RESEARCH PAPER

Lignocaine vs Articaine for Pulp Therapy in Children Aged 6–10 Years: A Randomized Control Clinical Trial

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ABSTRACT

Aim: Pain is a complex sensory and emotional experience that can be particularly distressing for children undergoing dental procedures. Dental pain and anxiety may be associated with procedures such as local anesthetic injections, tooth extraction, and pulp therapy. Therefore, effective pain control is an essential component of pediatric dental care. Local anesthetic agents are routinely used to minimize discomfort and facilitate safe and comfortable dental treatment. The present study aims to compare the clinical performance of lignocaine and articaine in pediatric dental patients. The two anesthetic agents will be evaluated based on the volume of anesthetic administered, onset of anesthesia, physiological parameters, anesthetic efficacy assessed using the Wong-Baker FACES Pain Rating Scale (WBRS) and the Face, Legs, Activity, Cry, Consolability (FLACC) Scale, duration of anesthesia, and postoperative complications.

Material and Methods: This prospective, single-blinded, randomized clinical study included 50 children aged 6–10 years who fulfilled the predefined eligibility criteria. Participants were randomly allocated into two equal groups of 25 children each. Group A received 2% lignocaine, whereas Group B received 4% articaine for maxillary buccal infiltration. The volume of anesthetic solution administered, onset of anesthesia, pulse rate, oxygen saturation, pain scores, duration of anesthesia, and post-anesthetic complications were recorded. Physiological parameters were assessed at predefined stages before, during, and after treatment. Pain was evaluated using the WBRS and FLACC scales. Statistical analysis was performed using IBM SPSS Statistics (Statistical Package for the Social Sciences), with $p < 0.05$ considered statistically significant. The study methodology specifies random allocation through selection of colored balls and blinding of the children to the anesthetic solution used.

Result: The mean onset time of anesthesia was significantly shorter with 4% articaine than with 2% lignocaine (2.17 ± 0.38 seconds vs. 4.88 ± 0.64 seconds; $p < 0.001$). The mean volume of anesthetic solution required was also significantly lower in the articaine group than in the lignocaine group (1.04 ± 0.64 mL vs. 1.55 ± 0.38 mL; $p < 0.001$). Intraoperative FLACC scores were significantly lower with articaine ($p = 0.001$), while postoperative WBRS scores also demonstrated significantly lower pain intensity in the articaine group ($p < 0.001$). The mean duration of anesthesia was significantly shorter with articaine than with lignocaine (0.68 ± 0.27 minutes vs. 1.44 ± 0.19 minutes; $p < 0.001$). Post-anesthetic cheek or lip biting with ulceration was reported in 11.8% of children receiving lignocaine, whereas no such complication was reported in the articaine group ($p < 0.001$). The study findings therefore indicate favorable clinical outcomes with articaine across several assessed parameters.

Conclusion: Articaine may be considered a favorable alternative to lignocaine for pediatric dental pulp therapy because of its rapid onset of anesthesia, effective pain control, and adequate duration of action. Its favorable clinical profile allows effective anesthesia with minimal postoperative complications. In addition, the relatively shorter

duration of soft-tissue anesthesia may reduce prolonged numbness and improve overall comfort in children. Thus, articaine can be considered a useful local anesthetic option for achieving effective and comfortable dental treatment in pediatric patients.

Clinical Significance: Articaine provides faster onset and more profound anesthesia than lignocaine, ensuring better pain control during pediatric dental procedures. Its superior tissue diffusion allows effective anesthesia even with infiltration techniques, often reducing the need for nerve blocks. Articaine also causes less prolonged numbness, which improves comfort and reduces the risk of children biting their lips or cheeks. Overall, it enhances patient cooperation, clinical efficiency, and treatment outcomes in pediatric dentistry.

Keywords: Anxiety, Articaine, Lignocaine, Local anesthesia, Pain

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Introduction

Pain is an unpleasant sensory and emotional experience that may arise from a variety of pathological and procedural conditions. In pediatric dentistry, pain may be associated with procedures such as needle insertion, tooth extraction, restorative treatment, and pulp therapy. Dental pain and the fear of painful procedures are important factors contributing to anxiety and negative behavior in children. Therefore, the provision of painless and minimally traumatic dental treatment is essential, particularly in pediatric patients, as the child's experience during dental treatment may influence cooperation, treatment acceptance, and attitudes toward future dental visits. Effective pain control is consequently a fundamental component of successful pediatric dental care. Although local anesthesia is indispensable for achieving adequate analgesia, the administration of local anesthetic itself may be a significant source of fear and anxiety in children because of the anticipated discomfort associated with needle insertion and injection [1].

Local anesthesia is defined as a reversible loss of sensation in a specific and localized area produced by suppression of neural excitability or interruption of impulse conduction along peripheral nerves. In pediatric dentistry, an appropriate understanding of the pharmacological properties of local anesthetic agents, their recommended dosage, routes of administration, and potential adverse effects is essential for safe and effective clinical practice. Adequate local anesthesia facilitates comfortable treatment, improves patient cooperation, and may reduce the development or persistence of dental fear and anxiety. The history of local anesthesia dates back to the recognition of the anesthetic properties of cocaine during the nineteenth century, followed by the development of synthetic agents such as procaine in the early twentieth century. These advances significantly contributed to the development of painless and minimally traumatic dental procedures. Subsequently, several local anesthetic agents have been introduced with improvements in onset, duration, efficacy, safety, and clinical applicability [2].

Among the local anesthetic agents used in dentistry, lignocaine (lidocaine) has traditionally served as the reference standard because of its well-established efficacy, predictable clinical action, and favorable safety profile. The subsequent introduction of articaine provided an alternative agent with distinctive physicochemical and pharmacological characteristics. Both agents exert their principal anesthetic effect by reversibly blocking voltage-gated sodium (Na^+) channels within neuronal membranes. This prevents the initiation and propagation of action potentials along sensory nerve fibers and consequently interrupts the transmission of nociceptive impulses from the site of stimulation to the central nervous system. Local anesthetic agents therefore temporarily suppress pain perception without producing loss of consciousness. Lignocaine was synthesized by Nils Löfgren in 1943 and subsequently introduced into clinical practice during the 1940s. In dentistry, it is commonly used at a concentration of 2%. It has an intermediate duration of action and generally demonstrates a relatively rapid onset, although the actual onset may vary according to the site and technique of administration. Lignocaine is an amide-type local anesthetic that undergoes extensive hepatic metabolism, with its metabolites subsequently eliminated primarily through the kidneys. Compared with ester local anesthetics, true allergic reactions to the lignocaine molecule itself are uncommon; however, adverse reactions may occasionally be associated with other components of local anesthetic preparations, including preservatives or antioxidants. In particular, meta sulfite-containing vasoconstrictor formulations may produce adverse reactions in susceptible individuals. Consequently, a history of previous reactions should be carefully evaluated before administration [3].

The use of local anesthesia provides several clinical advantages during dental procedures. In addition to preventing procedural pain, adequate local anesthesia may reduce the patient's physiological stress response and facilitate comfortable treatment while allowing the patient to remain conscious and cooperative. Prolonged soft-tissue anesthesia may also provide postoperative analgesic benefit; however, this characteristic should be considered carefully in children because persistent numbness may increase the risk of inadvertent biting or soft-tissue injury. Thus, selection of an appropriate anesthetic agent requires consideration of both the desired duration of anesthesia and the age and behavior of the pediatric patient.

Articaine, originally developed as carticaine, was introduced in the late 1960s and subsequently became widely available in Europe and other countries. Unlike conventional amide local anesthetics, articaine possesses a unique molecular structure containing both an amide linkage and an additional ester group. It also contains a thiophene ring rather than the benzene ring characteristic of lignocaine. These structural characteristics contribute to its relatively high lipid solubility, potency, and ability to diffuse through mineralized tissues. Articaine is commonly formulated at a concentration of 4% for dental use and is frequently combined with a vasoconstrictor [4].

A major pharmacological characteristic of articaine is its metabolism by both plasma esterases and hepatic pathways. This differs from lignocaine, which undergoes predominantly hepatic metabolism. Articaine has a relatively short plasma half-life, which may contribute to a lower duration of systemic exposure following administration. Its onset of clinical anesthesia is generally rapid, although the precise onset and duration depend on the injection technique, anatomical site, vascularity, and presence of a vasoconstrictor. These pharmacological characteristics have contributed to the increasing use of articaine in dentistry, particularly when rapid and effective local anesthesia is desired [5].

The clinical efficacy of articaine has been investigated in comparison with lignocaine in various dental procedures. Articaine has demonstrated effective anesthetic performance and, in some clinical situations, may provide advantages related to onset of anesthesia and diffusion through tissues. Comparative studies have reported that 4% articaine can provide effective anesthesia when compared with 2% lignocaine, although the magnitude of any clinical advantage may vary according to the injection technique, treatment procedure, anatomical site, and patient characteristics. In pediatric dentistry, these differences are particularly relevant because rapid onset of profound anesthesia and effective pain control may facilitate cooperation and reduce treatment-related anxiety. Despite the widespread use of both agents, the relative clinical performance of lignocaine and articaine in children remains an important area of investigation. Differences in onset and duration of anesthesia, anesthetic efficacy, quantity of anesthetic required, requirement for supplemental anesthesia, patient-reported pain, behavioral responses, and physiological parameters may influence the selection of an appropriate local anesthetic agent. Therefore, comparative evaluation of lignocaine and articaine in pediatric patients can provide clinically relevant evidence for optimizing pain management and improving the overall dental treatment experience in children [6].

The aim of the present study was to compare Articaine and Lignocaine in children undergoing dental treatment with respect to their clinical effectiveness and tolerability. The parameters assessed included onset and duration of anesthesia, quantity of anesthetic administered, requirement for supplemental palatal anesthesia, subjective and behavioral pain responses, heart rate, oxygen saturation, and postoperative complications.

Methodology

Study Type

The study is conducted in the Department of Pediatric and Preventive Dentistry, Mahatma Gandhi Dental College & Hospital, Jaipur, Rajasthan, India. It is a prospective, single blinded, randomized clinical study.

Sample Size

The sample size is estimated using Openepi software (v3.0) and the sample size of 25 is taken in each group considering the attrition of samples.

Randomization

The study employed simple randomization. Children were asked to select one of two colored balls—yellow or green. Based on the color of the ball chosen, they were allocated to one of the two groups. Children who selected the yellow ball were assigned to Group A received Lignocaine, while those who selected the green ball were assigned to Group B and received Articaine.

- Yellow ball – Group A – Lignocaine
- Green ball – Group B – Articaine

Ethical Approval

The study was conducted in the Department of Pediatric & Preventive Dentistry, Mahatma Gandhi Dental College & Hospital, Jaipur. The Ethical

committee approval was taken from Institutional Ethical Committee (**MGDC/IEC/1458/JPR/2024/39**). The duration of study was from June to November 2024.

Inclusion Criteria

1. Written informed consent
2. Children of age 6-10 years
3. Positive (+) and Definitely Positive (++) children (Frankle behavior rating scale)
4. Tooth indicated for extraction or grossly decayed tooth which cannot be restored
5. No medical history of any systemic disease
6. No history of allergy to LA

Exclusion Criteria

1. No written informed consent
2. Uncooperative/ Negative behavior
3. Teeth with Periapical pathology/ Grade III mobility
4. Root stumps
5. Medically compromised children/ special children
6. History of allergy to LA

Consent

The written informed consent is obtained from the parents before enrolling the children in the study.

Procedure

The child was made to sit comfortably on dental chair and their pulse rate; oxygen saturation was recorded. The children were blinded for the anesthetic solution used and all the readings were recorded by the same operator. The selected child was asked to rinse mouth with Chlorohexidine mouthwash. The maxillary infiltration site of needle penetration was dried with the sterile gauge and topical local anesthetic gel was applied with an applicator tip. After 1 min Group A was injected with 2% Lignocaine and Group B received 4% Articaine in the buccal vestibule of maxilla. The subjective symptoms of local anesthesia i.e., numbness and tingling sensation at injection site were checked by asking the child. Once confirmed, the objective signs of anesthesia were assessed by soft tissue probing using Moon's Probe. When the child reports no pain, the procedure was started. The tooth was isolated using a rubber dam, and the access cavity was prepared with a round bur. The coronal pulp was removed with the help of spoon excavator, while the radicular pulp tissue was extirpated using H files. The canals were irrigated intermittently with 2.5% sodium hypochlorite and saline. Formocresol dressing was then placed in the pulp chamber, followed by a temporary restoration. After the procedure, the child was asked to remain in the waiting area until the local anesthesia wears off, after which they were discharged. Patient was recalled for final obturation and permanent restoration subsequently.

Outcome Analysis

Statistical analysis was performed using IBM SPSS (Statistical Package for the Social Sciences) Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). The analysis was carried out at a 95% confidence interval with 80% study power. Normality of the data was assessed using the Kolmogorov–Smirnov test and the Shapiro–Wilk test. Descriptive statistics were expressed as mean and standard deviation. Intergroup comparisons between Group A and Group B were performed using the independent samples t-test. The same test was also used to compare the outcomes between the Lignocaine and Articaine groups. A p-value of <0.05 was considered statistically significant.

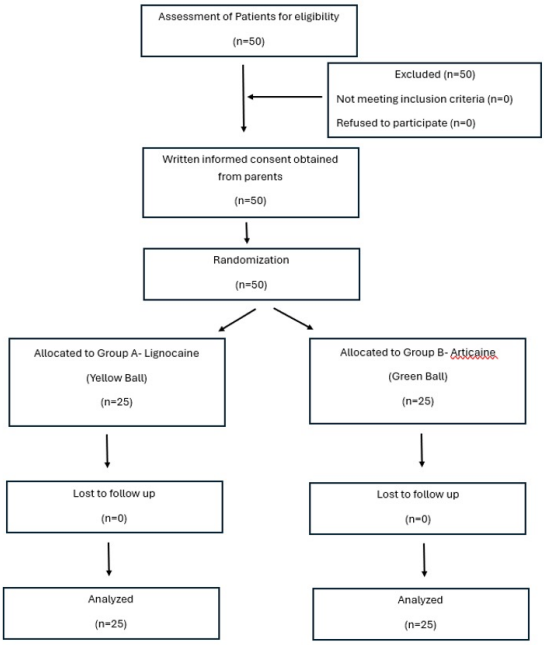


Figure 1: Consort Flowchart

Assessments

1. **Volume of anesthetic solution**

For maxillary teeth buccal infiltration 0.5ml LA solution was injected in the buccal vestibule (submucosal). If pain was reported on buccal side the infiltration was repeated and if reported on palatal side, additional 0.2 ml was injected for palatal infiltration to anesthetize the palatal mucosa. The procedure was repeated till complete anesthesia was attained. The amount of anesthetic solution used (ml) and any additional injections required were recorded. The total local anesthetic solution used was calculated as volume of anesthetic solution.

2. **Onset of anesthesia**

Using a watch, the time of needle retrieval from mucosa was noted. The child was asked for numbness after 30 seconds and repeated every 15 seconds till it is reported. It is then confirmed by probing the area.

If pain persists after probing, the LA administration was repeated followed by rechecking. The time of complete anesthesia was noted and difference of final time and needle retrieval time was calculated as onset time of anesthesia.

3. Physiologic parameters

In this study, pulse rate (beats per minute, bpm) and oxygen saturation (mm Hg) was measured using the pulse oximeter. The assessment was done preoperative and after application of topical anesthetic. It was then measured after needle retrieval i.e. local anesthetic administration, upon completion of procedure and lastly recorded before discharging the patient.

4. Efficacy

Pain Assessment

The pain is assessed using Wong-Baker Faces Pain Scale (WBFPR) and FLACC scale. The child is asked to tell the face corresponding to pain experienced after topical application, after LA administration and after the procedure. FLACC is a behavioral scale which measures the intensity of post-operative pain experienced by the child. It consists of 5 categories representing each letter of FLACC i.e. Face, Legs, Activity, Cry, Consolability with each category ranking on a scale of 0-2 depending on the severity of the behavioral descriptions in a total score between 0-10.

5. Duration

The time of needle retrieval from mucosa after local anesthesia administration was noted. After the completion of procedure, the child was asked for loss of numbness after 30 minutes and repeated every 5 minutes till he/she reports complete loss of numbness and return to normal senses. The final time of loss of numbness was recorded. The difference between two-time intervals was calculated as the duration of anesthesia.

6. Post operative complications

The parents were instructed to report any post extraction complication like lip or cheek bite, swelling etc. within 24 hours after the procedure.

Results

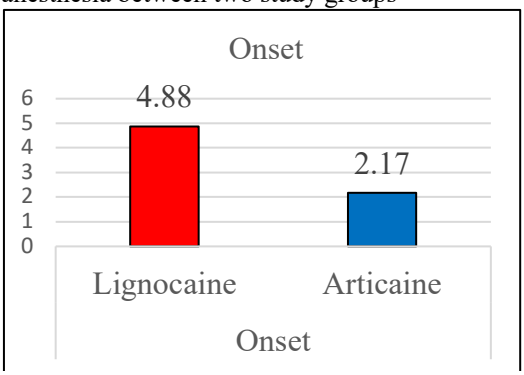
1. **Time of onset of anesthesia** [Table 1, Graph 1]

The mean onset time of anesthesia was 4.88 ± 0.64 seconds in the 2% Lignocaine group and 2.17 ± 0.38 seconds in the 4% Articaine group. The difference between the two groups was highly statistically significant ($p < 0.001$), indicating that 4% Articaine produced a significantly faster onset of anesthesia than 2% Lignocaine.

Table 1: Comparison of the mean onset time of anesthesia between the Lignocaine and Articaine Groups

Groups	Mean	Standard deviation	P value
2 % Lignocaine	4.88	.64	**<0.001**
4 % Articaine	2.17	.38	

Graph 1: Comparison of mean onset time of anesthesia between two study groups

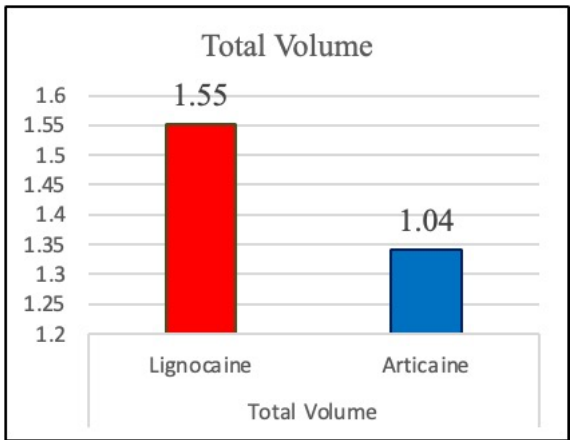


2. Drug Volume [Table 2, Graph 2]

The mean volume of local anesthetic used was significantly lower in the Articaine group than in the Lignocaine group. The mean volume was 1.04 ± 0.64 mL in the Articaine group compared with 1.55 ± 0.38 mL in the Lignocaine group, with a statistically significant difference ($p < 0.001$). These findings indicate that a smaller volume of Articaine was required to achieve the desired anesthetic effect. In the Articaine group, palatal infiltration was required in only 2 of the 25 cases, suggesting effective anesthesia with a relatively lower anesthetic volume.

Table 2: Comparison of the mean volume of local anesthetic used in the Articaine and Lignocaine

Groups	Mean	Standard Deviation	P value
2% Lignocaine	1.55	0.38	**<0.001**
4% Articaine	1.04	0.64	



Graph 2: Comparative analysis of local anesthetic volume between two study groups

3. Pulse rate and oxygen saturation

Pulse rate and oxygen saturation were recorded at five stages: preoperative, after application of topical anesthetic, after administering local anesthetic, postoperatively, and before discharge. No statistically significant difference was observed between the Articaine and Lignocaine groups, with a p-value <0.001. For intragroup comparison, pulse rate and oxygen saturation were also measured at five stages: and the values recorded at the different time intervals were compared. The analysis revealed no statistically significant variations in pulse rate or oxygen saturation across the five stages within either group receiving Articaine or Lignocaine ($p < 0.001$).

4. WBRS and FLACC [Graph 3, 4]

Intergroup comparison:

During the operative procedure, pain assessment using the FLACC scale demonstrated significantly lower pain scores in the Articaine group than in the Lignocaine group ($p = 0.001$). Postoperatively, assessment using the WBRS also revealed a highly significant difference between the two groups. The mean postoperative WBRS score was 0.23 in the Articaine group compared with 1.00 in the Lignocaine group ($p < 0.001$). These findings indicate that Articaine was associated with lower pain intensity both during the procedure and during the postoperative period.

Intragroup comparison:

Pain scores were additionally evaluated at different time intervals within each treatment group. In the Articaine group, FLACC scores remained relatively low during the operative period, while postoperative assessment using the WBRS demonstrated minimal discomfort, with a mean score of 0.30. In the Lignocaine group, comparatively higher intraoperative FLACC scores were observed, and the mean postoperative WBRS score was 1.10. The intragroup analysis demonstrated statistically significant variation in pain scores across the assessed time intervals in both groups ($p < 0.001$).

Graph 3: Comparison of intraoperative pain scores assessed using the FLACC scale between two study groups

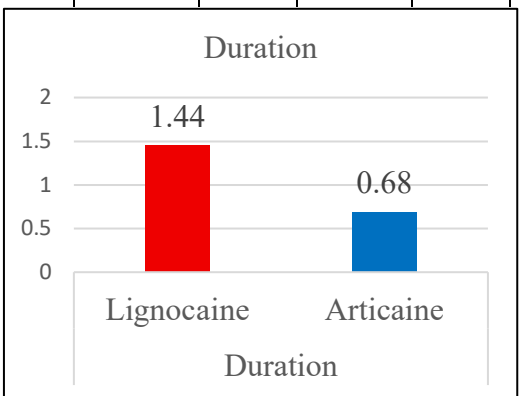
Graph 4: Comparison of postoperative pain scores assessed using the FLACC scale between two study groups

5. Duration of anesthesia [Table 3, Graph 5]

The mean duration of anesthesia was 0.68 ± 0.27 minutes in the 4% Articaine group and 1.44 ± 0.19 minutes in the 2% Lignocaine group. The difference between the two groups was statistically highly significant ($p < 0.001$). These findings indicate that Lignocaine produced a significantly longer duration of anesthesia than Articaine.

Table 3: Comparison of the mean duration of anesthesia between the 2% Lignocaine and 4% Articaine Groups

Groups	Mean	Standard Deviation	P value
2% Lignocaine	1.44	0.19	**<0.001**
4% Articaine	0.68	0.27	



Graph 5: Comparison of the Mean Duration of Anesthesia between Two study groups

6. Post anesthetic complications [Table 4]

Post-anesthetic complications were observed more frequently in the 2% Lignocaine group than in the 4% Articaine group. Cheek and lip biting resulting in ulceration was reported in 11.8% of children in the Lignocaine group, whereas no such complications were reported in the Articaine group. The difference between the two groups was statistically highly significant ($p < 0.001$), indicating a significantly higher incidence of post-anesthetic complications in the Lignocaine group.

Table 4: Post anesthetic complications

Group	Yes	No	P value
2% Lignocaine	11.8%	88.2%	**<0.001**
4% Articaine	0	100%	

Discussion

A crucial element of behavior management at a dental practice, particularly in pediatric dentistry, is effective pain management. Effective pain control is a fundamental component of behavior management in pediatric dentistry. The administration of local anesthesia may itself induce fear and anxiety in children, particularly during needle insertion and deposition of the anesthetic solution. Therefore, achieving effective anesthesia with minimal discomfort is essential not only for successful completion of dental treatment but also for promoting a positive attitude toward future dental visits. Appropriate selection and administration of local anesthetic agents consequently remain important considerations in pediatric dental practice [7]. Rapid onset of anesthesia is particularly desirable in pediatric dentistry because prolonged waiting for adequate anesthesia may increase apprehension and

reduce cooperation. The onset of action of a local anesthetic depends on several pharmacological characteristics, including concentration, lipid solubility, tissue diffusion, and interaction with Na^+ channels within neuronal membranes. The physicochemical properties of the anesthetic molecule therefore influence the time required to achieve clinically adequate neural blockade [8].

In the present study, Articaine demonstrated a significantly faster onset of anesthesia than Lignocaine. The mean onset time was approximately 2–3 minutes with Articaine compared with approximately 3–4 minutes with Lignocaine. The shorter onset observed with Articaine may be clinically advantageous in children, as it permits treatment to commence sooner and may reduce anxiety associated with prolonged waiting periods. The finding is consistent with the comparative observations of Kambalimath et al. (2013), who reported relatively rapid onset following administration of 4% Articaine and 2% Lignocaine in children. Their findings demonstrated onset times of approximately 1–2 minutes for Articaine and 1–5 minutes for Lignocaine, supporting the potential for Articaine to produce clinically effective anesthesia rapidly [9].

A substantial difference was observed between the two groups in the requirement for supplemental palatal infiltration following maxillary buccal infiltration. In the present study, 22 of 25 children in the Lignocaine group required additional palatal anesthesia, whereas only 2 children in the Articaine group required supplemental palatal infiltration. This observation suggests that Articaine may have provided more effective tissue diffusion under the conditions of the present investigation. The ability of Articaine to diffuse through tissues has been associated with its molecular structure, particularly the presence of a thiophene ring, which contributes to its physicochemical characteristics. Nevertheless, the requirement for palatal supplementation may vary according to the dental procedure, anatomical characteristics, injection technique, and individual response to the anesthetic. Bahrololoomi and Maghsoudi (2022), while evaluating Articaine during primary maxillary molar extraction similarly emphasized that Articaine infiltration does not invariably eliminate the need for palatal anesthesia [10]. The substantially lower requirement for supplemental palatal anesthesia in the present study may therefore represent a clinically useful finding; although it should not be interpreted as evidence that palatal supplementation is unnecessary in all pediatric maxillary procedures.

Duration of anesthesia is another important consideration when selecting a local anesthetic for pediatric patients. An ideal agent should maintain adequate pulpal anesthesia for the duration of treatment while avoiding unnecessarily prolonged soft-tissue anesthesia. Prolonged numbness of the lips, cheeks, or tongue may be uncomfortable for children and can increase the possibility of accidental biting following treatment. In the present investigation, the anesthetic effect persisted for approximately 1–1.5 hours with Articaine and 1.5–2 hours with Lignocaine. Thus, Lignocaine demonstrated a comparatively longer perceived duration of anesthesia. Mumtaz et al. (2021) also reported a longer anesthetic effect with Lignocaine compared with 4% Articaine during primary mandibular molar extraction [11]. Although prolonged duration may be beneficial for lengthy procedures, the relatively shorter duration associated with Articaine may be advantageous in pediatric patients by reducing the period during which postoperative soft-tissue numbness is experienced.

Physiological responses were assessed at five predefined stages: before treatment, following topical anesthetic application, after administration of local anesthesia and needle withdrawal, immediately after completion of the procedure, and following recovery before discharge. Monitoring these parameters was important because pain, anxiety, and local anesthetic administration can influence cardiovascular and respiratory responses in children. No statistically significant differences were observed between the Articaine and Lignocaine groups in the assessed physiological parameters. Khatri et al. (2021) similarly reported that heart rate, blood pressure, and oxygen saturation remained within clinically acceptable ranges among pediatric patients receiving Lignocaine, buffered Lignocaine, or Articaine [12]. These observations suggest that both agents can be administered safely in children without producing clinically important differences in the monitored physiological responses when used appropriately.

Assessment of pain in children is inherently challenging because pain is subjective and may be influenced by age, anxiety, previous dental experiences, emotional state, and individual pain thresholds. The use of age-appropriate pain assessment instruments can therefore improve the evaluation of treatment-related discomfort. In the present study, pain was assessed using the WBRS together with the FLACC scale, allowing both subjective reporting and behavioral assessment of pain. The present findings demonstrated a statistically significant difference in postoperative WBRS scores, with children in the Lignocaine group reporting greater pain than those in the Articaine group. This finding suggests that Articaine may have provided a more comfortable overall clinical experience under

the conditions of the present study. Erfanparast et al.(2020), who compared Articaine infiltration with Lignocaine nerve block in children undergoing pulp therapy, likewise identified differences in pain perception and behavioral responses associated with the anesthetic technique [13].

The FLACC assessment further demonstrated significant differences during the intraoperative period and following completion of treatment. Thus, the observed advantage of Articaine was reflected not only in the children's subjective pain reports but also in observable behavioral indicators of discomfort. Nevertheless, interpretation of pediatric pain outcomes should take into account factors such as anxiety, treatment type, injection technique, previous dental experience, and individual behavioral characteristics. The absence of significant differences in physiological parameters between the two anesthetic groups is also supported by findings from comparative pediatric investigations. Mittal et al. (2015) reported no significant differences in hemodynamic parameters between children receiving Articaine and Lignocaine during primary maxillary molar extraction [14]. The agreement between these observations and the present findings suggests that both anesthetic agents have a broadly comparable cardiovascular profile when used appropriately in pediatric dental procedures.

Postoperative safety represents an important consideration when evaluating local anesthetic agents in children. In the present study, no statistically significant difference was observed between Articaine and Lignocaine with respect to postoperative symptoms, clinical signs, or the requirement for systemic analgesics. This indicates that both agents demonstrated a comparable postoperative safety profile within the conditions of the present investigation. Elheeny (2020) evaluated the efficacy and safety of Articaine in young children and reported that the agent could be used effectively without clinically important safety concerns in the studied population [15]. The absence of significant differences in postoperative adverse effects observed in the present study is therefore consistent with previous pediatric evidence.

The findings of the present study can be interpreted in conjunction with previous evidence comparing articaine and lignocaine. Poorni et al. (2011) reported effective pulpal anesthesia with 4% articaine when administered through inferior alveolar nerve block and buccal infiltration techniques, supporting its potential as an effective local anesthetic in dental practice [16]. Similarly, Seshadri et al. (2023), in a comparative evaluation involving pediatric dental patients, observed differences in the analgesic effects of articaine and lignocaine, further supporting the clinical relevance of articaine in pediatric dentistry [17]. These findings provide additional support for the present study and suggest that articaine may offer favorable clinical performance while maintaining effective pain control in children.

Overall, the present randomized controlled study indicates that Articaine may offer certain clinical advantages over Lignocaine in pediatric dental procedures. Articaine showed a faster onset of anesthesia, reduced need for supplemental palatal infiltration during maxillary procedures and lower pain scores at selected assessment periods. Lignocaine demonstrated a comparatively longer perceived duration of anesthesia. However, both agents showed comparable effects on physiological parameters and postoperative adverse effects. Articaine may therefore be considered a suitable alternative to Lignocaine, particularly when rapid anesthetic onset and reduced duration of postoperative soft-tissue numbness are clinically desirable. Nevertheless, anesthetic performance may vary according to injection technique, treatment characteristics, anatomical factors, anxiety, and individual pain perception. Further large-scale randomized clinical trials with standardized protocols and longer follow-up are warranted to validate these findings and better define the clinical indications and limitations of both agents.

Limitations

The present study has several limitations that should be considered when interpreting the findings. The relatively limited sample size may have reduced the statistical power of the study and may restrict the generalizability of the results to a broader pediatric population. Although the participants were randomly allocated to the study groups, differences in individual responses to the two local anesthetic agents cannot be completely excluded. Variability in children's pain thresholds, anxiety levels, behavioral responses, and previous dental experiences may also have influenced the assessment of pain and anesthetic efficacy. Furthermore, the study was conducted under a specific clinical setting and age range, which may limit the applicability of the findings to children with different demographic or behavioral characteristics. Future investigations involving larger, multicenter samples and a split-mouth or crossover design could provide a more robust within-subject comparison of Articaine and Lignocaine while minimizing the influence of inter-individual variability.

Conclusion

Within the limitations of the present study, 4% Articaine demonstrated superior clinical performance compared with 2% Lignocaine in children aged 6–10 years undergoing pulp therapy. Articaine provided a more rapid onset of anesthesia, required a

comparatively lower volume, and produced more effective intraoperative pain control, as reflected by the lower FLACC and WBRS scores. Its duration of anesthesia was shorter and more appropriate for the treatment procedure, thereby potentially reducing the risk of prolonged soft-tissue numbness and associated postoperative complications. Notably, no lip or cheek-biting episodes were observed in the Articaine group, whereas such complications occurred in the Lignocaine group. Overall, 4% Articaine may be considered a clinically effective alternative to 2% Lignocaine for pediatric pulp therapy, offering efficient anesthesia with favorable postoperative outcomes and improved patient comfort.

Conflicts of Interest: Nil
Financial Support: None

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