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ANAESTHETIC EFFICACY OF SUPPLEMENTARY BUCCAL INFILTRATION VS INTRALIGAMENTARY INJECTION WITH ARTICAINE IN IRREVERSIBLE PULPITIS CASES.

Anesthesiology

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ABSTRACT

BACKGROUND: Local anaesthetics form the back bone of pain control in dentistry. However teeth with symptomatic irreversible pulpitis or 'hot teeth' classically resist the action of standard anaesthetic regimens and often pose a clinical challenge. Supplementary injections & alternative solutions have been investigated. The purpose of this study is to determine the anaesthetic efficacy of supplementary buccal infiltration or intraligamentary injection of 4% articaine with 1:100,000 epinephrine when the conventional IANB of 2% lidocaine with 1:80,000 epinephrine failed in patients with irreversible pulpitis in mandibular posterior teeth.

METHODOLOGY: Patients with irreversible pulpitis in mandibular posterior teeth received an Inferior Alveolar Nerve Block (IANB) of 2% lidocaine. Subjects who showed IANB failure received either 4% articaine as a buccal infiltration (group 1) or 4% articaine as an intraligamentary injection (group 2). The subjects' self-reported pain response was recorded on Heft Parker Visual Analogue Scale during access cavity preparation & pulp extirpation.

RESULTS: Both the techniques resulted in improved success rates compared to a plain IANB which had a success rate of 52 %. The supplementary buccal infiltration and intra-ligamentary injection had a success rate of 66% and 76% respectively, with no significant difference between them.

CONCLUSION: Supplementary injections with articaine using either intraligamentary or buccal infiltration techniques, result in an improved success rate and may be implemented as an initial supplementary injection prior to commencement of the root canal procedure. However, no technique provides 100% predictable anaesthesia and reinjection may be necessary.

KEYWORDS

Articaine; Buccal Infiltration; Intraligamentary; Irreversible Pulpitis.

INTRODUCTION

The term 'Root canal treatment' is often associated with pain, fear & anxiety. Achieving profound anaesthesia during endodontic treatment is of paramount importance to control pain and reduce anxiety. However, teeth with symptomatic irreversible pulpitis or 'hot teeth' especially mandibular molars commonly pose an anaesthetic challenge. Local anaesthesia fails to act in teeth with irreversible pulpitis eight times more as compared to healthy teeth [1].

The inferior alveolar nerve block (IANB) with lidocaine is the most common technique used to anaesthetize posterior mandibular teeth with irreversible pulpitis. However it has a low success rate of 19-56% [2-6]. The failure to achieve adequate anaesthesia in these cases is not fully understood but may be due in part to inflammatory hyperalgesia resulting from an increase in the number of tetrodotoxin-resistant sodium channels, decreased excitability thresholds and altered resting potentials of neurons innervating inflamed tissues [7-12]. Patient apprehension is also a significant factor in lowering anaesthetic success rates [12]. Supplementary anaesthetic techniques such as buccal infiltrations, intraligamentary or intraosseous injections have been suggested when the IANB fails to provide adequate pulpal anaesthesia [2,13-14]. Alternative anaesthetic solutions such as articaine, mepivacaine and bupivacaine have also been used as primary or supplementary injections for mandibular molars with irreversible pulpitis [15-17].

Articaine, in particular, has a higher success rate when compared with lidocaine as a primary or supplemental buccal infiltration of mandibular molars in asymptomatic as well as irreversible pulpitis cases [2,18-20]. While the intraligamentary supplemental injection with lidocaine has been found to be effective in cases where the IANB has failed [21-22], limited data is available evaluating articaine as a supplementary intraligamentary injection in these cases [23-24]. Hence, the purpose of this study was to comparatively evaluate the anaesthetic efficacy of supplemental buccal infiltration & intraligamentary injection of 4% articaine with 1:100,000 epinephrine when the conventional IANB of 2% lidocaine with 1:80,000 epinephrine failed in patients with irreversible pulpitis in mandibular posterior teeth. The null hypothesis tested was that there was no difference in the anaesthetic efficacy of 4% articaine administered as a supplementary buccal infiltration or as a supplementary intraligamentary injection.

MATERIALS & METHODOLOGY:

The study protocol was approved by the local ethics committee (YMTDC/250/2016). Sample size was determined using the mean and standard deviation values from literature using the formula $n = \underline{2 (Z_\alpha + Z_\beta)^2 [s]^2 / d^2}$. The α-level of the type I error was maintained at 0.05 and β-level of the type II error was set at 0.20. The calculations indicated that a total of 60 subjects (30 per group) should provide 80% power to detect a 20% difference in the success rates of two groups.

127 patients between the age of 18 to 50 years, visiting the Department of Conservative Dentistry and Endodontics were selected for the study. Inclusioncriteria was a vital mandibular molar with a history of spontaneous pain and prolonged response to the cold test. Subjects with tooth mobility greater than 0.5 mm in any direction, periodontal probing depths greater than 3mm, presence of periapical pathology, no response to the cold test, systemic disease contraindicating endodontic therapy, pregnancy, patients on medication which might influence anaesthetic assessment, and patients who failed to provide informed consent were excluded from the study. Prior to commencement of the procedure, patients were asked to rate their pre-operative pain on the Heft-Parker Visual Analog Scale (HP-VAS) (Fig. 1). The VAS scale was divided into four categories. No pain corresponded to 0 mm. Mild pain was defined on the scale from 0 mm to 54 mm, moderate pain from 54 mm to 114 mm and intense pain from 114 mm and 170 mm [25].

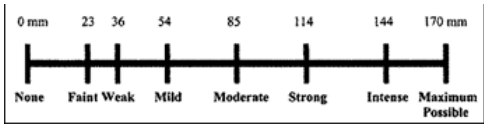

Fig. 1: Heft-Parker Visual Analogue Scale

All subjects then received a standard IANB using 1.8 ml of 2% lidocaine hydrochloride (Lignospan™, Septodont Healthcare India Pvt. Ltd.) with epinephrine 1:80000 by the first operator. After 5 minutes, the patients were asked to confirm the presence of lip numbness. Two patients failed to achieve lip numbness, the block was considered failed and they were excluded from the study. After 15 minutes, access opening was commenced under rubber dam isolation by the second operator. Patients were asked to rate any pain felt during access opening or pulp extirpation on the HP-VAS scale. 60 patients had moderate to severe pain and were randomly assigned to two groups using computer generated random number software (www.random.org); Group A was administered supplemental articaine (Septanest™, Septodont Healthcare India Pvt. Ltd.) buccal infiltration while Group B received a supplemental articaine intraligamentary injection by the first operator. The buccal infiltration was given with 1.7 ml of articaine at the apex of the mandibular first molar on the buccal aspect using a cartridge aspirating syringe (Aspiject™, Septodont Healthcare India Pvt. Ltd.) with a 27-gauge dental needle (Septoject™, Septodont Healthcare India Pvt. Ltd.) [2]. The intraligamentary articaine injection was given using a high pressure syringe (Dentamerica™, California, USA) and 30-guage extrashort needle (Septoject™, Septodont Healthcare India Pvt. Ltd.). 0.4 ml of solution was deposited into the gingival sulcus on the mesial and distal aspect (total 0.8 ml) of each tooth [26]. After 5 minutes, endodontic therapy was continued by the second operator. If the patient felt pain, the procedure was again discontinued, and the patient was asked to rate his/ her discomfort on the VAS. The supplementary anaesthesia was considered to be successful when no/mild pain was experienced by the subject at the completion of endodontic access and during further treatment. If the patient still had moderate to severe pain, it was judged as a failure, and an intrapulpal injection was administered. Data collection was performed by another dental assistant who was unaware of the type of injection administered. This ensured complete blinding in the study.

RESULTS

Data obtained was compiled on an MS Office Excel Sheet (v 2010) and was subjected to statistical analysis using Statistical package for social sciences (SPSS v 21.0, IBM). Inter group comparison of all numerical variables (age and initial pain) between the 2 groups was done using student t test. Comparison of frequencies of males & females between the 2 groups was done using chi-square test. Z test for proportions was used to compare the success rates between the 2 groups. $P<0.05$ was considered to be statistically significant.

The age, gender, initial pain of the patients is presented in Table 1. No significant difference ($P>0.05$) was detected between the 2 groups. The IANB was administered to 127 cases. Two patients did not report profound lip numbness and were excluded from the study. The IANB was successful in 52% of cases (65 patients) of irreversible pulpitis. Of the remaining 60 patients, 30 received supplementary buccal infiltrations and 30 received supplementary intraligamentary injections with articaine. The percentage of cases with successful anaesthesia is shown in Table 1. No significant difference ($P>0.05$) was observed between the two groups.

Table 1: Inter-group Comparison Of Age, Sex, Initial Pain Values And Success Rates

	Group A	Group B	P-value
Age (yrs)	38.1	36.4	0.64
Female (F)	13	15	0.79
Male (M)	17	15	
Initial pain (mm)	152.9	152.5	0.86
Success rates	20/30(66.7%)	23/30(76.6%)	0.38

*P>0.05: No significant difference

DISCUSSION

This study investigated two supplementary injection techniques i.e. buccal infiltration and intraligamentary injection of articaine in cases of irreversible pulpitis in mandibular molars, where the primary inferior alveolar nerve block had failed. Both the techniques resulted in improved success rates compared to a plain IANB which had a success rate of 52%. Articaine has been shown to be superior to lidocaine when used in teeth with healthy or inflamed pulps as a primary or supplemental injection and was therefore selected as a supplemental injection in our study [2,18-20].Articaine's increased effectiveness is due to its lipophilic thiophene ring and an additional ester group [2,18-20]. The thiophene ring increases lipid solubility while the additional ester group permits hydrolyzation in non-specific blood esterases lowering systemic toxicity. Its duration of action is longer because of its increased protein binding ability.

There was no significant difference between values such as age, gender or preoperative pain among the two groups in the study. Hence, the groups could be directly compared. Only first mandibular molars were selected since buccal infiltration is less predictable in second mandibular molars due to the thicker buccal cortical bone in this region which may limit the diffusion of the anaesthetic solution.

The results of our study have shown success rates of 66% for supplementary articaine buccal infiltration. According to previous studies, the success rate of supplementary articaine buccal infiltration after a failed IANB in mandibular posterior teeth with irreversible pulpitis was in the range of 42-70% [2,18,19,27]. Our results are similar to those of Rogers et al. and Rosenberg et al. who reported 62% and 70% success rates with supplemental buccal infiltration with articaine in failed IANB cases [27,18]. Matthews et al. concluded that when the IAN block failed to provide profound pulpal anaesthesia, the supplemental articaine buccal infiltration injection was successful in 58% cases [2]. Ashraf et al. have shown a success rate of 71% with supplementary articaine buccal infiltration after failed IANB [19]. However they used articaine for the primary IANB which may explain the higher percentage success.

We found that supplemental articaine intraligamentary injections were successful in 76% of cases after a failed IANB. The majority of literature has evaluated intraligamentary lidocaine injections [21,22,28]. Walton and Abbott[21] and Cohen et al[22] have reported a success rate of 63% and 74% for supplementary intraligamentary lidocaine injections. However, reinjection increased the success rate to 92-96%. Nusstein et al. reported a success rate of 56% with supplementary intraligamentary lidocaine injection in mandibular molars with irreversible pulpitis using a computer-controlled local anaesthetic delivery system [28]. Berlin, in 2005, concluded that the efficacy of 4% articaine was similar to the efficacy of 2% lidocaine for intraligamentary injection in vital teeth [23]. A recent study by Chenchugopal et al. demonstrated that 4% articaine showed slightly superior efficacy as compared to 2% lidocaine when used as a primary intraligamentary injection for pulpectomy procedures in pediatric patients [24]. To our knowledge ours is the first study evaluating articaine as an intraligamentary injection after failed IANB cases.

Fan et al. reported no significant difference between the overall success rate for IANB- intraligamentary (83%) and IANB-buccal infiltration techniques (81%) in mandibular molars with irreversible pulpitis [29]. These results include cases of successful IANBs also, which explains the higher success rates obtained in their study.

We found no significant difference between results obtained with buccal infiltration and intraligamentary injections, although the intraligamentary technique had a higher success rate which may be explained by the fact that the solution is deposited directly at the root apex and does not have to diffuse through the buccal cortical bone. Onset of anaesthesia using the intraligamentary technique is usually immediate while it takes five minutes for the buccal infiltration to take effect. The most important factor for success with the intraligamentary technique is to inject the solution under strong resistance which makes it technique sensitive. Although rare, there is a small risk of damage to the periodontium during needle insertion which could result in bone loss and pocket formation [30]. The buccal infiltration technique is also a simple method, less damaging to the periodontal ligament and avoids the bacteremia that follows intraligamentary injection [13]. The intraosseous technique although effective requires specialized equipment with cortical bone drilling and is therefore less preferred [1].

Whatever the technique chosen, the operator should strongly consider the use of supplementary injection techniques in mandibular molars with irreversible pulpitis. Owing to the difficulty in obtaining profound pulpal anaesthesia in these cases, the supplementary injections could be administered as an initial procedure immediately after the block anaesthesia prior to commencing the root canal procedure. This would improve patient comfort, lessen the time required for the procedure and greatly improve anaesthetic success rates with reinjection required in only a few cases.

CONCLUSION:

1. The IANB fails to provide profound pulpal anaesthesia in mandibular molars with irreversible pulpitis.
2. Supplementary injections with articaine using either intraligamentary or buccal infiltration techniques, results in an improved success rate and may be implemented as an initial supplementary injection prior to commencement of the root canal procedure.
3. However, no technique provides 100% predictable anaesthesia and reinjection may be necessary.

REFERENCES

1. Hargreaves KM, Keiser K. Local anesthetic failures in endodontics. Endod Topics. 2002; 1(1): 26-39.
2. Matthews R, Drum M. Articaine for supplemental buccal infiltration anesthesia in patients with irreversible pulpits when the IANB fails. J Endod. 2009; 35(3):343-46.
3. Kenndy S, Reader A. The significance of needle deflection in success of the inferior alveolar nerve block in patients with irreversible pulpitis. J Endod. 2003; 29(10):630-33.
4. Claffey E, Reader A. Anaesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. J Endod. 2004; 30(8):568-71.
5. Bigby J, Reader A. Anaesthetic efficacy of lidocaine/ meperidine for inferior alveolar nerve blocks in patients with irreversible pulpitis. J Endod. 2007; 33(1):7-10.
6. Nusstein J, Reader A. Anaesthetic efficacy of the supplemental intraosseous injection of 2 % lidocaine with 1:100,000 epinephrine in irreversible pulpitis. J Endod. 1998; 24(7):487-91.
7. Reader A, Nusstein J, Drum M. Successful Local Anesthesia for Restorative Dentistry and Endodontics, Quintessence Publishing Co, Inc. Hanover Park, IL. 2nd ed. 2011, pp 133-35
8. Potocnik I, Bajrovic F. Failure of inferior alveolar nerve block in endodontics. Endod Dent Traumatol. 1999; 15(6): 247-51.
9. Byers MR, Taylor PE, Khayat BG, Kimberly CL. Effects of injury and inflammation on pulpal and periapical nerves. J Endod. 1990; 16(2):78-84.
10. Roy ML, Nakanishi T. Differential properties of tetrodotoxin-sensitive and tetrodotoxin-resistant sodium channels in rat dorsal root ganglion neurons. J Neurosci. 1992; 12(6):2104-11.
11. Sorenson H, Skidmore L, Rzasa R, Kleier S, Levinson S, Hendry M. Comparison of pulpal sodium channel density in normal teeth to diseased teeth with severe spontaneous pain. J Endod. 2004; 30(4):287.
12. Virdee SS, Bhakta S, Seymour D. Effective anaesthesia of the acutely inflamed pulp: part 1. The acutely inflamed pulp. Br Dent J. 2015; 219(8): 385-90.
13. Kanna M, Whitworth JM, Corbett IP, Meechan JG. Articaine and lidocaine mandibular buccal infiltration anesthesia: a prospective randomised double- blind cross-over study. J Endod. 2006; 32(4):296-98.
14. Meechan JG. Supplementary routes to local anesthesia. Int Endod J. 2002; 35(11):885-96.
15. Parirokh M, Yosefi MH, Nakhaee N, Manochehrifar H, Abbott PV, Reza Forghani F. Effect of bupivacaine on postoperative pain for inferior alveolar nerve block anesthesia after single-visit root canal treatment in teeth with irreversible pulpitis. J Endod. 2012; 38(8):1035–39.
16. Gazal G. Comparison of speed of action and injection discomfort of 4 % articaine and 2% mepivacaine for pulpal anesthesia in mandibular teeth: a randomized, double-blind cross-over trial. Eur J Dent.2015; 9(2):201-6.
17. Virdee SS, Bhakta S, Seymour D. Effective anaesthesia of the acutely inflamed pulp: part 2. Clinical strategies. Br Dent J. 2015; 219(9): 439-45.
18. Rosenberg PA, Amin KG, Zibari Y, Lin LM. Comparison of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine when used as a supplemental anaesthetic. J Endod. 2007; 33(4): 403-5.
19. Ashraf H, Kazem M, Dianat O, Noghrehkar F. Efficacy of articaine versus lidocaine in block and infiltration anaesthesia administered in teeth with irreversible pulpitis: A prospective, randomized, double-blind study. J Endod. 2013; 39(1):6-10.
20. Fowler S, Drum M, Reader A, Beck M. Anesthetic success of an inferior alveolar nerve block and supplemental articaine buccal infiltration for molars and premolars in patients with symptomatic irreversible pulpitis. J Endod. 2016;42(3):390-2.
21. Walton RE, Abbott BJ. Periodontal ligament injec¬tion: a clinical evaluation. J Am Dent Assoc. 1981; 103(4): 571–75.
22. Cohen HP, Cha BY, Spångberg LS. Endodontic anaesthe¬sia in mandibular molars: a clinical study. J Endod. 1993; 19(7): 370–73.
23. Berlin J, Nusstein J, Reader A, Beck M, Weaver J. Efficacy of articaine and lidocaine in primary intraligamentary injection administered with a computer-controlled local anaesthetic delivery system. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005; 99(3):361-66.
24. Chenchugopal M, Mungara1 J, Venumbaka N, Elangovan A, Vijayakumar P, Rajendran S. In vivo evaluation of 4% articaine and 2% lidocaine intraligamentary injection administered with single tooth anesthesia-wand. Contemp Clin Dent. 2017;8(2):315-20.
25. Heft MW, Parker SR. An experimental basis for revising the graphic rating scale for pain. Pain. 1984; 19(2):153-61.
26. Kanna MD, Whitworth JM, Meechan JG. A prospective randomized trial of different supplementary local anesthetic techniques after failure of IANB in patients with irreversible pulpitis in mandibular teeth. J Endod. 2012; 38(4):421-25.
27. Rogers BS, Botero TM, McDonald NJ, Gardner RJ, Peters MC. Efficacy of articaine versus lidocaine as a supplemental buccal infiltration in mandibular molars with irreversible pulpitis: a prospective, randomized, double-blind study. J Endod. 2014; 40(6):753–58.
28. Nusstein J, Claffey E, Reader A, Beck M, Weaver J. Anaesthetic effectiveness of the supplemental intraligamentary injection, administered with a computer-controlled local anaesthetic delivery system, in patients with irreversible pulpitis. J Endod. 2005; 31(5):354–58.
29. Fan S, Chen WL, Pan CB, Huang ZQ, Xian MQ, Yang ZH et al. Anesthetic efficacy of inferior alveolar nerve block plus buccal infiltration or periodontal ligament injections with articaine in patients with irreversible pulpitis in the mandibular first molar. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;108(5):e89-e93.
30. Childers M, Reader A, Nist R, Beck M, Meyers WJ. Anesthetic efficacy of the periodontal ligament injection after an inferior alveolar nerve block. J Endod. 1996 ;22(6):317-20.