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ORIGINAL RESEARCH

Assessment of efficacy of 4% articaine and 2% lignocaine in patients undergoing dental extraction: A comparative study

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***ABSTRACT*:**
Background: Local anesthetics form the mainstay of pain control techniques in dentistry. In literature, there are many studies reported that the superiority of articaine over other local anesthetic agents. Hence; the present study was undertaken for comparing the clinical efficacy of 4% articaine with 1:100,000 epinephrine over 2% lidocaine in 1:80,000 epinephrine in patients undergoing dental extractions. **Materials & methods:** This in vivo study was carried out on 60 patients to compare the onset and duration of anesthesia, pain at the time of injection and extraction, and complications in the postanesthetic period of 4% articaine with 1:100,000 epinephrine and 2% lignocaine with 1:80,000 epinephrine in extraction of maxillary premolars for orthodontic considerations. Visual analog scale (VAS) was used to evaluate pain. Paired t test was used to evaluate and compare the values obtained. **Result:** The mean time of onset of anesthesia came out to be 38.44 ± 27.95 seconds and 84.42 ± 29.50 s in articaine group and lignocaine group respectively. This difference was statistically significant ($P < 0.001$) with the time of onset being slower in lidocaine group. In articaine group, the mean duration of anesthesia was 134.52 ± 46.81 and 92.30 ± 44.58 min with the lignocaine group. There is a statistically significant difference ($P < 0.001$) showing that articaine has longer duration of action compared to lignocaine group. Both the anaesthetic groups did not show any post operative complications, which was calculated using VAS scale during the post extraction period. **Conclusion:** Articaine HCL has a faster onset and longer acting anesthetic action as compared with lignocaine HCL.
Key words: Local anaesthesia, Extraction, Articaine

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INTRODUCTION

Local anesthetics form the mainstay of pain control techniques in dentistry. They are chemicals that block the nerve conduction in a specific, temporary, and reversible manner without affecting the patient's consciousness. Lidocaine was widely used and was considered the gold standard. The potency of lidocaine is presently regarded as the standard for comparison with other local anesthetics. In 1969, articaine hydrochloride was synthesized by Rusching et al. with the name of carticaine and was first marketed in Germany in 1976. By 1983, the drug was available practically in all of Europe and Canada, though it was not approved in the United States until March 2000. Articaine was available as a 4% solution with epinephrine 1:100,000.[1-3]

From cocaine (1884), procaine (1904), to lidocaine (1948), dentistry has been in forefront in seeking to provide patients with pain-free treatment. The primary local anesthetics used in dentistry are classified as amides and esters. Amides are more often used than ester agents since amides produce more rapid and reliable profound surgical anesthesia. As with lidocaine, articaine is also classified under amide group of local anesthetics with intermediate duration of action. Literature reports that patients treated with articaine become "drug free" more quickly than those who receive other local anesthetics.[2] In recent years, a significant amount of research has been conducted to investigate the efficacy of 2% lidocaine versus 4% articaine. One common topic of investigation is to compare the effectiveness of these two anesthetics in

challenging situations, such as the ability to anesthetize maxillary teeth with irreversible pulpitis.[4-6]

In literature, there are many studies reported that the superiority of articaine over other local anesthetic agents. Hence; the present study was undertaken for comparing the clinical efficacy of 4% articaine with 1:100,000 epinephrine over 2% lidocaine in 1:80,000 epinephrine in patients undergoing dental extractions.

MATERIALS AND METHODS

This in vivo study was carried out on 60 patients to compare the onset and duration of anesthesia, pain at the time of injection and extraction, and complications in the postanesthetic period of 4% articaine with 1:100,000 epinephrine and 2% lignocaine with 1:80,000 epinephrine in extraction of maxillary premolars for orthodontic considerations. Visual analog scale (VAS) was used to evaluate pain. Paired t test was used to evaluate and compare the values obtained.

Inclusion criteria

• Patients requiring extraction of maxillary premolars for orthodontic reasons irrespective of age and sex

Exclusion criteria

• Patient having systemic disorder like diabetes, hypertension, cardiac, or neurological disorder

There was a random selection of patients for the use of either of the local anesthetic solutions during the first visit for removal of maxillary premolar of the upper right quadrant. The other local anesthetic solution was used for the extraction of other side premolar. In this way every patient played as his/her own control. The patients were made comfortable in the dental chair and were kept unaware of the anesthetic solution used on either side. 0.6 ml of 4% articaine HCl with 1:100,000 adrenaline solution was used for buccal infiltration for anesthetizing maxillary teeth. Similarly, 0.6 ml and 0.3mi of 2% lignocaine HCl with 1:80000 adrenaline solution was used for buccal and palatal infiltration respectively for anesthetizing maxillary teeth on the other side. 5 minutes later objective symptoms were checked on both buccal and palatal sides. The patients were then asked to rinse their oral cavity with an antiseptic mouthwash and the extraction of premolars on either side was done by the same doctor. VAS was explained in detail to all the patients before the procedure and was asked to inform about lip numbness as soon as it was perceived. All parameters including time of injection, commencement of anaesthesia, and quantity of aesthetic agent injected were noted. All patients were reviewed for any postoperative complications. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

RESULTS

24 out of the 60 patients (40%) were males and the rest 36 were females (60%). Forty eight (80%) patients were in the age group of 11–18 years and 12 (20%) in 19–28years. In the present study, most common age group requiring orthodontic extraction was between 11 and 20 years (80%). Volume of solution of lignocaine group was higher than that of articaine group. The mean time of onset of anesthesia came out to be 38.44 ± 27.95 seconds and 84.42 ± 29.50 s in articaine group and lignocaine group respectively. This difference was statistically significant ($P < 0.001$) with the time of onset being slower in lidocaine group. In articaine group, the mean duration of anesthesia was 134.52 ± 46.81 and 92.30 ± 44.58 min with the lignocaine group. There is a statistically significant difference ($P < 0.001$) showing that articaine has longer duration of action compared to lignocaine group. Both the anaesthetic groups did not show any post operative complications, which was calculated using VAS scale during the post extraction period.

Table 1: Gender-wise distribution of patients

Gender	Number of patients	Percentage of patients
Male	24	40
Female	36	60
Total	60	100

Table 2: Distribution of patients according to age

Age group (years)	Number of patients	Percentage of patients
Less than 18	48	80
More than 18	12	20
Total	60	

Table 3: Mean duration of onset

Duration of onset (seconds)	Lignocaine group	Articaine group	p- value
Mean	84.42	38.44	0.01
SD	29.50	27.95	

DISCUSSION

Local anesthesia in dentistry provides comfort for the patient, but also as much comfort for the clinician as the planned procedures can be carried out under the best possible conditions. From clinical experience and from the literature, it is clear that dental local anesthesia is not always as successful as anticipated[5]Treating patients with minimal discomfort and pain has always been paramount in dentistry and continues to grow in necessity with the array of contemporary techniques and devices in our armamentarium. The most common method for pain control is achieved by administering a local anaesthetic solution via an injection.[6] Profound local anesthesia is critical, and several methods are introduced to reduce pain during injection such as applying topical anesthetics pastes, warming or buffering the local anesthetic agents, and slow inflation of local anesthetics. Furthermore, some studies have focused on cooling the injection site for better pain relief before or after local anesthetic injection. Also, vibration or pressure to the injection site by high-tech mechanical delivery systems has been tried out recently.[6- 8] Hence; the present study was undertaken for comparing the clinical efficacy of 4% articaine with 1:100,000 epinephrine over 2% lidocaine in 1:80,000 epinephrine for the application of inferior alveolar nerve block during the in extraction of maxillary premolars.

In the present study, it was observed that the volume of drug solution for lignocaine group was greater than that of articaine group. Katyal V et al carried out a systematic review was to compare the efficacy and safety of articaine with lignocaine in maxillary and mandibular infiltrations and block anaesthesia in patients presenting for routine dental treatments. Inclusion was limited to: (1) randomized controlled trials in patients requiring non-complex routine dental treatments; (2) interventions comparing 4% articaine (1:100,000 epinephrine) with 2% lignocaine (1:100,000 epinephrine) for maxillary and mandibular infiltrations and block anaesthesia; and (3) with principal outcome measures of anaesthetic success, post-injection adverse events or post-injection pain.They concluded that Articaine is more likely than lignocaine to achieve an anaesthetic success in the posterior first molar area with a relative risk for success at 1.31 (95% CI 1.12-1.54, P=0.0009). There is no difference in post-injection adverse events between articaine and lignocaine with a relative risk of 1.05 (95% CI 0.66-1.65, P=0.85). However, articaine injection results in a higher pain score as measured by Visual Analogue Scale, than lignocaine at the injection site after anaesthetic reversal with a weighted mean difference of 6.49 (95% CI 0.02-12.96, P=0.05) decreasing to 1.10 (95% CI 0.18-2.02, P=0.02) on the third day after injection.[8]

In the present study, the onset of anesthesia in articaine group was faster as compared to the lidocaine group and this difference was satistically significant was highly significant statistically on palatal aspect. Lugman U et al compared single buccal articaine injection versus conventional lignocaine buccal and palatal injections for uncomplicated maxillary tooth extractions. Patients aged 20 - 60 years under simple extraction in the maxillary arch were included in the study. Patients were randomly divided into two groups-A and B toss method. Maxillary teeth were divided into three groups; group-1 (posterior teeth) including first, second and third molars on either side, group-2 (middle teeth) including the premolars and group-3 (anterior teeth) including incisors and canines. Group-A (study group) received buccal infiltration of 4% articaine with 1:200,000 adrenaline and group-B (control group) received buccal and palatal infiltration of 2% lignocaine/HCl with 1:100,000 adrenaline. Faces Pain Scale (FPS) and a Visual Analogue Score (VAS) were used for objective and subjective assessment of per operative pain respectively. They conclude that buccal infiltration with a single articaine injection and lignocaine buccal and palatal infiltration were equally effective for maxillary exodontia.[9]

In the present study, it was observed that the mean difference in the duration of anesthesia was also statistically significant with the articaine group having a longer duration. da Silva-Junior GP et al compared the efficacy of lidocaine and articaine for pain control during third molar surgery, 160 patients presenting bilateral asymptomatic impacted mandibular third molars were selected. They received 1.8 mL of 2% lidocaine with epinephrine 1:100,000 during inferior alveolar nerve block. In group 1 (n = 80), an infiltrative injection of 0.9 mL of 2% lidocaine with epinephrine 1:100,000 was performed in buccal-distal mucosa of the third molar. Group 2 (n = 80) received 0.9 mL of 4% articaine with epinephrine 1:100,000 in the contralateral side. All procedures were performed at the same visit, by a single operator, in a double-blind and parallel design. The duration of each surgery and the moment when the patient expressed pain were noted. Data were analyzed by nonpaired t test and chi-square test (alpha = 5%). Duration of surgery did not differ (p = .83) between Groups 1 (19.8 ± 2.3 minutes) and 2 (19.7 ± 3.0 minutes). Pain was expressed more in group 1 (26.3%) than in group 2 (10%) (odds ratio = 3.2, p = .0138). In both groups, tooth sectioning was the most painful event (p < .0001). No influence of gender (p = .85) or age (p = .96) was observed in pain response. Buccal infiltration of 4% articaine with epinephrine 1:100,000 showed more efficacy than 2% lidocaine with epinephrine 1:100,000 when used in combination with inferior alveolar nerve block in controlling intraoperative pain related to impacted mandibular third molar surgery.[10]

CONCLUSION

This study concludes that articaine HCL has a faster onset and longer acting anesthetic action as compared

with lignocaine HCL. Moreover, a lesser quaintity of articaine is required to induce the required anesthesia. Since both articaine and lignocaine did not show any postextraction complications, articaine can be used as an alternative to lignocaine as a local anesthetic agent in dental procedures.

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