthy pulp, and curable pulpitis. The third SII

had no greater effect on success rates in molars with irreversible pulpitis. The overall success rate of preoperative pulpal anesthesia was 80%, 79.3%, 88.2%, and 71.4 percent, correspondingly, for teeth with all diagnoses, normal pulp, reversible pulpitis, and persistent pulpitis.

TABLE 1: Pre - operative Pulpal Local anesthetic Effectiveness For Various Pulpal Diagnosis

Injection	All diagnosis	Normal pulp	Reversible pulpitis	Irreversible pulpitis
IANB	16(26.7%)	11(37.9%)	2(11.8%)	4(21.4)
IANB + 1S	22(36.7%)	7(24.2%)	8(47.0%)	10(50.0)
IANB + 2S	5(8.3%)	2(6.9%)	3(17.6%)	-
IANB + 3S	5(8.3%)	3(10.3%)	2(11.8%)	-
Overall Success	48(80%)	23(79.3%)	15(88.2%)	14(71.4%)
Total	60 teeth	29 teeth	17 teeth	14 teeth

Success Of Preoperative Pulpal Anesthesia For Different Pulpal Dia

Intra-Operative

The intraoperative phase comprised 48 teeth that had received effective preoperative pulpal anesthetic. The overall performance of pulpal anesthesia After Dental Procedure was 72.9 % for all diagnosis; it was 87 %, 66.7 %, and 50 %, accordingly, for teeth with normal pulp, reversible pulpitis, and irreversible pulpitis. There was no noticeable difference in intraoperative pulpal anesthetic success among molars with differential diagnoses (P=0.07).

DISCUSSION

As far as we are aware, this study is the first to examine the effects of pulpal anesthetic on permanent teeth in children and teenagers with serious caries. The results revealed no statically significant distinctions between the two diagnoses and a 26.7 % rate for preoperative pulpal anesthesia following IANB in deep lesion molars for all diagnosis (23)

According to Zero et al., dental caries can produce pulpal irritation prior to the entry of bacteria into the pulp, and the inflammatory stage of the pulpal process seems to be more frequent in developing teeth(24) . The subjects of the research were young kids with underdeveloped pulps, with a mean age of 10 years (25). Young adult teeth have wider dentinal tubules than adult permanent dentition, which makes it easier for bacterial metabolites to diffuse through (26) . Younger pulp is also more responsive to unpleasant stimuli because it has more innervation and less fibrous tissue and calcification. Previous IANB trials on pulpal anesthesia mostly targeted teeth in individuals over the age of 18 with irreversible pulpitis and revealed a wide range of effectiveness between 10 and 75%(7,27) . Since diverse studies' methodologies make it impossible to directly compare them, additional research into how aging affects pulpal anesthesia is strongly advised (28) . The degree of patients' dread and anxiety is another potential factor that should not be disregarded in the analysis of low pulpal anesthetic success. According to Klingberg et al.Five to twenty percent of young people experience dental anxiety (29) . As a result, children may report erroneous pulpal anesthesia as a result of false negative or false positive responsiveness test results. However, the majority of our patients (84.5%) had just minor to no fear, and all of the participants had to cooperate in order to be enrolled in our study (30)

The overall performance of pulpal anesthesia, according to Mikesell et al., was only 40 to 50% after 15 minutes of IANB dosing, and 11 to 12% of their individuals experienced a sluggish start of pulpal anesthesia. As a result, it's probable that some of our individuals experienced a sluggish onset of anesthesia of the pulp for more than 15 minutes before it was determined that they had anesthetic failure (31) . Clinicians should be always alert for inadequate IANB pulpal anesthesia. One must therefore get ready for Ancillary injection.

Due to its quick to faster onset, frequent and frequently profound effective pulpal anesthesia, and simplicity of administration under rubber dam isolation, a Supplemental II Injection was chosen as a supplemental technique in this experiment (32). The method does not necessarily need specialized equipment, as past research has shown that the type of needle did not influence the success of Supplemental injections. The pressurized intraligamentary syringe was utilized in this investigation to save labor (24). However, Supplemental II injections have a number of disadvantages, such as their relatively short duration of pulpal anesthetic (30 to 45 minutes), hazards of bacteremia and damage to the needles and syringes. and potential for discomfort both during and after the injection. These effects, though, have never been seen in people(33). It has been demonstrated that a Supplemental II Injection in primary molars is associated with hypomineralization in adult teeth. Prior to beginning treatment, the researchers used both methods of pulp testing in an effort to validate pulpal anesthesia because an affirmative pulp response to either a cold fluorescence probe or an EPT indicates that the molar also isn't completely pulpally sedated (34). The outcomes of this trial, however, supported the findings of other earlier studies in that they did not provide an assurance that a negative pulp test result prior to surgery would result in complete intraoperative pulpal anesthesia. In this study, 72.9 % of the Restored teeth experienced successful pulpal anesthesia during therapy.

In 87 percent, 66.7 percent, and 50 percent of cases, respectively, pulpal anesthesia was extremely effective in treating molars with intact pulp, reversible pulpitis, and irreparable pulpitis. The effectiveness of the treatment appeared to decline with the severity of pulpal irritation, despite the differences not being statistically significant. When the central pulp regions, which are abundant in C fiber pain receptors, are not activated, partial pulpal anesthesia is predicted and diagnosed.

When stimulated thermally or electrically, the neuropathic terminals of the pulp (A-fibers) can produce a hostile response (35). A relatively low pH level, increased prostaglandin E2 level, increased vasodilation, and inflammation of the dental pulp, particularly in deepest pulpal tissues, could further explain the reduced success rates. Future research should examine procedures that are more reliable and capable of foretelling pulpal anesthetic failure. Additionally, further research should be done on ways to enhance pulpal anesthetic delivery techniques.

CONCLUSION

Regardless of their diagnosis, IANB commonly lead to insufficient pulpal analgesia in young permanent mandibular teeth with significant cavities. 27.1% of patients reported experiencing discomfort after surgery, despite the fact that the amount of preoperative pulpal anesthetic can be greatly increased with a supplementary intraligamentary injection. It appears insufficient to conduct a sensitivity test to determine whether the inflammatory pulpal tissue is pulpal anesthetic.

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