

Original Article

A comparison between articaine mandibular infiltration and lidocaine mandibular block anesthesia in second primary molar: A randomized clinical trial

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ABSTRACT

Background: One of the most important objectives of pediatric dentistry during dental practice is pain control and effective anesthesia. Because of the limitations of inferior alveolar nerve block (IANB), other techniques such as infiltration injection are suggested. Infiltration technique by using some other solutions such as articaine is an appropriate alteration for mandibular anesthesia. The aim of this study is to compare the efficacy of IANB using lidocaine with infiltration injection by articaine in mandibular second primary molar anesthesia in 8–11-year-old children.

Materials and Methods: This is a randomized, cross-over, clinical trial that was performed on 42 children aged 8–11 years, who needed extraction of both mandibular second primary molars. After clinical and radiographic investigations, block or infiltration injection was chosen randomly and treatment was performed in one side in each session. Patient's behavior was registered in two steps of injection and extraction by SEM scores. For comparison of the two sides, Wilcoxon–signed rank test was used ($P < 0.05$).

Results: We concluded that infiltration technique resulted in decrease of all the three SEM scores in comparison to block injection ($P < 0.05$). The effectiveness of two techniques during tooth extraction, although grade of lidocaine block was more than infiltrate, was not statistically significant.

Conclusion: It seems that infiltration technique with articaine is a better substitute for block technique in the extraction of mandibular primary molars.

Key Words: Articaine, lidocaine, local anesthesia

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INTRODUCTION

One of the most important issues affecting dental treatment for all persons in different age groups is pain control during treatment. This issue becomes more important in children because in addition to all therapeutic principles that are observed in adults, controlling the behavior of children should be

particularly considered because a painful stimulus can cause loss of child's cooperation and have an adverse effect in the treatment of children.^[1] In addition, in the cases of block anesthesia injections that affect major parts of the mouth, a common problem in children is trauma of biting numb lips and tongue

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that sometimes creates very worrying appearance, particularly for parents of the patients.^[2] Inferior alveolar nerve block (IANB) is the preferable way for pulpal anesthesia of mandibular teeth.^[3] *In vivo* studies have declared that IANB injection's failure is about 44%–84%.^[4] This issue highlights the need for a better substitute for local anesthesia. One of the alternative methods is taking the advantage of anesthetic infiltration injection in primary molars with different anesthetic drugs.^[5,6] Easier application, less numbness of soft tissues, and faster anesthesia are the benefits of the infiltration technique.^[7] In addition, because of the local effect of infiltration techniques, implementing two-way dental works in one session is possible.^[5] On the other hand, the infiltration technique of the lower jaw has less effect than the mandibular block technique in pulpotomy. Another disadvantage of this technique is that the syringe is exposed to the patients' vision, and this is unfavorable especially in children.^[1,6]

Previous studies comparing the efficacy of infiltration anesthesia in the mandible with mandibular block anesthesia of children in the treatment procedure of pulpotomy, reconstruction, and extraction of primary dentition have shown that both anesthetic methods had the same effects for restorative treatment. However, lidocaine, as the first amide drug, is the most common anesthetic agent.^[6] However, articaine has been recently introduced which possesses several advantages including a half-life of 30 min versus 90 min for lidocaine and low toxicity that guarantees its function in a higher concentration than other amide local anesthetic injection materials.^[1,8,9] Contraindications of using articaine are in patients allergic to amide-type anesthetics, patients with idiopathic or congenital methemoglobinemia, and patients with sickle cell anemia disease.^[10]

Comparisons of articaine and lidocaine in different studies have revealed that articaine has higher success rate and increased duration of action than lidocaine in mental nerve block injection and incisive nerve block.^[11] However, some studies have reported no difference in the anesthetic efficacy of articaine and lidocaine in mandibular block anesthesia.^[12]

Ghasemi *et al.* reported that the pain severity of infiltration injection is less than that of block injection, while they observed no significant difference in the pain severity between the two techniques during pulp exposure.^[13] Similarly, Yassen concluded that there is no

significant difference between the two techniques during injection and the treatment process. Besides, mandibular infiltration technique is as effective as block technique for filling, extraction, and pulpotomy of primary canine teeth. In addition, mandibular infiltration anesthesia is not more painful than block anesthesia.^[14]

Huang *et al.* suggested that articaine can be an appropriate alternative for lidocaine in the block method for extraction of mandibular third molar.^[15]

Due to disadvantages of block technique and low efficacy of infiltration injection with lidocaine in the extraction of mandibular second primary molars, and the positive characteristics of articaine that are studied in few studies, it was decided to conduct this study. The present study aimed to compare the success rate of implementing block method with lidocaine and infiltration technique with articaine for anesthesia in the extraction of primary mandibular second molars in 8–11-year-old children.

MATERIALS AND METHODS

The current randomized clinical trial was approved by the ethics committee of Isfahan Islamic Azad University (ethics code 1394.4.127) and recorded on the Iranian Registry of Clinical Trials. Forty-two, 8–11-year-old children were selected out of those referred to the dental clinic of Isfahan Islamic Azad University, Isfahan, Iran, who were candidates for extraction of the second primary molars of mandible. Before starting the study and treatment, all of the experimental procedures and subject of the study and its main objectives were clearly explained to the parents of children, and written consent forms were received from the parents of all children.

The inclusion criteria were that the children should be physically healthy and there must be no history of allergic reactions to local anesthetic solutions and no medical conditions contraindicating the use of epinephrine. In addition, they should have no disorders which cause pain and also in terms of the ability to collaborate, children who had Grade 3 (+) and 4 (++) according to Frankl scale (2) were selected. The least remaining root was 3/4 of the root length in all participants. Children who did not cooperate well with the dental team were excluded from the study.

At the beginning, infiltration injection or block injection was chosen randomly for patients. Those with even numbers at the end of their social ID

number received block injection and for those with odd numbers at end, infiltration injection was implemented in the first session of work. In the second session, the injection technique was changed. In each session of dental work, one side of the jaws was treated. Before injection, topical anesthetic gel (Benzotop, DFL Rio de Janeiro, Brazil) was applied with a cotton roll for 1 min.

The clinician was aware of the types of anesthetic solution, but the patient and the parents were not. The study was carried out as a single-blind, parallel trial. In this method, both block and infiltration techniques were performed for all patients at two different times. At least 72-h interval was considered between the two treatment sessions.^[6,7] IANB injection was performed using 2% lidocaine and 1/100,000 epinephrine or infiltration injection by 4% articaine and epinephrine 1/100,000, and the maximum permissible dose was calculated based on the body weight of children, by digital scales (articaine: 5 mg/kg and lidocaine: 4 mg/kg).^[6]

In the infiltration technique, after the initial entry of syringe, a small amount of the solution was injected in the mucosal surface and after a few seconds that the syringe moved in the mucobuccal folds toward the second primary molar teeth, the remaining anesthetic solution was injected. In this study, articaine was injected at the root apex site and after 5 min, anesthetic solution was re-injected in the mesial and distal papillae of second primary molar so that whitening of lingual tissue occurred.^[7] In the block method, the thumb was placed on the coronoid notch on the anterior border of the ramus and other fingers were placed on its posterior border. The syringe's average entrance in the tissue was about 15 mm and for all mandibular nerve block injections, a 30G needle with length of 25 or 30 mm was used.

The sound, eye, motor scale for the assessment of child's behavior (SEM) scale was used for pain assessment during treatment. This scale consists of voice recording (sound), eye examination, and patient motor, which are recorded separately for each treatment. After injection, the scale's score was recorded by a trained nurse in the relevant information sheets which were prepared for each child.^[16] Response to pain during the injection and tooth extraction was recorded.

Data were analyzed using SPSS 20 software (released in 2020, USA, Chicago) and Wilcoxon-test and *t*-test, and the statistical significance level was considered as $P < 0.05$.

RESULTS

Assessing the block injection with lidocaine and infiltration injection with articaine during injection revealed statistically significant difference in three indicators of SEM, namely sound ($P < 0.001$), motor ($P < 0.001$), and eye movements ($P < 0.013$), between these two methods [Table 1].

In the evaluation of block injection with lidocaine and infiltration injection with articaine during extraction, the average of the three indices of SEM (voice, motor, and eye movements) in the block injection was less than that of the infiltration technique, but there was no significant difference between the two methods [Table 2]. In all the three indicators of sound, motor, and eye movements during the extraction, nerve block injection with lidocaine had better performance, but there was no significant difference between the two methods.

DISCUSSION

The most common anesthetic injection in the lower jaw of children is IANB. Considering that block

Table 1: Comparison of block injection with lidocaine and infiltration injection with articaine during injection in three indicators of SEM

Method	<i>n</i>	Mean±SD	<i>P</i>
Sound			
Infiltration injection	42	1.69±0.811	0.001
Block injection	42	2.14±0.899	
Eye			
Infiltration injection	42	1.76±0.655	0.001
Block injection	42	2.09±0.821	
Motor			
Infiltration injection	42	1.45±0.055	0.13
Block injection	42	1.67±0.65	

SD: Standard deviation

Table 2: Comparison of block injection with lidocaine and infiltration injection by articaine during extraction in three indices of SEM

Method	<i>n</i>	Mean±SD	<i>P</i>
Sound			
Infiltration injection	42	1.74±0.665	0.18
Block injection	42	1.67±0.712	
Eye			
Infiltration injection	42	1.83±0.581	0.1
Block injection	42	1.74±0.627	
Motor			
Infiltration injection	42	1.43±0.59	0.15
Block injection	42	1.33±0.526	

SD: Standard deviation

injection causes the long-established anesthesia in children and can also cause traumatic injuries to soft tissues, the necessity of an alternative injection is felt. In this research, the effects of infiltration injection technique with articaine and IANB with lidocaine in order to extract the second primary molar in the lower jaw of 8–11-year-old children were evaluated. In order to measure and compare the pain during injection, the SEM scale was used in both infiltration and block methods, which is a reliable and easy-to-use test.^[17]

Based on the findings of the present research, comparison between the two injection techniques of block injection with lidocaine and infiltration with articaine revealed that infiltration technique at the injection stages reduced all the three criteria of SEM significantly. In this way, the child's discomfort due to anesthetic injection in infiltration technique was significantly less than that by block technique, and this result was similar to the results of the study conducted by Tudeschoie *et al.*,^[13] Ram *et al.*,^[18] and Jones *et al.*^[16]

Zafarmand *et al.* concluded that most of the children had eye, hand, foot, and body movements in the infiltration injections, and they also cried. In none of the cases, there was significant difference between the two techniques, hence it seems that this difference is due to the participation of children with lower age (5–8 years old) than that in the current study.^[19] Yassen found no difference in pain between two techniques in the study of infiltration injection and block injection. The reason might be the difference in the type of teeth that were studied. (They studied canine teeth, whereas we did the research on molars).^[14]

According to the results of this study, in none of the SEM indexes, significant difference during tooth extraction was observed. This finding is consistent with the results obtained by Haghgoo and VahidGolpayegani,^[20] Sharaf,^[7] and Donohue *et al.*^[5] However, in their study, several types of treatment methods were implemented (reconstruction, pulpotomy, and extraction) on the primary molars, and lidocaine was used in both techniques. On the other hand, a different result was obtained by Oulis *et al.* where it was found that infiltration technique was less effective for tooth extraction and pulpotomy of the lower jaw than the block method. Accordingly, anesthesia by infiltration techniques was unreliable in their opinion^[21] that it may be because of the double-sided treatment of children, their probable

tiredness, and their negative reactions other than pain. For this reason, in the present study, the teeth have been extracted in separate sessions. In addition, in the study by Oulis *et al.*, 3–9-year-old children were examined and as the possibility of negative reactions in addition to pain in young children is much greater, this could be the reason for the failure of their study. In addition, more effectiveness of infiltration injection of articaine than block injection of lidocaine, indicates its higher osseous penetration in anesthesia.^[6,12]

In addition, Alinejhad *et al.* studied the difference between the effect of IANB with lidocaine and infiltration injection with articaine in pulpotomy of primary second mandibular molars and suggested that the use of local anesthetics with articaine can cause deeper anesthesia in 6–10-year-old children. Despite the difference in the operation type, their results are similar to those of ours.^[22]

Based on the results of this study, the effectiveness of infiltration with articaine for the extraction of second primary molar was more than that of block injection with lidocaine, and these results were consistent with the findings of Rajput *et al.*,^[23] Huang *et al.*,^[15] and Abdullah *et al.*^[24] The only difference was that the mentioned studies were conducted on the extraction of permanent teeth.

However, in this study, no significant difference was found between articaine infiltration injection and the block with lidocaine during tooth extraction. However, because of the positive characteristics of articaine, such as higher power and less toxicity than lidocaine, and also due to the disadvantages listed about the block technique, it seems that articaine can be as effective as lidocaine in the extraction of mandibular second primary molar teeth.

CONCLUSION

Articaine infiltration injection can be as effective as IANB injection with lidocaine anesthesia in mandibular second primary molar extraction.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial, in this article.

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