Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(4):738-743

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Use of 4% articaine (with 1:100,000 epinephrine) as buccal infiltration in surgical removal of impacted mandibular third molar

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ABSTRACT

We conducted a single blinded prospective study on infiltration anesthesia using articaine in the muco-buccal fold opposite the impacted lower third molar and the purpose of this study was to evaluate the clinical anesthetic efficacy of buccal infiltration obtained by 3.4 ml of 4% articaine (with 1:100,000 epinephrine) in extraction of impacted mandibular third molar with supplemental lingual anesthesia. For the purpose of study 54 patients of impacted mandibular third molar were included. All surgical procedures were performed by a single surgeon, who began the procedure after buccal infiltration of 3.4 ml of 4% articaine (with 1:100,000 epinephrine) in the muco-buccal fold opposite the impacted lower third molar with supplemental lingual anesthesia. For assessment of anesthetic efficacy, any pain during surgery was recorded using the visual analog scale. Also, the onset and duration, anesthesia were recorded. Data was analyzed using statistical package of social sciences (SPSS) software. Buccal infiltration of articaine, as a sole anesthetic technique in surgical removal of impacted lower third molar achieved successful anesthesia in 92.5% of our study patients. Thus, the results of this present study may be enough evidence to support the view that using 4% articaine (with 1:100,000 epinephrine) infiltrations in the muco-buccal fold opposite the impacted lower third molar may be a good option for lower third molar surgery with supplemental lingual anesthesia.

Keywords: Articaine(with 1:100,000 epinephrine), buccal infiltration, impacted mandibular third molar

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INTRODUCTION

One of the usually experienced symptoms in practice of Oral & Maxillofacial surgery is pain. Alleviation of pain during any kind of surgical procedure is of prime concern for every clinician [1] and for this purpose a variety of local anesthetic drugs have been employed and among them lidocaine HCl is well thought-out as a gold standard [2]. There are three main clinical considerations for the selection of local anesthetic solution: Anesthetic potency, time of onset of anesthesia and duration of action. But there are certain other valuable clinical properties like pharmacokinetics and toxicity of the drug that should also be taken into consideration while selecting local anesthetic solution [3]. Now a day's articaine (with or without epinephrine) is gaining more importance than

lidocaine HClamong clinicians because of its increased level of anesthetic potency low systemic toxicity in clinical situations [4] and dose dependent effectiveness [5].

Rusching et.al in 1969, first synthesized articaine hydrochloride (HCl) or 4 methyl-3-(1-oxo-2 propylamino)-propionamido)-2-thiopenecarboxylic acid methyl ester hydrochloride as an amide local anesthetic under the name of 'Carticaine'.It has an inherent property of high lipid solubility asit contains thiophene ring instead of aromatic ring and alsoit is the only amide local anesthetic that contains ester group in its chemistry which makes enable its hydrolization in plasma both by plasma esterase and by liver microsomal enzymes [6]. Moreover, articaine has high protein binding capacity (94%), resulting in its prolonged duration of action [7] and above mentioned these two properties are theoretically related to increased anesthetic efficacy [8].

Most frequently used anesthetic administration technique for mandibular teeth are regional nerves blocks but these techniques have their own disadvantages like trismus after inferior alveolar nerve block (IANB), intra-arterial injections leading to systemic toxicity, hematoma formation etc. and failures. A survey was conducted by Kaufman et.al [29]among93 general practitioners to assess the anesthetic efficacy achieved with IANB and in it they found that 90% of practitioners had difficulties in obtaining appropriate anesthesia with greatest number of failures (88%) occurring with IANB's, so this survey concluded that pain control during any dental procedure with IANB is much more difficult than infiltration method. Several other clinical studies [30, 31] have also pointed out 15% - 35% of overall failure rates with IANB for healthy lower molars. Vreeland et.al [32], in their study have also reported overall failure rate of 37% -47% with IANB with different volumes and different concentrations of lidocaine; though, buccal infiltration anesthesia of the mandibular molar would be beneficial to both clinicians and patients in terms of the ease and comfort [9]. These days articaine is being used as an infiltration anesthetic with success rate of 54% to 94% [9, 10] because now it is proven that articaine is more effective as an infiltration anesthesia over lidocaine in mandibular teeth [11].The mechanism of effectiveness of articaine in infiltration is not fully understood but could be due its better diffusion capability [12, 13].Some other studies have also administered articaine and lidocaine as buccal infiltration and compared the depth of pulpal anesthesia in mandibular molars inferior alveolar nerve block (IANB) found a similar success rate for both the anesthetic solutions [14, 15].

This prompted us to conduct a single blinded prospective study on infiltration anesthesia using articainein the muco-buccal fold opposite the impacted lower third molar and the purpose of this study was to evaluate the clinical anesthetic efficacy of buccal infiltration obtained by3.4 ml of4% articaine (with 1:100,000 epinephrine) in extraction of impacted mandibular third molar with supplemental lingual anesthesia.

To the best of our knowledge, this is the first clinical trial studying the anesthetic efficacy of 4% articaine (with 1:100,000 epinephrine) as buccal infiltration in the muco-buccal fold opposite the impacted lower third molar for its removal, so comparisons with other same reports may be difficult.

EXPERIMENTAL SECTION

After taking ethical approval from institutional authority, 54patients of impacted mandibular third molar who reported to Department of Oral & Maxillofacial Surgery for extraction were included in the study. After discussing the details of the treatment a well informed and written consent was obtained from all patients included in this study. The inclusion criteria were an age older than 18 years, no systemic disorders or history of allergy to local anesthetics and the exclusion criteria consisted of pregnancy, taking any medications that could affect pain assessment, reduced mouth opening, or active sites of infection in the area of local anesthetic injection or area of surgery. Periapical radiographs were used to assess the composite difficulty scores [17] of the impacted mandibular third molars based on the: Winter's classification and Pell and Gregory classification. All surgical procedures were performed by a single surgeon, who began the procedure after buccal infiltration of3.4 ml of 4% articaine (with 1:100,000 epinephrine) in the muco-buccal fold opposite the impacted lower third molar. The anesthetic solution was deposited over 2 minutes at a rate of 1.7 ml/min. Then, for achieving lingual soft tissue anesthesia 0.3 ml of the same anesthetic was deposited under the lingual mucosa opposite the third molar area near the superior margin of the ridge. An additional 0.3 ml of the same anesthetic was infiltrated, if needed. After administration of anesthesia, patients were asked to report when they start feeling numb and when the maximum amount of numbness occurred. At that point, objective signs of anesthesia were investigated to confirm the depth of anesthesia. At confirmation of profound anesthesia, removal of impacted lower third molars followed a standard surgical technique. If the patient felt pain or any discomfort was noticed during surgery, the procedure was stopped and anesthesia was used again either in the form of inferior alveolar nerve block or infiltration. The following parameters were recorded:

1. The onset of anesthesia was recorded using stop watch and was defined by the time elapsed from withdrawal of the needle to the time at which the patient felt maximum numbness;

2. The duration of anesthesia was recorded as the time from the patient's perception of the anesthetic effect to the moment when the subjective numbness began to fade;
3. Type of impaction and there composite difficulty scores (Score according to winter's classification + Pell & Gregory classification)
4. Adverse effects like paresthesia / hypoesthesia, infections, allergic response etc.
5. Depth of anesthesia (Profoundness of anesthesia) was assessed using Heft-Parker visual analog scale (VAS) [16]. The VAS used was a 170-mm line with various descriptive terms. To interpret the data, the VAS was divided into the following 4 categories: No pain - 0 mm on the scale; Mild pain ->0 to <54 mm; Moderate pain ->54 to<114mm; Severe pain >114 mm

The technique was considered successful when none of our patients reported any discomfort during the procedure i.e. VAS – 0 mm. Data was analyzed using statistical package of social sciences (SPSS) software.

RESULTS

In this study 54 patients (54 impacted third molars) were enrolled and among them 38 (70.3%) patients were male and 16 (29.6%) patients were female (Figure 1). The mean age of the patients was 27.5± 6.62years.Buccal infiltration of articaine (with 1:100,000 epinephrine), as a sole anesthetic technique in surgical removal of impacted lower third molar achieved successful anesthesia in 92.5% of study patients i.e. 50 patients. The technique was considered as a failure for the remaining4 patients (7.4%) who had pain / discomfort during the tooth sectioning as a result of which the procedure was stopped and anesthesia was repeated to alleviate the discomfort. In this study mean time of onset of anesthesia was 4.86 ± 0.55minutes and mean time for duration of anesthesia was 89.5 ± 5.9 minutes (Table - 1).Bone removal was required in all the cases though; tooth sectioning was required in 39 (72.2%) patients. In this study out of 54 patients, 29 (53.7%) patients had mesio-angular impaction, 12 (22.2%) patients had disto-angular impaction, and 13 (24%) patients had horizontal impaction with overall mean difficulty score 4.96 ± 1.24 (Table -1).

Table-1 Anesthetic success, onset and duration of anesthesia for 4% articaine (with 1: 100,000 epinephrine) and Mean composite difficulty score

Variables measured	Results
Anesthetic success in Patients, n (%)	50 (92.5%)
Onset of anesthesia (min.) Mean ± Standard deviation	4.86 ± 0.55 minutes
Duration of anesthesia Mean ± Standard deviation	89.5 ± 5.9 minutes
Composite difficulty score Mean ± Standard deviation	4.96 ± 1.24
Surgeries with tooth sectioning, n (%)	39 (72.2%)

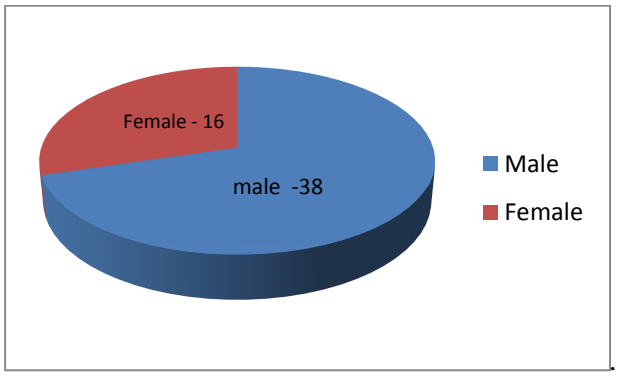

Figure – 1: Distribution of patients according to gender

DISCUSSION

Pain, panic and nervousness are always associated with every surgical procedure especially in the context of oral surgery in ambulatory and otherwise healthy patients. The overall control of pain, panic and nervousness in any minor oral surgical procedure like surgical removal of impacted tooth, in addition to proper tissue handling has a great impact on post-operative outcome in terms of ease of the patient. Even though, there is no uncertainty that the

majority of patients who go for treatment can be managed onlywith good local anesthetic techniques [17] and clinical efficacy of any anesthetic technique should be investigated only when standardized procedures are used. For this purpose, it is important to select patient carefully to make sure that trauma caused by surgical procedure should be of same degree and also the same surgical procedure should be used in every patient by the same surgeon [18].

Depth of anesthesia:
Depth of anesthesia was assessed using Heft-Parker visual analog scale (VAS) in which patient was instructed to score intra-operative pain intensity. The results of this study showed that when articaine was used as buccal infiltration in the muco-buccal fold opposite the impacted lower third molar, successful anesthesia was achieved in 92.5% of the patients (VAS – 0 mm)and this finding is in agreement with those of El-kholey KE [20] who used buccal infiltration of 4% articaine plus 1: 100,000 epinephrine in the muco-buccal fold opposite first molar and reported 93% success, Rebolledo et.al [19] who compared 4% articaine with 2% lidocaine in IANB in surgical extraction of lower third molar, Robertson et.al [11] who used mandibular first molar buccal infiltrations of two anesthetic solutions: 4 percent articaine with 1:100,000 epinephrine and 2 percent lidocaine with 1:100,000 epinephrine and reports 75 to 92% and 45 to 67% success with articaine and lidocaine respectively, Kambalimath DHet.al [33] in their study compared the anesthetic properties of 4 % Articaine hydrochloride and 2 % Lidocaine both with 1:100,000 epinephrine for mandibular inferior alveolar nerve anesthesia and reported 96.6% and 86.6% success with articaine and lidocaine respectively, while Kanaa MD et.al [23] compared the efficacy of buccal infiltration with 4% articaine and 2% lidocaine (both with 1:100,000 epinephrine) in securing mandibular first molar pulp anesthesia and reported 64.5% and 38.7% success with articaine and lidocaine respectively. Similarly, Abdulwahab and colleagues [21] and Abdullah WA and colleagues [22] also noted that 4% articaine (with 1:100,000 epinephrine) was more successful than 2% lidocaine with 1:100,000 epinephrine for pulpal anesthesia when used as buccal infiltration in mandibular molar region.

Still, the exact mechanism for the increased efficacy of articaine when used as a buccal infiltration at the area of the lower molar is not fully understood. According to Singla M et.al [24], articaine is more successful than lidocaine when used as a buccal infiltration because of its chemistry and high lipid solubility as this enhanced lipid solubility increases its penetration in the cortical plates of mandible along with the formation of intra-molecular hydrogen bond (Skjeviket al.) [25]. Meechan [26], in his article on the use of an infiltration anesthetic technique to anesthetize mandibular teeth in adults, mentioned that the likely mechanisms of anesthetic effect of articaine as a buccal infiltration may be related to penetration through to the inferior alveolar nerve canal resulting in the blockage of the inferior alveolar nerve distal to that point. May be this is the reason why high percentage of anesthesia was achieved in this study when articaine is used as a buccal infiltration opposite the impacted lower third molar supplemented by lingual infiltration. Because of its unique structure articaine has relatively short half-life in the blood stream and reason for this is rapid conversion of ester moiety on thiophene ring to carboxylic acid moiety resulting in enhanced systemic safety profile [27, 28] and because of this higher doses of articaine can be used safely in mandibular buccal infiltration apparently resulting in greater anesthetic efficacy.

Onset of anesthesia (latency):
As we all know that there are several factors like inherent properties of a drug, technique of anesthesia used, and pKa value, that influence the onset of anesthesia (latency)and as a minimum in theory 4% articaine has shorter latency period [33] and our results are in agreement to this supposition. The onset of anesthesia in this study was 4.86 ± 0.55 minutes and this is in agreement with the study conducted by El-kholey KE [20]who reported onset of action of 5.21 ± 0.38 minutes using buccal infiltration of 4% articaine plus 1: 100,000 epinephrine in the muco-buccal fold opposite first molar, Moore et.al [34], who reported onset of about 4.2 ± 2.8 minutes using 4% articaine (with 1:100,000 epinephrine).

Duration of action:
Like onset of anesthesia, there are several factors that effects duration of action of a particular anesthetic for example: efficacy of local anesthetic solution to bind with proteins, technique used to deposit anesthetic, presence or absence of vasoconstrictor and site of injection [19]. Articaine has high protein binding capacity (94%) of all amide local anesthetics, resulting in its prolonged duration of action [7]and our results are in agreement to this supposition. The reported duration of action in this study was 89.5 ± 5.9 minutes and this is in agreement with the study conducted by El-kholey KE [20] who reported duration of action of 93.0 ± 4.24 minutes using buccal infiltration of 4% articaine (with 1:100,000 epinephrine) in the muco-buccal fold opposite first molar.

Composite difficulty score:
Periapical radiographs were used to assess the composite difficulty scores of the impacted mandibular third molars based on the: Winter's classification and Pell and Gregory classification. Mean composite difficulty score in this

study was4.96 ± 1.24 which is comparable with the study conducted by M. James Antony Bhagat et.al [17] who reported mean composite difficulty score of 4.76 ± 1.213.

Adverse effects:
According to the literature every drug has its own effects and side-effects and this is also true in context of articaine too. In general, Malamed et.al [4] reported incidence of adverse events in the combined studies was 22 % for Articaine and 20 % Lidocaine of which paresthesia was 0.9 %, hypoesthesia 0.7 %, headache 0.55 %, infection 0.45 %, rash and pain 0.3 %. But in our study we didn't report not even a single case of adverse effect and the reason might be the use of articaine as a buccal infiltration rather than using it in IANB.

CONCLUSION

Thus the results of this present study may be enough evidence to support the view that using 4% articaine (with 1:100,000 epinephrine) infiltrations in the muco-buccal fold opposite the impacted lower third molar may be a good option for lower third molar surgery with supplemental lingual anesthesia.

Acknowledgement
- Conflicts of Interest – None declared
- Sources of support in the form of grants or funds – None
- Ethical approval – approved from institutional authority. Ref. no.- KDCRC/IERB/08/2015/08
- Patient Consent – obtained
- Yes, all the authors have viewed & agreed to the submission

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