Comparative Evaluation of Pain Perception of 2% Lignocaine and 4% Articaine in Inferior Alveolar Nerve Block among Pediatric Dental Patients: An Observational Study

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Doi: 10.63001/tbs.2025.v20.i03.S.I(3).pp447-450

Keywords:

Pain,
Local anesthesia,
Articaine

Received on: 06-07-2025
Accepted on: 09-08-2025

Published on: 18-08-2025

ABSTRACT

Aim: This study aimed to compare and assess the pain perception of 2% lignocaine with 1:80,000 epinephrine against 4% articaine with 1:100,000 epinephrine in children.

Material and Method: A split-mouth randomized controlled trial was carried out involving 20 children aged 4 to 8 year who required inferior alveolar nerve block (IANB) anesthesia for dental work in the lower jaw. Pain perception was evaluated using a visual analog scale (VAS) where patients rated their subjective pain, alongside the FLACC scale, which assessed objective pain through the operator's observations of the child's face, legs, activity, crying, and ability to be consoled.

Result: The VAS and FLACC scores were lower for 4% articaine compared to 2% lignocaine; however, this difference was not statistically significant ($p > 0.05$), indicating that they were statistically similar.

Conclusion: In conclusion, we can infer that 4% articaine is as effective as 2% lignocaine, demonstrating a slightly better pain experience in children, even though these observations were not statistically significant.

Introduction:

Pain management is a critical aspect of pediatric dentistry, especially during procedures requiring inferior alveolar nerve block anesthesia.[1] The success of dental treatments often hinges on effective anesthesia, which is essential for minimizing discomfort and anxiety in young patients. Local anesthetics such as lignocaine (also known as lidocaine) and articaine are widely used for this purpose.[2,3] Lignocaine, a longstanding choice, has been the standard for local anesthesia; however, newer agents like articaine have gained attention due to their favorable pharmacological properties, including a rapid onset and effective pain control. Articaine, a hybrid anesthetic, is thought to penetrate nerve tissues more effectively, potentially leading to quicker pain relief.[4-6] This observational study aims to evaluate and compare the pain perception between 2% lignocaine and 4% articaine during IANB in pediatric dental patients. Through this comparative analysis, we seek to ascertain not only the effectiveness of each anesthetic in terms of pain experience but also the onset time of anesthesia, ultimately contributing to improved dental care practices for children. Understanding these differences can guide dental practitioners in selecting the most appropriate anesthetic agent for pediatric patients, enhancing their overall treatment experience and comfort.

Materials and Methods: A randomized controlled trial using a split-mouth design was conducted at the Department of Pedodontics, with ethical approval secured from the Institutional Review Board. The study involved 20 children aged 4 to 8 years who required inferior alveolar nerve block anesthesia for bilateral dental procedures in the lower jaw. The principal investigator provided a detailed explanation of the study procedures to the parents or guardians, and written consent was obtained. Inclusion criteria included children with no prior experience of dental anesthesia, no history of allergic reactions to local anesthetics, and no significant medical issues. Conversely, children who were medically compromised, had existing soft tissue infections, or were unable to communicate were excluded from the study.

For the randomization process, two envelopes were created and labeled as type A and type B. Cartridges containing both anesthetic agents—2% lignocaine hydrochloride with 1:80,000 epinephrine (Lignospan Standard, Septodont, Canada) and 4% articaine hydrochloride with 1:100,000 epinephrine (Septanest, Septodont, France)—were checked for expiration dates and then covered with opaque labels to conceal the identity of the anesthetic agent. An external independent observer, who was blinded to the study,

assigned the lignocaine cartridge to type A and the articaine cartridge to type B envelopes, ensuring an unbiased randomization process for the trial.

The site of local anesthetic (LA) administration was dried using a gauze piece, and a topical anesthetic agent (Lignospan-O manufactured by Septodont, India) was applied with a cotton earbud for 60 seconds. A cartridge from one of the randomly labeled envelopes was then selected for use. The LA was administered using the standard technique of inferior alveolar nerve block. Once the anesthesia took effect, the children were shown a visual analog scale (VAS) **(Fig 1)**.[7] The visual analogue is a line approximately 10 mm in length with each end anchored by extreme descriptive (e.g., no pain versus worst pain imaginable). Treatment was performed following standard protocols, and during the procedure, the children were monitored for any signs of pain. The operator evaluated their objective symptoms based on the child's behavior and activity using the face, legs, activity, cry, and consolability scale (FLACC). In this scale, the operator observes the level of discomfort from 0 to 2 in each of the 5 categories, and the scale was scored in a range of 0 to 10.[8] After completing the procedures, parents were informed about the duration of the LA's effects and given precautions to prevent injuries to the anesthetized tissues.

The patient's second appointment was scheduled one week later, during which the same procedure was followed using the anesthetic agent that was not utilized during the previous appointment. This agent was administered on the contralateral side from the initially selected side. All collected data was organized into tables, and statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software (Windows version 24.0).

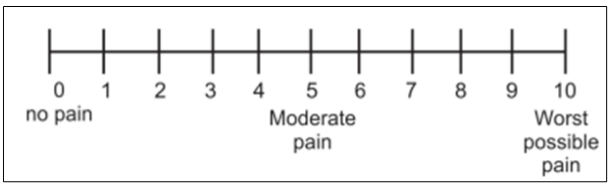

Figure 1: Visual Analog Scale

Result: This study aimed to compare pain perception between 2% lignocaine and 4% articaine in 20 children aged 4 to 8 years requiring inferior alveolar nerve blocks. Pain perception was assessed using the Visual Analog Scale and the FLACC scale. Results indicated that 4% articaine yielded lower VAS and FLACC scores compared to 2% lignocaine. However,

statistical analysis revealed no significant differences ($p > 0.05$), indicating that both anesthetics are similarly effective for managing pain in pediatric patients undergoing dental procedures. Further research may be needed for conclusive insights. **(Table 1)**

Table 1: Comparation of Mean VAS and FLACC Score

Group	Mean VAS Score ± SD	Mean FLACC Score ± SD
Group A	3.03 ± 0.45	1.85 ± 0.15
Group B	2.85 ± 0.51	1.31 ± 0.20
t value	1.11	1.00
p value	NS	NS

SD; Standard Deviation, NS; Not Significant

Discussion: This observational study aimed to evaluate and compare the pain perception associated with two widely used local anesthetics, 2% lignocaine and 4% articaine, during the inferior alveolar nerve block in pediatric dental patients. Given the significance of effective pain management in pediatric dentistry, understanding the comparative efficacy of these anesthetics is crucial for optimizing patient experiences during dental procedures.

Pain management is a critical component in pediatric dentistry, as children's fear and anxiety can significantly amplify their perception of pain. Selecting an effective anesthetic not only facilitates smoother dental procedures but also contributes to positive lifelong perceptions of dental care. Lignocaine and articaine are both commonly employed, yet their comparative effectiveness, especially in a pediatric context, necessitates further exploration.[9-11] The observational nature of this study allowed for real-time assessment of pain perception as patients underwent IANB. By observing pain responses during the administration of both anesthetics, researchers could capture a holistic view of patient experiences. The use of validated pain assessment tools, such as the Visual Analog Scale and the FLACC scale, facilitated robust data collection, providing both subjective and objective measures of pain.

Given that the study focused on a pediatric population, the selection of appropriate measures to account for varying levels of communication and expression of pain in young patients was essential. The FLACC scale, which evaluates facial expression, leg

movement, and consolability, is particularly suited for this demographic.

The findings indicated that while both 2% lignocaine and 4% articaine are effective for IANB, differences in pain perception were observed. Notably, articaine demonstrated a trend toward lower pain perception scores compared to lignocaine, potentially suggesting its superior efficacy in this context. However, it is important to contextualize these findings within the framework of the study design and sample size. The result of our study in accordance to the study conducted by Wright et al., Oulis et al., Singh SS et al.[12-14]

The results align with previous literature suggesting that articaine may provide a more profound and faster onset of anesthesia, particularly in certain clinical scenarios. Its chemical structure allows for better diffusion and effectiveness in areas requiring deeper anesthesia. Nevertheless, the precise clinical significance of the observed differences requires cautious interpretation, particularly given the subjective nature of pain perception.

The results have meaningful implications for clinical practice in pediatric dentistry. When considering anesthetic options for IANB in young patients, the potential for reduced pain perception with articaine could lead to enhanced patient cooperation and overall satisfaction. This, in turn, may foster a more positive attitude toward dental care and mitigate anxiety during future visits.

However, it is crucial for dental practitioners to also weigh the individual needs and medical histories of their pediatric patients when choosing between these anesthetics. Issues surrounding allergies, previous adverse reactions, and the specific dental procedure must also be considered when making decisions.

Based on the findings, practitioners are encouraged to adopt a patient-centered approach, evaluating each case individually. The use of articaine might be particularly advantageous in managing anxious patients or those undergoing complex procedures requiring more profound anesthesia. Additionally, providing thorough explanations and reassurance to young patients can greatly reduce anxiety and improve their overall experience.

This study lays a foundation for further research into pediatric pain management in dentistry. Future studies should focus on larger, multi-center trials to validate the findings and enhance the generalizability of the results. Exploring additional variables, such as the long-term effects of each anesthetic on postoperative pain and comfort, would further contribute to the understanding of these agents.

Furthermore, investigating the roles of psychological interventions, such as

behavior management strategies and parental involvement during procedures, can provide a more comprehensive understanding of pain perception in pediatric dental patients.

Conclusion: In conclusion, this observational study highlights the comparative evaluation of pain perception between 2% lignocaine and 4% articaine during inferior alveolar nerve blocks in pediatric dental patients. The results suggest potential advantages associated with articaine; however, individual patient contexts remain paramount in selecting appropriate anesthetic strategies. Ongoing research in this area will undoubtedly contribute to refining pain management approaches, ultimately improving the pediatric dental care experience.

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