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Re-Evaluation of the Need for Palatal Injection Using 4% Articaine Hydrochloride as Local Anesthetic Agent in Exodontia

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Abstract: Articaine hydrochloride (HCL) is a hybrid molecule classified as an amide local anesthetic (LA) agent. But it possesses both amide and ester characteristics, so the biotransformation occurs in plasma and liver. In this study, we have evaluated the diffusion property for palatal anesthesia effect after buccal infiltration of articaine for extraction of maxillary molar tooth comparing it with lignocaine which requires a separate palatal injection. A randomized prospective study was conducted involving 40 patients divided into 4 groups (Group A, B, C, D). Each group was sub-divided into sub-group I and II with 5 patients each. All the patients in sub-group I were administered with 2% lignocaine HCL and patients in sub-group II with 4% articaine HCL. All the patients who received 2% lignocaine HCL required palatal injection along with the buccal injection. Patients who received 4% articaine required palatal injection for extraction of firm tooth whereas the extraction of mobile tooth did not require the additional palatal injection. But the onset of action was longer in group that received articaine. From this study we conclude that articaine has diffusion properties and can be used as a modality for extraction of mobile maxillary tooth without the need for a separate palatal injection.
Keywords: Articaine, amide, palatal injection, diffusion property, anesthesia.

INTRODUCTION

Articaine is one of the recent amide type local anesthetic drugs available to dentists worldwide. Various studies advocate its superiority over other common local anesthetic agents and there exists controversies regarding its clinical safety [1].

Articaine was originally synthesized as carticaine in 1969 and was first brought to clinical practice in Germany in 1976[2]. Articaine can diffuse through soft and hard tissues more reliably. Articaine provides palatal soft tissue anesthesia without palatal infiltration [2]. Though lidocaine is considered the "gold standard" local anesthetic agent in dentistry [3], articaine due to its safety and efficacy [3, 11] has gained its advantage and clinical importance over time. In the two major classes of local anesthetics the hydrophobic part and the amine are linked either through an ester or amide bond, giving rise to amino ester or amino amide local anesthetics. Articaine belongs to the latter group. Articaine hydrochloride is an amide local anesthetic,3-N-Propylamino-proprionylamino-2-carbomethoxy-4-methylthiophene hydrochloride[2]. It shows the properties of both esters and amides and contains a thiophene ring. It is unique as it contains an additional ester group which is metabolized by esterase in blood and tissue [3] (Figure 1).

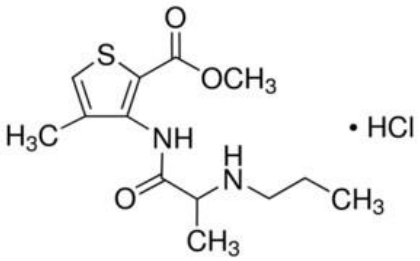

Fig-1: Chemical structure - Articaine HCL processes both amide and ester characteristics with a thiophene ring

The elimination half-life of articaine is 20 minutes. Since it is hydrolyzed quickly in the blood, the risk of systemic intoxication seems to be lower than with other anesthetics, especially after repeated dose of injection [5].

MATERIALS AND METHODS

A prospective randomized clinical study was carried out in our institutional set up after obtaining approval from the institutional ethical committee. 40 patients were randomly selected as samples for study. They were randomly divided into 4 groups with 10 patients in each group. Group A comprised of patients requiring extraction of firm tooth. Group B comprised of patients requiring extraction of Grade I mobile tooth, Group C with Grade II mobile tooth and Group D with Grade III mobile tooth.

The patients included in this study were healthy individuals above 18 years and below 45 years requiring extraction of maxillary teeth. Patient's refusal for the procedure, pediatric and geriatric individuals, patients requiring mandibular tooth extraction and physically and mentally unfit individuals were excluded. The mobility of the tooth was assessed using Millers mobility index (MMI).

Patients in all the groups were further divided into two sub-groups (subgroup 1 and 2). The sub-groups comprised of 5 patients each. Sub-group 1 patient was administered with 2% lignocaine hydrochloride to anesthetize the operative site. Under all aseptic conditions buccal infiltration and palatal block was administered. Sub-group 2 patients were administered with 4 % articaine hydrochloride local anesthetic agent to anesthetize the operating site. Buccal infiltration was done without palatal anesthesia. Standard procedure of exodontia was then carried out after checking subjective and objective symptoms by a single qualified operator. The need for palatal injection was then assessed in the patients administered with 4 % articaine hydrochloride.

RESULTS

The prospective study included the sample size (n=40) of 40 patients which were divided into 4 groups of 10 patients each. Each group was further divided into 2 sub-groups of 5 patients each. All the patients from sub-group I from all the four groups received 2% lignocaine HCL and patients of sub-group II received 4% articaine HCL.

All the patients from sub-group I of Group A, B, C and D required a separate palatal injection for extraction of tooth irrespective of the tooth mobility (Using MMI) [10] or firm tooth. Whereas only sub-group II patients from Group A required an additional palatal injection. Patients from sub-group II, Group B, C and D did not require an additional palatal injection (Table 1).

Table-1: Requirement for a palatal injection between patients who received Lignocaine HCL and Articaine HCL

Tooth type	Sub-group I Lignocaine group	Sub-group II Articaine group
Firm	Yes	Yes
Grade 1 mobility	Yes	No
Grade 2 mobility	Yes	No
Grade 3 mobility	Yes	No

The onset of action to achieve palatal anesthesia with 2% lignocaine was found to be 3.6 ± 1.07 minutes and with 4% articaine hydrochloride was found to be 9.98 ± 1.27 minutes (Table 2). This explains that the duration of the procedure could be longer when articaine is used as compared to lignocaine.

Table-2: Onset of action (in minutes) to achieve anesthesia in patients administered with 2% lidocaine HCL and 4% articaine HCL

Patient	Lignocaine group	Articaine group
1	2	8
2	4	9
3	2.5	10.8
4	3	11.5
5	5	12
6	3.5	9.5
7	2.5	8.5
8	4.5	10
9	4	10
10	5	10.5
Onset of action – Average time (In minutes)	3.6 ± 1.07	9.98 ± 1.27

DISCUSSION

Mahalawy *et al.*[3] in their study concluded that the diffusion property of 4% articaine solution with 1:100,000 epinephrine to the palatine soft tissue after infiltration in buccal vestibule was greater in a rabbit model.

Skjevik *et al.*[4] in their study explained that articaine has the unique character to form an internal hydrogen bond appears to be a mechanism that enables an increased lipid solubility which explains that it has superior hard and soft tissue penetration along with anesthetic efficacy on posterior teeth compared to other local anesthetic drugs.

Local anesthesia is used in majority of the minor or major surgical procedure in oral and maxillofacial surgery practice. Palatal injections being most painful of all augments patient's anxiety. Diffusion characteristic of articaine aids in reducing patient's anxiety. However there are two schools of thoughts that support this hypothesis and oppose it[6].

Somuri *et al.* [7], Hassan *et al.*[8] concluded from their clinical studies that articaine diffuses into the palatal area eradicating the need of separate palatal injections. Palatal anesthesia achieved by depositing articaine to the buccal vestibule was as effective as palatal infiltration of lignocaine [7].

Evans *et al.*[9] concluded that the anesthetic efficacy of articaine is greater than lidocaine in his study. It provides sufficient pulpal anesthesia in maxilla. The success of infiltration using articaine solution was 88% in lateral incisor as compared to infiltrating lidocaine solution which was 62% in the lateral incisor.

However some studies oppose the presence of articaine diffusion in palatal tissues. Özeç *et al.*[6] in their study concluded that there is no presence of anesthesia using 4% articaine hydrochloride in the palatal tissues after buccal injection.

In this study, all the patients administered with 4% articaine hydrochloride were found to have palatal numbness. This shows that anticline diffuses into the soft tissues. Although anesthetic effect was not profound to extract firm tooth, but was potent enough for the extraction of mobile tooth. Although all the patients responded with absence to minimal pain in palatal soft tissue on probing.

CONCLUSION

In this study we conclude that articaine hydrochloride possess the property of diffusion and can produce palatal numbness. But its anesthetic efficacy limits the operating surgeon to extract mobile tooth without the need for palatal anesthesia. As for the extraction of firm tooth separate palatal injection is necessary to reduce patient discomfort during the procedure.

COMPLIANCE WITH ETHICAL STANDARDS

Ethical approval

Obtained. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from the patients involved in this study.

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