

COMPARING THE EFFICIENCY OF 2% LIDOCAINE AND 4% ARTICAINES AS A LOCAL ANESTHETIC AGENT IN CHILDREN

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Received: 27 December 2017, Revised and Accepted: 01 February 2018

ABSTRACT

Objective: The objective of this study is to compare the anesthetic efficiency of conventional 2% lidocaine with 4% articaine when infiltrated in the maxillary arch for pediatric patients during pulp therapy and extraction.

Methodology: A randomized control trial was done with 45 children (n=45) of the age group 4–8 years. The children were randomly allotted to two experimental groups. Group A – Children received 2% Lidocaine HCL infiltration both buccally and palatally, Group B – Children received 2% Lidocaine infiltration buccally and Group C – Children received 4% Articaine infiltration buccally as local anesthetic agent. Post treatment, pain assessment was done using visual analog scale.

Results: Articaine group had significantly lower pain scores when compared to the lidocaine group.

Conclusion: Articaine infiltration can be considered as an effective alternative for the conventional lidocaine infiltration.

Keywords: Articaine, Lidocaine, Pain assessment, Visual analog scale.

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INTRODUCTION

Pain control in pediatric dentistry is an important contributor to reduce the child's anxiety. Children tend to have greater emotional outbursts when compared to adults during medical and dental procedures [1]. Thus, managing children during an invasive procedure is a challenging task. Local anesthetics play a part and parcel of dentistry in pain control techniques [2]. Advancements in local anesthetics have taken its course way back from 1884 when cocaine was used for anesthetic purposes to lidocaine from the year 1943. Lidocaine was first synthesized by a Swedish Chemist Nils Lofgren, which still continues to be a benchmark in local anesthetic evolution. 2% lidocaine HCL is considered as the reference standard for comparing the other local anesthetics till date. In the succeeding years, other amide local anesthetics (prilocaine, bupivacaine, etc.) were introduced [3]. At present, the local anesthetic armamentarium consists of anesthetic agents whose duration of action ranges from 20 min (mepivacaine) to 3 h (bupivacaine with adrenaline) [2].

In the year 1969, a new local anesthetic drug, articaine was discovered by Rusching *et al.* It was first named as carticaine, but then its generic name was renamed as articaine in the year 1984 [4]. Since its time of invention, articaine is being the subject of interest among the dentists. Articaine is considered to be a unique local anesthetic agent as it is the only local anesthetic with a thiophene ring in the place of the benzene ring, which increases its liposolubility [5]. Due to this, biotransformation of articaine takes place in both plasma and liver and is excreted through the kidneys [6]. Articaine penetrates well into the tissues and diffuses efficiently. Its plasma protein binding capacity is 95% higher than the other local anesthetics [5]. The mechanism of action of articaine is similar to that of lidocaine [2]. Addition of a vasopressor to lidocaine and articaine would produce a localized vasoconstriction, thus retarding the absorption of local anesthetic agents, leading to a prolonged action [2]. Hence, adrenaline is being added to both articaine and lidocaine to intensify its property. Clinical trials conducted using various concentrations of articaine with and without vasopressor

showed that 4% articaine with adrenaline provide significantly greater properties when compared to 1%, 2%, and 3% articaine [7-9].

Hence, 2% lidocaine HCL and 4% articaine HCL were used in this study. Although various studies have been conducted so far to check for the efficiency of articaine as a local anesthetic agent and also to compare its properties and advantages over lidocaine, similar studies on pediatric patients are quite less. Thus, this study aims in assessing the efficiency of articaine over lidocaine among the pediatric patients and also find if articaine is effective in providing palatal anesthesia when infiltrated buccally.

METHODOLOGY

The research protocol and informed consent were approved by the ethical committee board of the institution. Clinical procedures were explained in detail to the patient's parents/caregivers. Informed consent was obtained from every patient included in the study prior treatment. A randomized control trial was conducted among 45 children of the age group 6–9 years, requiring extraction of maxillary primary molars. Only Frankel's definitely positive and positive children with no medical history were included in the study. Children with negative behavior, non-vital teeth, and medical complications were excluded from the study. A total of 45 children were divided randomly into three groups as follows:

Group A (control group) - 1.8 ml of 2% lidocaine HCL with adrenaline 1:2,00,000 was injected buccally (1.5 ml) and palatally (0.3 ml)
Group B - 1.8 ml of 2% lidocaine injected buccally
Group C - 1.8 ml of 4% articaine injected buccally.

Children in Group A received both buccal and palatal injection, whereas children in Group B received only buccal injection.

The mucobuccal fold corresponding to the site of injection was dried with gauze, and a topical anesthetic gel (2% benzocaine) was applied. In the control group, 1.8 ml (1.5 ml buccally and 0.3 ml palatally) of 2%

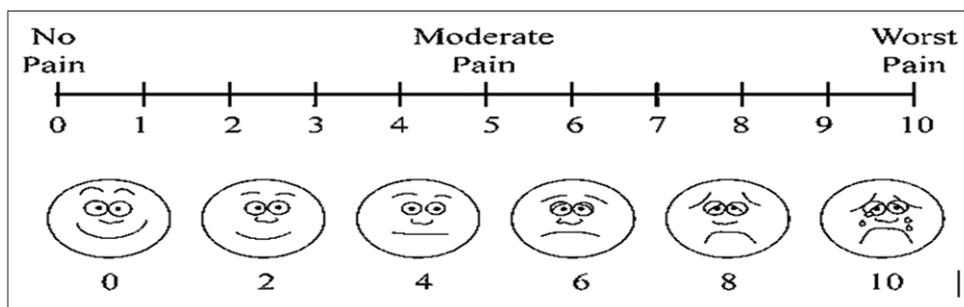


Fig. 1: Visual analog scale used in the study

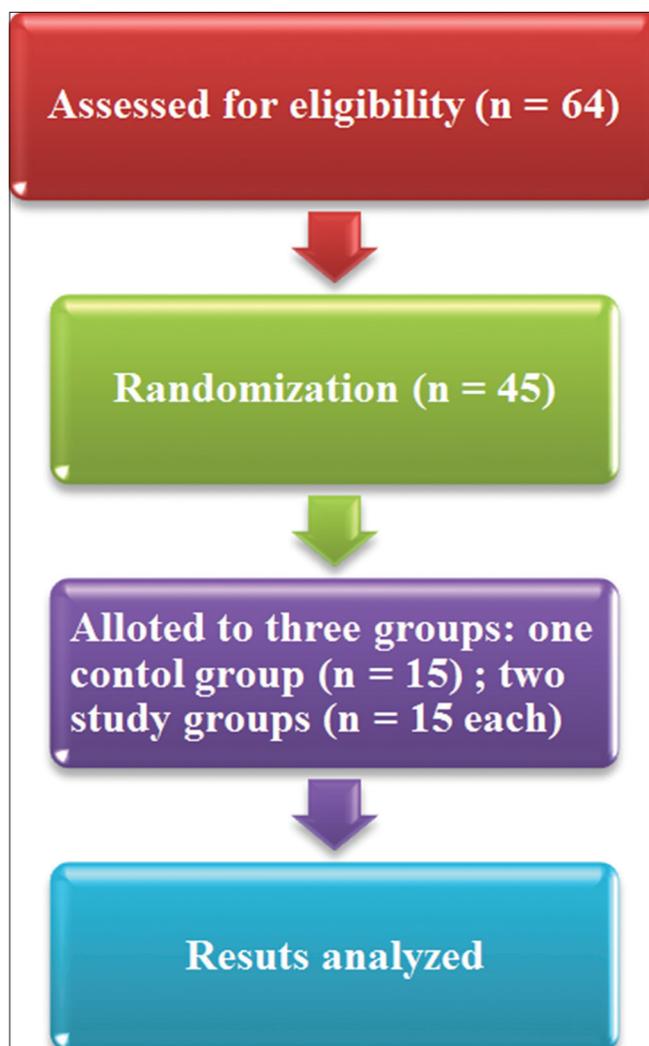


Fig. 2: Flow diagram of study methodology

lidocaine solution was injected using a 27-gauge needle under sterile condition. A similar procedure was followed in the other two groups, except that, 1.8 ml of 2% lidocaine was injected buccally in Group B patients and 1.8 ml of 4% articaine was injected buccally in Group C patients. Objective signs of numbness were evaluated using a periosteal elevator, first on the contralateral side and then on the anesthetized side after 10 min.

The visual analog scale (VAS) (Fig. 1) was given immediately after the local anesthetic injection and after the extraction to patients belonging to all the three groups for the assessment of pain, and the score was recorded.

Table 1: The comparison of pain scores between the groups during injection and during extraction

Intervention	n	Mean±SD	SE	F	p
During injection					
1.00	15	8.1333±1.76743	0.45635	15.983	0.000
2.00	15	4.4000±1.72378	0.44508		
3.00	15	5.0667±2.25093	0.58119		
Total	45	5.8667±2.50091	0.37281		
During extraction					
1.00	15	1.2000±1.47358	0.38048	82.053	0.000
2.00	15	7.2000±1.47358	0.38048		
3.00	15	1.3333±1.44749	0.37374		
Total	45	3.2444±3.17057	0.47264		

SD: Standard deviation, SE: Standard error

The materials and methodology has been depicted in brief in the form of a flowchart (Fig. 2).

RESULTS

The VAS indicated numbers from 0 to 10 (no pain to worst pain). The score 0, 2,4,6,8, and 10 was given as chosen by the child. The results were recorded and tabulated.

The mean value of the pain scores obtained was calculated (Table 1). Pain experienced during extraction showed higher scores on a VAS for 2% lidocaine when injected only in the buccal aspect (Group B). It showed that there was a significant difference in anesthetic efficiency between 2% lidocaine and 4% articaine in maxillary infiltration (Table 2). Articaine although given only buccally provided palatal anesthesia which was not so with lidocaine. Children experienced more pain during palatal injection of lidocaine (Table 2).

ANOVA analysis showing statistical values of results obtained from 45 pediatric patients included in the study.

DISCUSSION

Lidocaine is the most commonly used local anesthetic agent in dentistry and is considered to be the referral base to check for the efficiency of other local anesthetic agents. It provides pulpal anesthesia for about 1 h and soft tissue anesthesia for about 3–5 h [10]. Lidocaine is also used as a topical anesthetic gel and transdermal patch. Various preparation methods have been proposed so far [11,12]. When several other local anesthetic agents failed to compete for the standard of lidocaine, articaine was found to be equally efficient and sometimes more efficient than lidocaine since its introduction in the year 1969 [13]. Articaine is the second most commonly used local anesthetic agent in dentistry. It provides pulpal anesthesia for about 1 h and soft tissue anesthesia for about 2.25 h. Articaine is unique among the other amide local anesthetics because it contains a thiopentone group instead of the benzene ring [14]. Articaine is one of the safest local anesthetics due to

Table 2: The *post hoc* Tukey's analysis of the significance level between the groups

Dependent variable	(I) groups	(J) groups	Mean difference (I-J)	SE	p
During injection	1.00	2.00	3.73333*	0.70433	0.000
		3.00	3.06667*	0.70433	0.000
	2.00	1.00	-3.73333*	0.70433	0.000
		3.00	-0.66667	0.70433	0.614
	3.00	1.00	-3.06667*	0.70433	0.000
		2.00	0.66667	0.70433	0.614
During extraction	1.00	2.00	-6.00000*	0.53492	0.000
		3.00	-0.13333	0.53492	0.966
	2.00	1.00	6.00000*	0.53492	0.000
		3.00	5.86667*	0.53492	0.000
	3.00	1.00	0.13333	0.53492	0.966
		2.00	-5.86667*	0.53492	0.000

SE: Standard error

its faster metabolic rate. Subsequently, it decreases the risk of systemic toxicity and overdosage. Evidences were claimed that articaine had no toxic reactions when injected among 211 pediatric patients [15].

In the present study, no significant difference in pain perception was seen between the control group and the articaine group (Group C) during extraction procedure. Several studies have reported with similar results [16-20]. There was a significant difference between the articaine group (Group C) and the lidocaine group (Group B) in terms of pain perception. About 4% articaine group offered a better palatal anesthesia than 2% lidocaine group with only buccal infiltration. The result of this study goes in concordance with several other studies [21,22], while Ozeç *et al.* [23] and Mittal *et al.* [24] disproved the concept of 4% articaine's efficiency in providing palatal anesthesia only with buccal infiltration. Pain perception in the lidocaine group (Group B) is higher during extraction when compared to the control group. Few studies have reported contradictory results in this aspect [25-27].

Hence, lidocaine infiltration given both buccally and palatally and articaine infiltration given buccally provide an excellent anesthetic effect. Lidocaine when given only buccally has no effect on palatal tissues. In spite of the application of topical local anesthetics before the injections, palatal injections remain to be the most painful of all. Thus, the present study emphasizes at evaluating the anesthetic efficiency of lidocaine and articaine when given only in the buccal aspect.

CONCLUSION

This study shows that 4% articaine has better anesthetic efficiency than 2% lidocaine when only buccal infiltrations are given. This enables the practitioner to avoid palatal injection, causing less pain to the child, thus helping the practitioner in gaining the child's cooperation.

ACKNOWLEDGMENT

Nil.

CONFLICT OF INTEREST

Nil.

AUTHORS CONTRIBUTION

Concept and collection of data-Meenakshi Mohan, Ganesh Jeevanandan
Writing the article and critical review of article - Meenakshi Mohan, Manisha Nair
Final approval of the article - Ganesh Jeevanandan

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