Original Article

Evaluation of articaine/clonidine anesthesia on IANB in symptomatic irreversible pulpitis teeth

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Abstract

Introduction: Inferior alveolar nerve block plays a major role in treatment of the patients with irreversible pulpitis. The present study aimed to evaluate the effect of 4% Articaine anesthesia with epinephrine 1:100000 in the combination with clonidine on the success of inferior alveolar nerve block in the molar teeth with the symptomatic irreversible pulpitis. Methodology: A total of 100 patients with diagnosis of irreversible symptomatic pulpitis in the mandibular molar teeth were selected. The subjects were randomly assigned into two groups. In the first group, 0.2 ml of the clonidine 150 µg / ml were added to 1.8 ml of the 4% Articaine anesthetic solution with epinephrine 1:100000 by using Hamilton's syringe. In the second group, 0.2 ml of the sterile distilled water was added to 1.8 ml of the 4% Articaine Anesthetic solution with epinephrine 1:100000 by using the Hamilton's syringe. The inferior alveolar nerve block was injected to each of the patients. The access cavity was prepared 15 minutes after the injection and inducing the lip anesthesia. Success was defined as no pain or mild pain during the preparation of the access cavity or the initial instrumentation based on HP-VAS. The data were analyzed by using the t-test, Mann-Whitney and Chi-square tests. Results: In this study, the success rate was 66% in the group that received 4% Articaine solution with the epinephrine 1/00000 in the combination with clonidine and it was 58% in the group that received 4% Articaine solution with epinephrine 1:100000 with distilled water (P-value=0.410). Conclusion: Adding clonidine to 4% Articaine anesthesia drug did not increase the success of the inferior alveolar nerve block anesthesia in the molar teeth with the symptomatic irreversible pulpitis.

Keywords: Articaine, Clonidine, Irreversible pulpitis, Pain

Introduction

Since most of the dental works are performed by outpatient treatment and under the local anesthesia, the creation of deep local anesthesia and inducing of the analgesia at work will increase the quality of treatment and improve the dentist-patient relationship [1]. The use of inferior alveolar nerve block is the most common method of inducing the mandibular local anesthesia in order to perform the root canal treatment. However, the inferior alveolar nerve block is not always associated with successful pulpal anesthesia. Clinical studies have reported high failure rates for inferior alveolar nerve block anesthesia. In most of the studies conducted in this regard, the rate of local anesthesia failure has been reported to be 44 to 81%. Several factors are involved in the success of the inferior alveolar nerve block [2-5]. Anatomical and clinical studies have reported that the failure of mylohyoid anesthesia is one of the causes of failure in the block injection. However, when the injection of the mandibular block along with mylohyoid nerve block was compared with the mandibular block alone, it was observed that the injection of the mylohyoid nerve block along with mandibular block injection does not increase the pulpal anesthesia [6].

Inaccuracy in the mandibular block injection cannot be a reason for failure of this anesthesia, since even accurately locating of mandibular nerve bundles or mandibular foramen location by applying ultrasound and radiography cannot increase the success rate of this injection [7]. The needle curvature (either away from the ramus or toward the ramus) during the block injection also cannot lead into the block anesthesia failure [8]. The idea of using a combination of drugs has always considered in the medical world. One of these cases is the use of a combination of various local anesthetics, which have several benefits such as possible synergistic effects, etc. [9]. In order to increase the success of the inferior alveolar nerve block, a variety of combined treatments have

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been used, including hyaluronidase [10], sodium bicarbonate [11], mannitol [12], meperidine [13] and clonidine [14]. Clonidine is an alpha-2 adrenergic receptor that is used as a central antihypertensive agent in medicine [15]. Clonidine has also been used in other cases, such as local anesthetics for various purposes, including epidural anesthesia, brachial plexus anesthesia, and peripheral nerve block [15]. Clonidine has three important characteristics that are very useful in the root canal therapy, especially in the patients with pain:

1) The Blood pressure measurements is safe and has no other cardiovascular risks [16].
2) It directly inhibits the pulp pain transmitting neurons [17].
3) It has a mild sedative effect [18].

Articaine is a new anesthetic substance that has been used widely in the dentistry due to improving the local anesthetic effect. The use of Articaine was approved in the United States since 2002. The most common formula of this substance for the local anesthesia in dentistry is 4% solution with the epinephrine1:100000. Articaine is considered as an amide anesthetic substance and contains a thiophene ring instead of benzene, so its solubility is high in fat. The second molecular difference between Articaine and other amide anesthetic substances is the extra ester bond in the Articaine molecule, which makes the plasma esterase to play a role in its hydrolysis [19, 20]. The current studies have indicated that the efficacy of the Articaine was similar with that of other anesthetics. For example, Malamed et al. evaluated the efficacy of the Articaine. In their study, a total of 1325 patients at the age range of 4 to 80 years received either 4% Articaine with epinephrine 1: 100000 or 2% lidocaine with epinephrine1: 100000 [21-23].

Their study revealed that the time of onset and duration of the anesthesia of the Articaine were similar to those of lidocaine. Malamed et al. did not find statistically a significant difference between the two tested substances. Thus, several studies suggest that Articaine is not statistically superior to other substances. Some studies have also reported acceptable anesthesia by using the 4% Articaine with epinephrine 1:100000 in the inferior alveolar nerve block in irreversible pulpitis of mandibular molar teeth [24, 25]. Several studies have been conducted so far on the methods of increasing the inferior alveolar nerve block anesthesia. For example, the effect of increasing lidocaine volume, increasing the volume of 4% anesthetic solution, increasing the speed of injecting inferior alveolar nerve block, rate of epinephrine, and other drug combinations such as acetaminophen and hydrocodone [10], hyaluronidase [10], sodium bicarbonate [11], mannitol [12] and meperidine [13] on the success of the mandibular molars with the irreversible pulpitis has been investigated in this regard. No study has been conducted so far to evaluate the efficacy of the Articaine anesthesia along with the clonidine in the success of the inferior alveolar nerve block in the molar teeth with the irreversible painful pulpitis. Hence, this study aims to evaluate the effect of 4% Articaine solution with the epinephrine 1:100000 along with the clonidine 150 µg / ml on the success of the inferior alveolar nerve block in the molar teeth with the irreversible painful pulpitis.

Methodology

A total of 100 patients with a mandibular molar tooth with a long and severe pain response to cold test participated in the present study. The tooth was examined with the cotton impregnated with cold spray (Roeko; Coltene Whaledent, Langenau, Germany). To ensure results, three teeth, including two adjacent teeth and one tooth on the opposite side (as the control tooth that should be free from caries, filling, as well as gum diseases), were tested. Radiography was performed to evaluate the bone destruction around the root of the tooth and the periapical lesions in order to assess the health of the periapical area of the tooth. The patient would be excluded from the study if a periapical lesion and tooth necrosis was observed in the clinical or radiographic findings. The patients would be also excluded in the absence of live pulp tissue in the preparation of crown access cavity (partial necrosis). All patients were evaluated in terms of inclusion and exclusion criteria and their biographical information was recorded. The study began after oral explanation of the steps of the conducting the study and resolving the ambiguities and obtaining the written consent of the patients in the implementation phase of the study.

In order to assess the pain by using Heft-Parker Visual Analogue Scale (HPVAS) criterion, the patients were asked to describe their pain on a standard line ranged from 0 to 170 mm (Number 0 means no pain and number 170 means the highest pain that the patient has ever experienced) [26]. Then, a local anesthetic solution was made in this way: Using a Hamilton syringe (Hamilton; Hamilton company, Switzerland), 0.2 ml of clonidine vial (Catapressan amp, 150µg / ml; Boehringer-Ingelheim, Ingelheim am Rhein, Germany) was removed and added to 1.8 ml of 4% Articaine carpule containing epinephrine 1:100000 (Artinibsa, Inibsa Laboratories, Spain). To make the second solution, we added 0.2 ml of sterile distilled water to 1.8 ml of 4% Articaine carpule containing epinephrine 1:100000. The solutions were shaken 5 times in order to be mixed well. Accordingly, the first group drug consisted of 1.8 ml of 4% Articaine along with epinephrine 1:100000 plus 0.2 ml of clonidine 150 µg / ml and the second group drug consisted of 1.8 ml of 4% Articaine along with epinephrine 1:100000 plus 0.2 ml of distilled water (placebo). After preparing the anesthetic solutions, random numbers were attached to the vials for double-blinding of the study and the researcher randomly selected a vial using random numbers for each patient. As a result, neither the patients nor the researcher were aware of the contents of the vial.

To create a similar standard situation for all patients, the solutions were injected by a single endodontist using an aspirated syringe (Novocol Ontario, Canada) and a long 35-mm gauge needle (Septoject, Septodont, Saint-Maur-des-fosses cedex, France). Before inferior alveolar nerve block, 20% benzocaine topical anesthetic gel (20% benzocaine; Denticare, Medicom, Canada) was applied on the injection

site for 60 seconds. One centimeter of above the occlusal surface at the rotation site of *pterygomandibular raphe,* needle entered upwards and aspiration happened after entering the needle to tissue by 3-5mm and approximately 0.2 ml of cartridge content was injected. After the needle contacted the bone tissue (in a way that the syringe body was positioned on the opposite premolars), the 1-mm syringe was withdrawn. Then, the whole cartridge was injected within one minute after the aspiration. After 15 minutes, when appropriate anesthesia happened on the lips, the patient was included into the study and access cavity preparation began. When pain occurred during preparation of the access cavity, the treatment stopped and the patient recorded his or her pain score on the HPVAS index and the study was completed at this stage. To interpret the results, VAS was divided into 4 groups, including 0 mm, 1-54 mm, 55-113 mm, and 114-171, indicating no pain, mild pain, moderate pain, and severe pain, respectively. Success of the inferior alveolar nerve block was defined as the absence of pain or mild pain during the access cavity preparation or primary file entry into the canal and failure was defined as presence of moderate or severe pain.

Results

Out of the 100 patients referred to the dental school with molar teeth with irreversible symptomatic pulpitis, 56 were female and 44 were male. The mean age of the two groups was 30.74 ±10.08 in the Articaine + clonidine group and 29.30 ± 8.92 in the Articaine + placebo group.

Table 1 illustrates the pre-work variables of the study. It shows that there is no significant difference between the two groups in terms of the age, gender and primary pain (P-value <0.05).

Table 1- Pre-work variables in the two groups of Articaine + Clonidine and Articaine + Placebo

Variable	Articaine + Clonidine	Articaine + Placebo	*P*-value	*Test type*
n	50	50		
Age (year)	30.74 ± 10.08	29.30 ± 8.92	0.451	**t-test**
gender	27 females 23 males	29 females 21 males	0.687	**Chi-square**
Primary pain	110.68±20.21	103.12 ± 18.97	0.067	**Mann–Whitney**

The success rate of the inferior alveolar nerve block was 66% in the Articaine+ clonidine group and 58% in the in the Articaine + placebo group.

Discussion:

The most prevalent method of the mandibular anesthesia method is the use of the inferior alveolar nerve block (IANB). Unfortunately, the rate of failure in the anesthesia by using this method is high and it is a major concern for the clinicians. The high rate of the failure in nerve block has led into the introduction of various anesthesia techniques. In the present study, the effect of 4% Articaine with epinephrine 1:100000 in combination with 0.2 ml clonidine 150 µg / ml was compared with the effect of the 4% Articaine with epinephrine 1:100000 in combination with 0.2 ml distilled water. Pre-work variables, including age, gender and pain, were not significantly different between the two groups in our study, so these variables had a negligible confounding effect on the final results of the study. HP-VAS was used in order to assess the success of the inferior alveolar nerve block anesthesia. HP-VAS is a valid criterion that is used for evaluating anesthesia efficacy. For this reason, it has been used by many researchers.

Due to the high failure rate of the inferior alveolar nerve block, several studies have been conducted in order to increase the success of this injection in various ways such as changing the anesthesia drug, the use of a variety of complementary injections such as intraosseous infusion, buccal infiltration, periodontal intra-ligament injection, intra-pulp injection, increasing the volume of anesthetic solution, increasing the injection time, increasing the concentration of vasopressor drug, NSAIDS, anxiolytic drug and sedatives, the use of various supplements along with anesthetic solution. Most of them have failed. The present study examined the effect of adding 0.2 ml of the clonidine to 150 µg / ml of the 4% anesthetic solution of Articaine with epinephrine 1:100000. The success rate was 66% in the Articaine/ clonidine group and 58% in the other group. The success rate was higher in the Articaine / clonidine group, but there was no statistically significant difference between the two groups in term of the success rate of the inferior alveolar nerve block. The results of two studies conducted by Goodman et al. [13] and Bigby et al. [27] to evaluate the effect of adding 36 mg meperidine to 36 mg lidocaine containing 18 µg epinephrine in the inferior alveolar nerve block anesthesia in the patients with the irreversible pulpitis of posterior mandibular teeth revealed that adding of the 36 mg meperidine had no significant anesthetic effect compared to standard lidocaine solution. The results of the present study are similar to the results of the studies conducted by Brkovic et al. [14] that revealed the anesthetic effect of clonidine (15 µg / ml) and 2% lidocaine with epinephrine 1:100000 on the inferior alveolar nerve block in extracting the third molar tooth. They reported that the duration and level of anesthesia did not differ significantly between the two groups. There was also no significant difference between the two groups in terms of the physiological parameters such as systolic blood pressure, diastolic blood pressure and mean arterial pressure. Molnar et al. [28] also showed that there was no significant difference between lidocaine 1.5% plus clonidine and 1.5% lidocaine plus epinephrine in terms of the onset of cervical network anesthesia. Gaumann et al. [29] also showed no significant difference between the 1% lidocaine containing 150 µg of the clonidine and the 1% lidocaine containing 200 µg of the epinephrine in terms of the brachial plexus anesthesia.

The study carried out by Shadmehr et al. [26], unlike our study, revealed that the use of 2% lidocaine with epinephrine 1/ 80000 plus clonidine at a final concentration of 15 µg / ml compared to the standard solution of the lidocaine alone significantly increased the inferior alveolar nerve block in the patients with the irreversible pulpitis. This difference may be attributed to the higher success rate of Articaine than that of the lidocaine, as reported in some articles. In a study conducted by da Silva-Junior et al. [30] to evaluate the anesthetic effects of the buccal infiltration with 4% Articaine with epinephrine 1:100000 and 2% lidocaine with epinephrine 1:100000 after applying the inferior alveolar nerve block with 2% lidocaine with epinephrine 1:100000 in latent third molar tooth surgery, the results showed that the Articaine was more successful than the lidocaine. In a meta-analysis study conducted to evaluate the efficacy and the safety of the 4% Articaine with epinephrine 1:100000 in comparison to the 2% lidocaine with the epinephrine 1:100000 in the patients with painful irreversible pulpitis, the results revealed that the Articaine was more successful than the lidocaine in achieving the successful anesthesia, lower VAS score, and faster anesthesia onset time [31].

Conclusion

Based on the results of the study, the use of the combination of Articaine + clonidine compared to the standard anesthetic solution of the Articaine alone does not significantly increase the success rate of the inferior alveolar nerve block in the patients with irreversible pulpitis.

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