Comparative Evaluation of Behavioral Efficacy of 4% Articaine With 24 Gauge Needle in Buccal Nerve Block Compared to 2% Lignocaine With 20 Gauge Needle in Inferior Alveolar Nerve Block in Children With Dento - Alveolar Abscess

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Abstract

Introduction: Pain management in pediatric dentistry is crucial for alleviating anxiety and facilitating successful dental procedures. This study aims to compare the anesthetic efficacy of 2% lignocaine with a 20-gauge needle in Inferior Alveolar Nerve Block (IANB) and 4% articaine with a 24-gauge needle in Buccal Nerve Block (BNB) during dento-alveolar abscess extraction, assessed using the Frankl Behavior Rating Scale.

Method: A 12-month randomized controlled trial involving 100 pediatric patients aged 5 to 11 was conducted. Patients were randomized into two groups receiving either lignocaine or articaine as local anesthetics. Behavior assessments were performed during injection and extraction procedures using the Frankl behavior rating scale. Post-operative evaluations were conducted after 24 hours.

Result: Results indicate no significant difference in behavior responses between the IANB+LI and BNB+LI techniques during both injection and extraction procedures. Both

techniques effectively managed behavior during pediatric dental procedures, with slight variations observed between injections and extractions.
Conclusion: In conclusion, both IANB+LI and BNB+LI techniques demonstrate comparable efficacy in managing behavior during pediatric dental extractions. The study provides valuable insights into optimizing local anesthetic techniques to enhance the dental experience for pediatric patients.
Keywords: Lignocaine, Articaine , Frankl Behavior Rating Scale

INTRODUCTION

Local anesthetics offer patients pain-free dental care while lowering patient apprehension and anxiety. [(1)] Pain management in dentistry is crucial for lowering the anxiety and fear related to dental operations. Dentistry relies heavily on local anesthetics to manage pain, and there is a lot of ongoing research in developing safer and more potent local anesthetics. [(2)]

Pediatric dentists frequently deal with anxiety in their patients because young patients frequently refuse dental care out of fear of pain and damage. This anxiety is associated with unfavorable consequences, including a poor family attitude, a fear of pain and trauma, and the sense of unsatisfactory dental therapy.

Carticaine Hydrochloride, first created in Germany in 1969, was first used for deep anesthesia in dental procedures. Clinical trials in 1971 demonstrated its effectiveness, with 2% articaine with 1:1,000,000 adrenaline outperforming 2% lignocaine. In 1984, it was rebranded as articaine. The US FDA approved Septocaine in 2000. [(3)]

Lignocaine, an amide local anesthetic, was first introduced in 1948. [(2)] It is available in various forms and concentrations. The kidneys excrete 80% of its metabolites, with a half-life of 1.6 hours. Lignocaine and epinephrine have maximum dosages of 6.6 mg/kg and 4.4 mg/kg, respectively. Lignocaine was invented by Nils Lofgren in 1943 and procaine by Alfred Einhorn in 1904. [(4)]

Deciduous teeth's dental pulp can be infected by decaying teeth, caries, or dental trauma. If neglected, caries can spread to the pulp, leading to tooth abscesses. Pulmonal necrosis can result from severe inflammation or death. Dental trauma can also cause damage to blood vessels and nerves.

The aim of this study is to compare and evaluate the anesthetic effects of 2% lignocaine with a 20 gauge needle in Inferior Alveolar Nerve Block (IANB) and 4% articaine with a 24 gauge needle in Buccal Nerve Block (BNB) in cases of dento-alveolar abscess extraction. This will be done by using the Frankl Behavior Rating Scale.

METHODS

1. STUDY DESIGN

In a randomized trial, the behavioral effectiveness of 2% lignocaine with a 20 gauge needle in inferior alveolar nerve block and 4% articaine with a 24 gauge needle in buccal nerve block were evaluated in children with dento-alveolar abscesses. Following the principles derived from the 2010 Consolidated Standards of Reporting Trials statement, patients who satisfied all inclusion criteria were randomized 1:1 to one of two therapeutic groups. The trial was approved by the institutional ethics committee (RDCH/Ethical/2021-24/174). Rajasthan Dental College and Hospital carried out a 12-month randomized controlled research with 100 healthy youngsters. The study included patient groups, radiographic tests, and oral exams. Patients were divided into groups and given 2% lignocaine and 4% articaine as anesthetic medications. The study included patient diagnosis, clinical examination, full history, and ethics committee approval. While preparing an anesthetic solution for the nerve block, assessments of behavior and pain were conducted. A day later, post-operative instructions were given and calls for follow-up were received. Before receiving their agreement, the parents or guardians were fully informed about the study's methodology.

1. INCLUSION CRITERIA

- children between the ages of 5 and 11
- Patients' consent
- Mental capacity for communication
- Deep dentinal caries with bone loss
- Tooth with history of illness or swelling necessitating extraction;

2. EXCLUSION CRITERIA

- Mental and physical disability
- Hypersensitivity to sulfurites or local anesthetics.
- A history of severe illness or behavioral issues.
- The patient is taking medicine.
- Injection site pathosis that is active.
- Unable to provide informed permission.

3. SAMPLE SIZE

- The sample size was determined using the API-INFO program. There were 100 patients in all. (For every group, 50 patients)

4. RANDOMIZATION TECHNIQUE

- Once the qualifying patients were chosen, they were divided into two groups at random: Group A received 2% lidocaine with a 20 gauge needle for an inferior alveolar nerve block, whereas Group B received 4% articaine with a 24 gauge needle for a buccal nerve block. The kids in the research were seen by a single, skilled pediatric dentist in order to ignore inter-operator variability.

5. ALLOCATION CONCEALMENT

- A pediatric dentist who was not involved in the experiment assigned treatment sequence alternatives based on the kind of intervention to every participant who was recruited using a lottery technique. Prior to treatment, the operator received the sealed envelopes with the recorded allocation results.

6. SAMPLE GROUPING

- Children were assigned randomly into two groups with 50 members each.
- Group 1 – 2% Lignocaine with 20 Gauge Needle in Inferior Alveolar Nerve Block
- Group 2 - 4% Articaine with 24 Gauge Needle Buccal Nerve Block

7. BLINDING

- The data analyst doing the analysis was blinded to the sorts of interventions, but the operating dentist did not hide the type of intervention. Prior to the study, the parents provided written informed permission. Every kid in every group received the same level of care and evaluation from the same dentist in the same environment to avoid bias.

8. OPERATIVE PROCEDURES

Behavior Assessment - Observed clinical parameters: behavior assessment on behavior on injection and extraction by using Frankl Behavior Rating Scale

Rating	Categories Of Behavior	Level Of Acceptance	Influence On Treatment
4	Active Physical Resistance , Protests Screaming , Refusal Of Treatment, Crying , Fearful	Definitely Negative No Acceptance	Treatment Can't Be Carried Out Without Physical Control
3	Crying, No Cooperation , Some Evidence Of Negative Attitude But Not Pronounced	Negative Acceptance	Treatment Can Be Carried Out Without Undue Delay, Raised Hands Interfering With The Treatment
2	Signs Of Resistance Such As Strained Muscles, Reserved Attitude, No Answer But Following Directions With Cooperation	Positive Reluctant Acceptance	Treatment Can Be Carried Out Without Undue Delay, Raised Hands But No Interference With The Treatment
1	Relaxed Calm Eyes, Talking And Showing Interest In The Procedure , Good Cooperation	Definitely Positive Acceptance	Treatment Can Be Carried Out Immediately (After Proper Information)

RADIOGRAPHIC PARAMETERS

To make a diagnosis and rule out any other pathology, IOPA was obtained.

OPERATIVE PROCEDURE

GROUP A - 2% Lignocaine with 20 Gauge Needle in Inferior Alveolar Nerve Block

To provide a sanitary environment, the patient was draped. Subsequently, the local infiltration and inferior alveolar nerve block anesthetic solutions were made. To direct the penetration of the needle and the injection of the fluid, landmarks were highlighted. The nerve block procedure went well, and the patient's behavior and level of pain were monitored. This entailed keeping an eye on their behavior and assessing for discomfort throughout the injection. Throughout the course of the therapy, particularly during the extraction procedure, the level of discomfort and behavior were regularly monitored. The patient received post-operative instructions. Furthermore, a telephone follow-up was done a day later to make sure they were okay.

GROUP B - 4% Articaine with 24 Gauge Needle in Buccal Nerve Block

To maintain sterility, the patient was draped. The anesthetic solutions for the local infiltration and buccal nerve block were then made. To help with the needle penetration and solution injection, landmarks were indicated. The nerve block was effectively performed, and the procedure included an evaluation of the patient's behavior and level of discomfort. This involved observing their behavior and feeling for discomfort throughout the injection. Pain and behavior were monitored at every stage of the therapy, especially when the extraction was being done. The patient received instructions for following surgery. Furthermore, a telephone follow-up was done a day later to make sure they were okay.

INTERVALS OF EVALUATION - Anesthesia injection pain was quantified, and extraction operation pain was assessed.

AFTER OPERATIVE REPORTING

A 24-hour post-operative evaluation was conducted on the patient in order to document behavior using frankl behavior rating scale. About their child's suffering, bites, numbness, and length of numbness, parents were questioned. Parents provided the data.

9. STATISTICAL ANALYSIS

- SPSS was used to perform statistical analysis and describe the mean and sd value by descriptive analysis.

RESULT

Table 1: Variable		IANB	BNB	P valve	Overall
Age	Mean SD	8.94	8.32	2.7	0.62
Gender	Female	18 (36%)	15 (30%)	0.9	33 (33%)
	Male	32 (64%)	35 (70%)		67 (67%)

The study enrolled a total of 100 pediatric patients, with demographic characteristics evenly distributed among the treatment groups. There was a slight male predominance, with 67 males and 33 females participating in the study. The mean age of the patients was 0.62 years (SD = 2.7), ranging from 5 to 11 years old. (table 1)

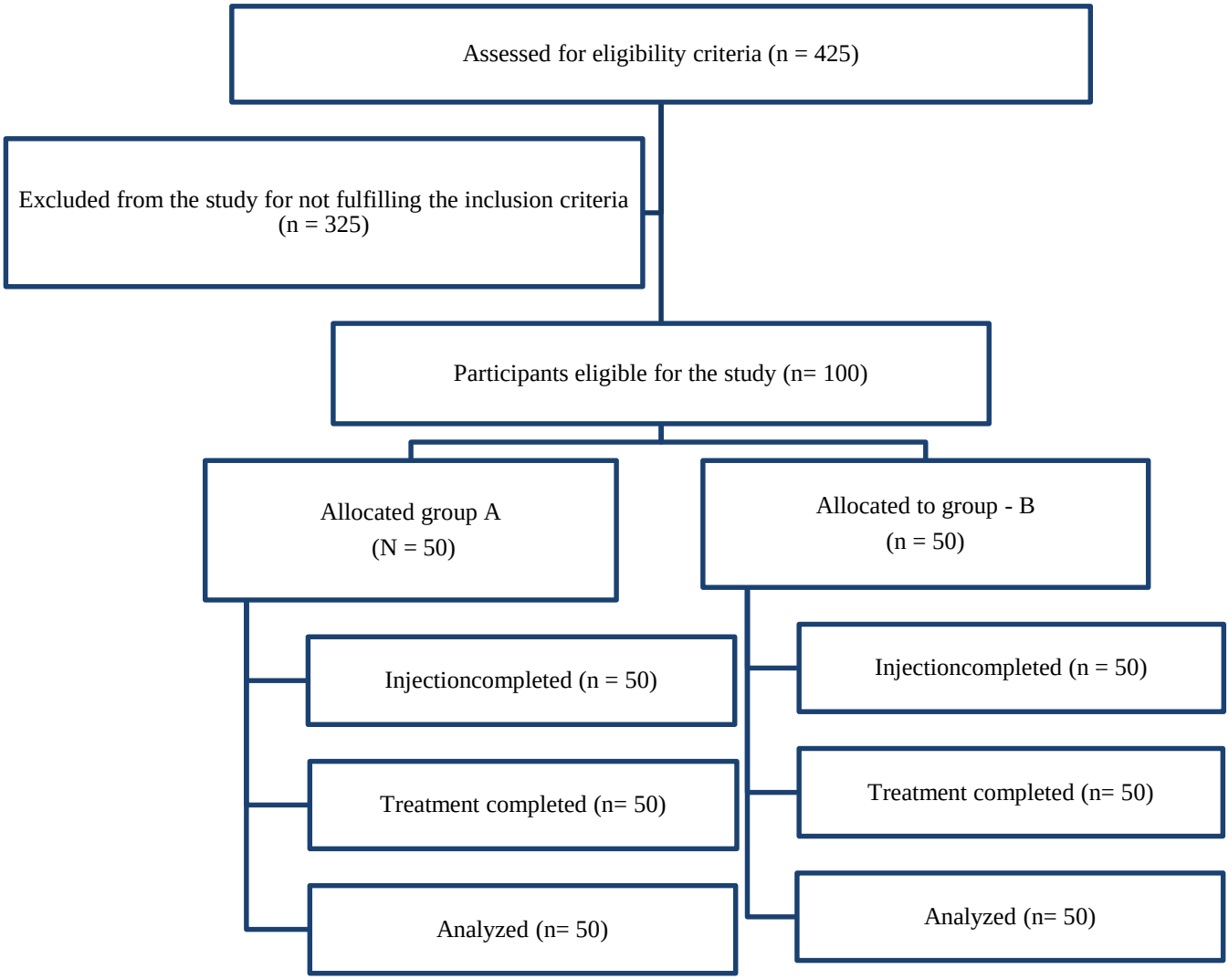

Table 2: The behavior Assessment of the IANB+LI technique during the Injection of lignocaine was assessed using the Frankl Behavior Rating Scale for observational evaluation.

	Indicator	Frequency	Percent	Mean	SD
Frankl Behavior Rating scale	Definitely Negative	7	14%	1.96	0.49
	Negative	38	76%		
	Positive	5	10%		
	Definitely Positive	0	0%		
	Total	**50**	**100%**		

Table 3: The behavior Assessment of the IANB+LI technique during Extraction was assessed using the Frankl Behavior Rating scale for observational evaluation.

	Indicator	Frequency	Percent	Mean	SD
Frankl Behavior Rating scale	Definitely Negative	1	2%	2.82	0.43
	Negative	7	14%		
	Positive	42	84%		
	Definitely Positive	0	0%		
	Total	**50**	**100%**		

The behavior of the child was assessed during the IANB + LI and BNB + LI techniques using the Frankl Behavior Rating Scale to measure the observed time.

Table 2 and 3, show that 5 children (10%) exhibited a positive response with no behaviour change during Lignocaine injection, while none showed a positive response during extraction. Positive responses were observed in 42 children (84%) during extraction and 5 children (10%) during Lignocaine injection. The mean and p-value for Injection Lignocaine and Extraction were (1.96±0.49) and (2.82±0.43), respectively. The assessment of behavior during Lignocaine injection using the IANB + LI technique was conducted through observational evaluation using the Frankl Behavior Rating Scale.

Table 4: The behavior Assessment of the BNB + LI technique during Injection Articaine was assessed using the Frankl Behavior Rating Scale for observational evaluation.

	Indicator	Frequency	Percent	Mean	SD
Frankl Behavior Rating scale	Definitely Negative	4	8%	2.78	0.58
	Negative	3	6%		
	Positive	43	86%		
	Definitely Positive	0	0%		
	Total	**50**	**100%**		

Table 5: The behavior Assessment of the BNB+LI technique during Extraction was assessed using the Frankl Behavior Rating Scale for observational evaluation.

	Indicator	Frequency	Percent	Mean	SD
Frankl Behavior Rating scale	Definitely Negative	0	0%	3.5	0.61
	Negative	3	6%		
	Positive	19	38%		
	Definitely Positive	28	56%		
	Total	**50**	**100%**		

In Tables 4 and 5, 43 children (86%) demonstrated a positive response with no behavior change during Articaine injection, whereas 28 children (56%) exhibited a positive response during extraction. Negative responses were observed in 3 children (6%) during extraction and injection during Process. The mean and p-value during injection and Extraction were (2.78±0.58) and (3.5±0.61), respectively. The evaluation of behavior during BNB + LI technique was conducted through observational assessment using the Frankl Behavior Rating Scale.

Correlation:

Table 6: Behavior Significance between Frankl Behavior Rating Scale		
Indicator	Mean	SD
Behavior changes during injection and Extraction by IANB+LI Tech.	0.16	0.01
Behavior changes during injection and Extraction by BNB+LI Tech.	1.08	0.00

Table 6 delineates the assessment of child behavior using the Frankl Behavior Rating scale throughout the IANB+LI process and extraction. Notable shifts in behavior were discernible during both the local anaesthesia administration and the extraction procedure. Specifically, a substantial alteration in behavior, signifying significance at a P-value of 0.01, was evident during the IANB+LI Technique. However, in the context of BNB+LI, there was no statistically significant change in observed behavior.

Table 7: The behaviour Assessment of the IANB+LI technique during Injection of Lignocaine by the 20-gauge needle was assessed using the Frankl Behaviour Rating Scale for observational evaluation.					
	Indicator	**Frequency**	**Percent**	**Mean**	**SD**
Frankl Behaviour Rating scale	Definitely Negative	5	10%	2.06	0.54
	Negative	38	76%		
	Positive	6	12%		
	Definitely Positive	1	2%		
	Total	**50**	**100%**		

Table 8: The behaviour Assessment of the BNB+LI technique during Injection Articaine by 24 gauge needle was assessed using the Frankl Behaviour Rating Scale for observational evaluation.					
	Indicator	**Frequency**	**Percent**	**Mean**	**SD**
Frankl Behaviour Rating scale	Definitely Negative	0	0%	3.24	0.55
	Negative	3	6%		
	Positive	32	64%		
	Definitely Positive	15	30%		
	Total	**50**	**100%**		

In the Table 7, IANB+LI technique using a 20-gauge needle was evaluated for behavior during lignocaine injection using the Frankl Behavior Rating Scale. Results showed that 10% of patients were definitely negative, 76% were negative, 12% were positive, and 2% were definitely positive, with an overall mean score of 2.06 and a standard deviation of 0.54.

In the Table 8, Behavior Assessment of the BNB+LI technique during injection with Articaine by a 24-gauge needle, evaluated using the Frankl Behavior Rating Scale, indicated positive outcomes. The majority of children displayed positive (64%) or definitely positive (30%) behavior. The mean rating was 3.24 with a standard deviation of 0.55, highlighting generally favorable responses.

DISCUSSION

Local anesthetics operate on the nerve membrane, with the particular receptor theory being the most widely recognized explanation. They reduce or completely remove sodium permeability by binding to specific receptors inside the sodium channel. [5] they are efficient at inhibiting high-frequency nerve impulses due to their ability to reach their site of action during the channel's inactive state.[6] Articaine, a 4% local anesthetic solution, is used in manufacturing due to its lower systemic toxicity and equivalent analgesic efficacy. It contains amide and ester groups, reducing toxicity through liver microsomal enzymes and plasma esterase hydrolysis. [7]

Pain control is crucial for children during invasive tooth extractions, and local anesthetic medication is commonly used to alleviate discomfort. However, children often react negatively to these injections, making painless treatment necessary. [8,9] Techniques to reduce pain include computerized systems, precooling, warming, and applying vibration or pressure on the injection site.[10] Dento-alveolar abscess is a small accumulation of pus in tooth tissues, resulting from tooth damage, poor dental care, or untreated dental caries. Bacterial invasion causes an inflammatory reaction, leading to pus collection and abscess development.

Dentist appointments can be stressful, especially for children, who often display behavioral distress indicators. According to Jean Piaget's cognitive theory, children between ages 4 and 11 are in the preoperational phase, while those between ages 7 and 11 are in the concrete operational phase. These children are naturally curious, intuitive, and require syllogistic reasoning, making them more challenging to manage. Behavior assessment in pediatric dentistry research and everyday clinical practice is accomplished using the Frankl Behavior Rating Scale.

The study assessed a child's behavior during dental treatment using the Frankl behavior rating scale. Dental fear and anxiety are common issues in pediatric dentistry, and behavioral ratings are crucial for classifying behavior and evaluating treatment. [11] The Frankl scale is brief and simple, but it lacks clinical details about difficult conduct. The study aimed to investigate children's acceptance of local anaesthetic dental treatment, parents' satisfaction with the procedure, and their child's impact. It also aimed to analyze the dental injection experience and compare two approaches (IANB and BNB) to determine which causes less discomfort or is more well-liked by the children.

Patients who had undergone the BNB+LI technique reported happiness during the injection procedure, and the sustained effect of articaine post-treatment contributed to a prolonged positive experience. These findings indicate that the BNB+LI technique may be considered a preferable option for minimizing negative behavioral responses during dental procedures. Halenur Alten et al (2021) studied that pain perception with a new needle-free system and dental needle method in children. During pulpotomy and restorative treatment, a needle-free system performed with 0.3 mL anesthesia was found as effective as infiltrative anesthesia with a dental needle method. [12] Similar to the present study, Pricila De Camargo Smolarek et al (2020) in their study evaluated the influence of different local anaesthetic techniques on pain, disruptive behavior, and anxiety in children's dental treatment. They concluded that different anaesthetic dental local techniques do not affect the levels of pain, disruptive behavior, anxiety, and physiological parameters in children aged 5–8 years old. [13]

Based on the statistical findings, it can be inferred that the BNB+LI technique is associated with a more favorable and stable behavioral response compared to the IANB+LI technique during injection. These results indicate that the BNB+LI technique may be considered a preferable option for minimizing negative behavioral responses during dental procedures or extraction procedures. Similar to the current study, Leila Erfanparast (2020) conducted a study to examine the impact of 2% lidocaine inferior alveolar nerve block and 4% articaine buccal infiltration on children's behavioral feedback and pain perception during pulp treatment of their mandibular second primary molar. They came to the conclusion that for pulp treatment of the second primary mandibular molars, buccal infiltration with 4% articaine produced an anaesthetic result that was similar to that of 2% lidocaine for inferior alveolar nerve block. [14] When extracting a mandibular primary molar bilaterally, Zahra Bahrololoomi et al. (2021) examined the anaesthetic effectiveness of a single buccal injection with 4% articaine in comparison to a standard inferior alveolar nerve block with 2% lidocaine. So, they came to the conclusion that an alternate method to the IANB for the extraction of primary mandibular molars may be the articaine infiltration approach. [15]

According to the American Academy of Pediatrics (2011), a dentist's communication abilities have a significant impact on both patient satisfaction and behavior advice. According to Pinkham, behavior control is just as crucial as dexterity and knowledge, and both are essential for successful clinical outcomes in pediatric dentistry. The majority of treated children in this trial showed positive outcomes and good behavior, this may be attributed to several factors:

- Good behavior management techniques employed.
- The high clinician's skill level and experience with children.
- Well-established relationship between the dentist and child/parents.
- Good case selection for the patients who fit very well with the trial inclusion criteria.[16]

CONCLUSION

The study explores the use of local anesthetics, particularly articaine and lignocaine, in the context of tooth extraction in pediatric dentistry. Patient behavior is assessed using the Frankl behavior rating scale. The discussion highlights the importance of proper communication, behavior management techniques, and the dentist's skill level in influencing children's behavior and satisfaction during dental procedures. The study supports the growing trend favoring the use of articaine over lignocaine in pediatric dental anesthesia. To conclude, the study contributes valuable insights into the comparative efficacy of anesthetic techniques in pediatric dental extractions. The positive behavioral response associated with both the IANB+LI and BNB+LI techniques underscores their viability in managing pain and improving the overall experience for pediatric patients.

DECLARATION OF INTEREST

The authors declare no conflicts of interest.

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