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Comparison of the Anesthetic Success Rate of Articaineversus Lidocaine Buccal Infiltration Injections When Coupled With an IANB: A Randomized, Double-Blinded Study

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ABSTRACT

Background

An inferior alveolar nerve block (IANB) and various supplemental injections are frequently required for profound pulpal anesthesia in posterior mandibular teeth with irreversible pulpitis. The goal of this randomized, double-blind study was to compare the anesthetic success rate of articaine and lidocaine buccal infiltration injections when coupled with an IANB.

Method

A total of 125 emergency patients with irreversible pulpitis in their first or second mandibular molars took part in the trial and were given the IANB using either 2 percent lidocaine with 1:100,000 epinephrine or 4 percent articaine with 1:100,000 epinephrine. One hundred and two patients reported moderate-to-severe pain at the start of their endodontic treatment or after their dental canals were filed, and they were given extra buccal infiltration injections using the same anesthetic as the IANB. Success was achieved with no or slight pain during instrumentation of the dental canals after the block or additional buccal infiltration injections.

Result

When lidocaine was used to administer infiltration injections after a partial IANB, the success rate was 29%, while when articaine was used, it was 71% (P.001). After the block injections, there were no significant differences in the success rates between the two anesthetics.

Conclusions: In mandibular molars with irreversible pulpitis, supplementing an incomplete articaine IANB with articaine infusion improves anesthetic success more efficiently than lidocaine.

Key Words: lidocaine, Articaine, infiltration, irreversible pulpitis

I. INTRODUCTION

The most popular approach for anesthetizing posterior mandibular teeth during endodontic treatments is inferior alveolar nerve block (IANB) (1–4). However, 10%–81 percent of the time (1–6), it fails to perform successfully. Anesthetic success rates have been evaluated using other approaches such as intraosseous, intraligamentary, and infiltration injections (6–9). According to certain prior investigations, intraosseous injection appears to increase the success rate to a reliable extent (10). It is not a preferred method because it necessitates the use of specialized equipment, cortical bone drilling, and the preparation of a site for anesthetic solution administration (11).

Intraligamentary injections have a limited half-life and may exacerbate postoperative pain (12). The intraosseous and intraligamentary procedures are successful in enhancing anesthesia levels in difficult anesthetic conditions; however, it would be useful if equivalent effects could be accomplished with less invasive approaches such as infiltration. This method has been extensively researched in asymptomatic teeth (13–19). A comparison of lidocaine and articaine was undertaken in a few of these trials (13–16). Some studies found no significant differences between the two anesthetics (13, 14), while others found that articaine was superior to lidocaine in elevating pulpal anesthesia in mandibular teeth (13, 14). (15, 16). Kanna et al (20 evaluated lidocaine and articaine in maxillary teeth with irreversible pulpitis in a research. Their findings revealed that there were no significant differences between these anesthetics. The anesthetic efficacy of 4 percent articaine with 1:200,000 epinephrine was shown to be comparable to 4 percent articaine with 1:100,000 epinephrine in a primary mandibular buccal infiltration of asymptomatic mandibular first molars in a study by McEntire et al (21). Poorni et al(22) compared the efficacy of an IANB with articaine or lidocaine to that of a buccal infiltration with articaine that had not been combined with an IANB on mandibular molars with irreversible pulpitis. This raises the possibility that the infiltration approach could be a reliable anesthetic option. A study was conducted by Aggarwal and colleagues (23) on mandibular molars with irreversible pulpitis. Anesthesia success rates increased to 54 percent and 62 percent, respectively, when lidocaine IANB was combined with extra infiltration of articaine or articaine with ketorolac tromethamine. Supplemental articaine infiltration injections were used after lidocaine IANB failed in posterior mandibular teeth with irreversible pulpitis in a research by Matthews et al(9). The articaine infiltration injection was shown to be successful 58 percent of the time. Lidocaine and articaine infiltration injections were used on both the buccal and lingual sides of posterior mandibular teeth with irreversible pulpitis after lidocaine IANB, according to Aggarwal et al(6). They discovered that lidocaine and articaine had success rates of 47 percent and 67 percent, respectively. Despite the fact that these investigations focused on mandibular teeth with irreversible pulpitis, the IAN blocks were administered with lidocaine, and the results cannot be used to predict pulpal anesthesia in all patients seeking endodontic treatment. We reasoned that while articaine infiltration injections improved the success rate of pulpal anesthesia, we could improve the success rate even more if the block injections were also provided with articaine. We compared the degree of anesthesia achieved by using either 2 percent lidocaine with 1:100,000 epinephrine or 4 percent articaine with 1:100,000 epinephrine in the first and second mandibular molars with irreversible pulpitis if both the IANB and infiltration injections were performed with the same anesthetic solution.

II. METHOD

This study included 125 emergency patients who were attending ShahidBeheshti University's dependent dental clinic and were having discomfort in their first or second mandibular tooth. Patients who were less than 20 years old, pregnant women, patients with systemic disease, and those with clinically observable lesions or swellings at the injection site were all screened out of the trial. Each participant signed a written informed consent form. All of the patients experienced active discomfort in their first or second mandibular molar on the day of treatment and had not used any pain relievers. The presence of irreversible pulpitis in the teeth was established by a prolonged response to cold testing with an ice stick, vital pulp tissue during access opening, and the lack of periapical radiolucencies on periapical radiographs (save for periodontal ligament widening). Throughout the treatment, participants were asked to rate their discomfort using the Heft-Parker visual analogue scale (HP-VAS). The HP-VAS was a 170-mm line that was separated into distinct pain categories. The several marks on the line each represented a different pain degree. 0 mm linked to the absence of pain. Mild pain was defined as greater than 0 mm up to 54 mm with the descriptors faint, weak, and mild pain, moderate pain was defined as greater than 54 mm up to 114 mm with the descriptors strong, intense, and maximum possible amount of pain, and severe pain was defined as greater than 114 mm up to 170 mm with the descriptors strong, intense, and maximum possible amount of pain. Patients were asked to rate their discomfort before starting treatment, after having block injections, and after receiving infiltration injections if needed. For each primary and final outcome, the study was given a parallel design with an allocation ratio of N articaine/N lidocaine. The patients were initially separated into two groups: men and women, who were then randomly assigned to one of two subgroups: lidocaine or articaine, using random allocation software. All individuals were enrolled and allocated to intervention by a blinded nurse. There were an equal number of lidocaine and articaine cartridges accessible, each of which had been wrapped and coded. Another nurse in the department was aware of the codes and distributed the cartridges in equal numbers and at random according to the lidocaine or articaine subgroups. Because the block and infiltration injections were expected to be given with the same anesthetic, there was only one code for each of the two cartridges bundled together. For the block injection, all patients received 1.5 mL of either anesthetic solution, and for the lengthy buccal injections, 0.3 mL (about one-eighth of a cartridge's volume) was utilized. For individuals who required infiltration injections, 1.8 mL of the same anesthetic was used. The same clinician administered all of the shots. The typical IANB and lengthy buccal injections with 2 percent lidocaine and 1:100,000 epinephrine were given to all patients or or 4 percent articaine with 1:100,000 epinephrine (Septocaine; Septodont, Lancaster, PA). They were asked if they had any lip numbness after 15 minutes. Patients who did not have lip numbness were removed from the research and had their cartridges changed. For data analysis, those who complained lip numbness were investigated. The treatment includes using a rubber dam to isolate the teeth, prepping the access cavity, and executing the initial canal filing. Throughout the treatment, patients were asked to rate their level of discomfort on the HP-VAS scale. After the IANB, if the patient reported minimal or mild pain on the HP-VAS scale, the block was judged successful, and endodontic treatment was completed without the use of additional infiltration injections. The rubber dam was removed for individuals who felt moderate-to-severe pain on the HP-VAS scale, and the infiltration injection was given using the same anesthetic solution that had been used for the block injection. 27-gauge short needles (Septoject; Septodont) were utilized for the infiltration injections, and the needle was advanced until the estimated apical root location of the teeth was reached. At a rate of 1 mL/min, the cartridge content was deposited. The endodontic treatment resumed after 5 minutes, and block or supplemental infiltration success was defined as the capacity to complete the procedure of preparing the access cavity or initial filing of the canals with no or no discomfort.

III. STATISTICAL ANALYSIS

An independent sample t test was used to compare the mean continuous variables between the two intervention groups. PS vs. 2.1.31 was used to calculate the number of patients in each category (power and sample size calculation software; Department of Biostatistics, Vanderbilt University, Nashville, TN). We assigned 50 patients to each group such that our study's power would be more than 80% (20% false negative), allowing us to identify a 15% difference in the success rates of the lidocaine and articaine infiltration groups. We predicted that 25 patients would drop out due to a lack of lip numbness following the IANB or other missing data. We used SPSS vs. 16.0 to apply logistic regression to the binary outcome (SPSS Inc, Chicago, IL). Results The IANB was given to 125 adult patients between the ages of 20 and 60 who agreed to participate in the study. In 14% of the patients (17/125), the IANB was successful. After the IANB, six individuals did not have lip numbness. The additional infiltration injections were not given to 23 patients. The block injections did not differ significantly between the two anesthetic solutions. Supplemental infiltration injections were given to 102 patients, comprising 47 men (47/102) and 55 women (55/102). There were 58 successful infiltration injections out of a total of 102. (57 percent). The success rate of the anesthetic was 71 percent with articaine and 29 percent with lidocaine (P.001). According to our age- and sex-adjusted logistic regression analysis, articaine had a 4 times larger likelihood of being successful in infiltration injections (odds ratio = 4.343; 95 percent confidence range, 1.692– 11.151; P.002). Second molars had a higher success rate (28 percent versus 72 percent, P.01) than first molars. There were no significant differences in the success rates of the two anesthetics between men and women (50 percent versus 50 percent).

Table 1 shows the percentage and number of successful injections for various anesthetics, teeth, and sex groups.

	Articaine	Lidocaine	Pvalue*
Age (M±SD)	37.9(10.0)	32.5(8.7)	<.01
Men	24/47(51%)	23/47(49%)	NS
Women	27/55(49%)	28/55(51%)	NS

First Molar	17/42(40%)	25/42(60%)	.05
Second molar	34/60(57%)	26/60(43%)	.05
Successful block injections	8/17(47%)	9/17(53%)	NS
Successful infiltration anesthesia	41/58(71%)	17/58(29%)	<.001

NS, not significant.*Chi-square test.

TABLE 1. Percentage and Number of Successful Injections on the Basis of the Different Anesthetics, Teeth, and Sex Groups

IV. DISCUSSION

According to our findings, articaine infiltrations after incomplete anesthesia achieved by articaine IANB had a 71 percent anesthetic success rate, while lidocaine infiltrations after incomplete anesthesia achieved by lidocaine IANB had a 29 percent anesthetic success rate. This is higher than the 58 percent and 67 percent described by Matthews et al (9) and Aggrawal et al (6) for articaine infiltration anesthesia in posterior mandibular teeth with irreversible pulpitis, respectively. However, they used 2 percent lidocaine with 1:100,000 epinephrine in all of their IANBs, whereas half of our block injections were given with articaine, and we were able to compare the two anesthetics in both block and infiltration injections. The better success rate in our trial could be attributed to using articaine for both the block and infiltrate injections. The difference of 4% between our results and Aggarwal et al(6findings)'s is not significant. They had given the infiltration injections on both the buccal and lingual sides of the mandibular teeth, but we skipped the lingual side to minimize possible lingual nerve concerns, and we still got essentially identical outcomes. We also ran logistic regression analysis on our data, which takes additional factors like age, gender, and tooth type into consideration and gives us a more accurate conclusion. These studies showed that regardless of the patient's age, sex, or the type of tooth being treated, articaine had a 4 times higher likelihood of a successful infiltration injection than lidocaine. Kanna et al (24) found that buccal infiltration with articaine following lidocaine IANB was successful 84 percent of the time in mandibular teeth with irreversible pulpitis. The higher success rate in their trial could be attributable to the use of a larger volume of anesthetic solution for the infiltration injections (2.0 mL). In asymptomatic mandibular first molars, Martin et al(25) compared the analgesic effectiveness of 1.8 mL buccal infiltration with 3.6 mL 4 percent articaine.The anesthetic solution with a volume of 3.6 mL had a statistically greater success rate of 70% when compared to the anesthetic solution with a volume of 1.8 mL, which had a 50% success rate. Endodontic treatment was started after the IANBs were given, and infiltration injections were not given until the HP-VAS pain ratings indicated the need for additional analgesia. As a result, we were able to determine the efficacy of block injections in teeth with irreversible pulpitis by using either lidocaine or articaine, and patients did not receive extra injections when there was no justification for them. It should be emphasized that the existence of lip numbness does not always imply that the IANB will provide deep pulpal anesthesia (5, 16, 26). The IANB was only effective in 17 of 125 patients, implying that supplementary injections will be required in the majority of cases of irreversible pulpitis in the posterior mandibular teeth. In our study, we used HP-VAS to determine the degree of pulpal anesthesia, and we didn't use an electric pulp tester (EPT). This was based on the findings of Nusstein et al (27) who utilized EPT to measure pain levels in teeth with irreversible pulpitis. Their findings revealed that 42% of patients who had a negative EPT response following anesthesia still experienced pain throughout treatment and required additional injections. In the IANBs, there were no statistically significant differences between articaine and lidocaine. Other investigations have come up with similar results (5, 28, 29). Buccal infiltration alone has been found to generate anesthesia for a short amount of time (16). As a result, a successful IANB would be beneficial in both increasing anesthetic success and lengthening the duration of effect. We split men and women into two groups and conducted the study separately on each group. We speculated that there might be some distinctions between them, such as differing pain reactions. There were no significant differences in the success rates of the two anesthetics between men and women (50 percent versus 50 percent). Infiltration injections were found to be more effective in the second mandibular molars. The amount of injections of lidocaine and articaine were equal, but the teeth were assigned to one of the two anesthetics at random using random allocation software. The articaine infiltration injections were given more frequently to the second molars. This could have contributed to their increased success rate. It would be beneficial if further studies measured the anesthetic efficacy of articaine on second molars with irreversible pulpitis, because the thicker bone present at the site of these teeth would be expected to lower their success rate. The results of the studies of Oliveira et al(30)and Costa et al(31) suggested that the duration of pulpal anesthesia also lasts longer with articaine than with lidocaine. We should point out that we waited 15 minutes after the IANB and 5 minutes after the infiltration injections, which was based on the time suggested by previous studies for these injections to take full effect (3, 16). As a result, the effects of the anesthetics utilized in our study were maximized. Articaine use has been linked to an increased risk of paresthesia in some studies (32, 33). There were no evidence of paresthesia in any of the participants in our investigation. Paresthesia caused by articaine or prilocaine injections is rare, according to a research by Haas and Lennon (32), with an incidence of 1:785,000 injections. In a research of 1325 patients, Malamed et al(34) found that articaine and lidocaine had the same incidence of paresthesia. It should be mentioned that in all of the patients who were participating, the paresthesias went away. To the best of our knowledge, our study was the first to administer both the block and infiltrate injections with articaine in mandibular teeth with irreversible pulpitis. Further research on teeth with irreversible pulpitis and the efficacy of articaine in these teeth would be beneficial. If future research corroborate our findings, dentists and patients will have superior anesthetic options. Articaine has a four-fold higher chance of success than lidocaine, according to our logistic regression study.

V. CONCLUSION

Supplemental injections in posterior mandibular teeth with irreversible pulpitis would be required for the majority of patients after the IANB. When an incomplete IANB is complemented with an infiltration injection using the same anesthetic for both injections in teeth with irreversible pulpitis, articaine appears to raise anesthetic success more efficiently than lidocaine. Obtaining profound pulpal anesthesia in all patients is a long-term aim that will require more research.

REFERENCES

[1]. Dagher BF, Yared GM, Machtou P. The anesthetic efficacy of volumes of lidocaine in inferior alveolar nerve blocks. J Endod 1997;23:178–80.
[2]. Goldberg S, Reader A, Drum M, et al. Comparison of the anesthetic efficacy of the conventional inferior alveolar, Gow-Gates, and Vazirani-Akinosi techniques. J Endod 2008;34:1306–11.
[3]. Vreeland DL, Reader A, Beck M, et al. An evaluation of volumes and concentrations of lidocaine in human inferior alveolar nerve block. J Endod 1989;15:6–12.
[4]. Cohen HP, Cha BY, Spangberg LS. Endodontic anesthesia in mandibular molars: a clinical study. J Endod 1993;19:370–3.
[5]. Mikesell P, Nusstein J, Reader A, et al. A comparison of articaine and lidocaine for inferior alveolar nerve blocks. J Endod 2005;31:265–70.
[6]. Aggarwal V, Jain A, Kabi D. Anesthetic efficacy of supplemental buccal and lingual infiltrations of articaine and lidocaine after an inferior alveolar nerve block in patients with irreversible pulpitis. J Endod 2009;35:925–9.
[7]. Childers M, Reader A, Nist R, et al. Anesthetic efficacy of the periodontal ligament injection after an inferior alveolar nerve block. J Endod 1996;22:317–20.
[8]. Nusstein J, Reader A, Nist R, et al. Anesthetic efficacy of the supplemental intraosseous injection of 2% lidocaine with 1:100,000 epinephrine in irreversible pulpitis. J Endod 1998;24:487–91.

[9]. Matthews R, Drum M, Reader A, et al. Articaine for supplemental buccal mandibular infiltration anesthesia in patients with irreversible pulpitis when the inferior alveolar nerve block fails. J Endod 2009;35:343–6.
[10]. Bigby J, Reader A, Nusstein J, et al. Articaine for supplemental intraosseous anesthesia in patients with irreversible pulpitis. J Endod 2006;32:1044–7.
[11]. Hargreaves KM, Keiser K. Local anesthetic failure in endodontics: mechanisms and management. Endod Topics 2002;1:26–39.
[12]. McLean ME, Wayman BE, Mayhew RB. Duration of anesthesia using the periodontal ligament injection: a comparison of bupivacaine to lidocaine. Anesth Pain Control Dent 1992;1:207–13.
[13]. Haas DA, Harper DG, Saso MA, et al. Lack of differential effect by Ultracaine (articaine) and Citanest (prilocaine) in infiltration anaesthesia. J Can Dent Assoc 1991;57:217–23.
[14]. Haas DA, Harper DG, Saso MA, et al. Comparison of articaine and prilocaine anesthesia by infiltration in maxillary and mandibular arches. Anesth Prog 1990;37: 230–7.
[15]. Kanaa MD, Whitworth JM, Corbett IP, et al. Articaine and lidocaine mandibular buccal infiltration anesthesia: a prospective randomized double-blind cross-over study. J Endod 2006;32:296–8.
[16]. Robertson D, Nusstein J, Reader A, et al. The anesthetic efficacy of articaine in buccal infiltration of mandibular posterior teeth. J Am Dent Assoc 2007;138:1104–12.
[17]. Corbett IP, Kanaa MD, Whitworth JM, et al. Articaine infiltration for anesthesia of mandibular first molars. J Endod 2008;34:514–8. CONSORT Randomized Clinical Trial JOE — Volume 39, Number 1, January 2013 Efficacy of Articaine versus Lidocaine in Block and Infiltration Anesthesia 9
[18]. Jung YIL, Kim JH, Kim SE, et al. An evaluation of buccal infiltrations and inferior alveolar nerve blocks in pulpal anesthesia for mandibular first molars. J Endod 2008;34:11–3.
[19]. Meechan JG, Kanaa MD, Corbett IP, et al. Pulpal anaesthesia for mandibular permanent first molar teeth: a double-blind randomized cross-over trial comparing buccal and buccal plus lingual infiltration injections in volunteers. IntEndod J 2006;39: 764–9.
[20]. Kanaa MD, Whitworth JM, Meechan JG. A comparison of the efficacy of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:80,000 epinephrine in achieving pulpal anesthesia in maxillary teeth with irreversible pulpitis. J Endod 2012;38:279–82.
[21]. McEntire M, Nusstein J, Drum M, et al. Anesthetic efficacy of 4% articaine with 1:100,000 epinephrine versus 4% articaine with 1:200,000 epinephrine as a primary buccal infiltration in the mandibular first molar. J Endod 2011;37: 450–4.
[22]. Poorni S, Veniashok B, Senthilkumar AD, et al. Anesthetic efficacy of four percent articaine for pulpal anesthesia by using inferior alveolar nerve block and buccal infiltration techniques in patients with irreversible pulpitis: a prospective randomized double-blind clinical trial. J Endod 2011;37:1603–7.
[23]. Aggarwal V, Singla M, Rizvi A, et al. Comparative evaluation of local infiltration of articaine, articaine plus ketorolac, and dexamethasone on anesthetic efficacy of inferior alveolar nerve block with lidocaine in patients with irreversible pulpitis. J Endod 2011;37:445–9.
[24]. Kanaa MD, Whitworth JM, Meechan JG. A prospective randomized trial of different supplementary local anesthetic techniques after failure of inferior alveolar nerve block in patients with irreversible pulpitis in mandibular teeth. J Endod 2012;38: 421–5.
[25]. Martin M, Nusstein J, Drum M, et al. Anesthetic efficacy of 1.8 mL versus 3.6 mL of 4% articaine with 1:100,000 epinephrine as a primary buccal infiltration of the mandibular first molar. J Endod 2011;37:588–92.
[26]. Nusstein J, Reader A, Beck FM. Anesthetic efficacy of different volumes of lidocaine with epinephrine for inferior alveolar nerve blocks. Gen Dent 2002;50:372–5.
[27]. Nusstein J, Reader A, Nist R, et al. Anesthetic efficacy of the supplemental intraosseous injection of 2% lidocaine with 100,000 epinephrine in irreversible pulpitis. J Endod 1998;24:487–91.
[28]. Tortamano IP, Siviero M, Costa CG, et al. A comparison of the anesthetic efficacy of articaine and lidocaine in patients with

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irreversible pulpitis. J Endod 2009;35:165–8.

[29]. Claffey E, Reader A, Nusstein J, et al. Anesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. J Endod 2004;30:568–71.

[30]. Oliveira PC, Volpato MC, Ramacciato JC, Ranali J. Articaine and lignocaine efficiency in infiltration anaesthesia: a pilot study. Br Dent J 2004;197:45–6.

[31]. Costa CG, Tortamano IP, Rocha RG, et al. Onset and duration periods of articaine and lidocaine on maxillary infiltration. Quintessence Int 2005;36:197–201.

[32]. Haas DA, Lennon D. A 21 year retrospective study of reports of paresthesia following local anesthetic administration. J Can Dent Assoc 1995;61:319–20, 323–326, 329–330.

[33]. Miller P, Lennon D. Incidence of local anesthetic-induced neuropathies in Ontario from 1994–1998. J Dent Res 2000;79:627.

[34]. Malamed SF, Gagnon S, Leblanc D. Articaine hydrochloride: a study of the safety of a new amide local anesthetic. J Am Dent Assoc 2001;132:177–85.