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Original Research

‘‘Breakthrough in Local Anesthetic Agent (Articaine) - Gone are the Days of Painful Palatal Injections’’

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ABSTRACT

The aim of the present study was to evaluate the efficacy of articaine HCL in maxillary procedures on administration of only buccal infiltration, obviating the need for palatal injection. A randomized descriptive study was undertaken on 100 patients who underwent various minor oral and maxillofacial surgical procedures in the maxillary arch. Anesthesia was achieved using 4%articaine hydrochloride with 1:200,000 epinephrine. Post-operatively all patients were asked to furnish their response on a Visual Analog Scale and comfort levels respectively. Majority of the patients found the procedure to be very comfortable and without any significant pain. Patients belonging to age group 10-30 years were more comfortable and had less pain when compared to other age groups. Chi- Square Test was taken to test the significance of the study. For VAS v/s age p=0.011(<0.05); VAS v/s sex p=0.024(<0.05). Comfort score v/s age p=0.018(<0.05) gave statistically significant results. In conclusion, 4 % articaine can be an effective anesthesia for minor surgical procedures in maxillary arch where painful palatal injections can be eliminated.

Key words: Articaine hydrochloride, maxillary procedures, buccal infiltration, palatal injection.

INTRODUCTION

One of the most important aspects of the practice of dentistry is the control or elimination of pain. In the past, pain has been so closely associated with dentistry that the words pain and dentistry have become almost synonymous. Research has proved that more patients stay away from dental offices from fear of pain than from all other reasons combined. In the practice of dentistry, pain is not considered as a warning signal but as an evil to be conquered. Pain is not a pure sense as is hearing, vision and the like; and cannot be dealt with as such[1]. Arbitrarily one may define ‘Pain’ as an unpleasant emotional experience usually initiated by a noxious stimulus and transmitted over a specialized neural network to the central nervous system where it is interpreted as such[2].

This aspect was unwittingly realized centuries ago when ‘OPIUM’ was determined to be “GOD’s OWN MEDICINE” for pain which eliminated fear, anxiety and produced definite analgesic effect. Management of pain during dental treatment has progressed since the introduction of nitrous oxide in the 1840’s. CARTICAINE, first prepared by RUSCHING and colleagues in 1969, had its generic name changed to ARTICAINE when it entered clinical practice in Germany in 1976. It was approved for use in United States by Federal Drug Administration (FDA) in April 2000. Articaine is an amide type local anesthetic; and the only amide that contains a thiophene ring and an additional ester ring. Biotransformation of articaine occurs in both the plasma (hydrolysis by plasma esterase) and the liver (hepatic microsomal enzymes). As it is metabolized both in the plasma and liver it causes less systemic toxicity as compared to other amide local anesthetic. It has been claimed by many authors that unlike other local anesthetic solutions, buccal

infiltration of articaine results in maxillary palatal anesthesia, eliminating the need for a palatal injection because of its high capacity of diffusion through soft and hard tissues[3].
Palatal mucosa is very tightly adherant to the underlying periosteum and has an abundant nerve supply hence making palatal injections very painful. Thereby any local anesthetic technique that eliminates palatal injections would be of great benefit to the patients[4].

The aim of the present study is to evaluate the efficacy of articaine HCL in maxillary procedures on administration of only buccal infiltration obviating the need for palatal injection.

MATERIALS AND METHODS

This was a randomized descriptive study done on 100 patients; out of whom 55 were males and 45 females. 4% Articaine Hydrochloride with 1 : 200,000 epinephrine supplied by Fabrique par Aventis Pharma Deutschland, Frankfurt, Germany and a Reg. Trademark of Hoechst with the commercial name ULTRACAINE® D-S was the local anesthetic (Fig.1). A 30 gauge needle supplied by Dentsply pharmaceuticals with the trade name Accujet containing 100 sterile disposable needles was used for the study. A self aspirating syringe, manufactured by Miltex, Inc, Germany was used for administration of the local anesthetic. Articaine is supplied in a box of 50; 1.7 ml sterile glass cartridges (Fig.2).

Figure 1: armamentarium

Figure 2: Cartridge before injection

Written informed consent was taken from all the patients participating in the study. The administration of local anesthetic solution, 4% articaine hydrochloride with 1:200,000 was via a buccal infiltration. All the procedures carried out under this local anesthetic solution were in the maxillary arch. The patients were given two scales one of VAS (Visual Analogue Scale) and the other of Comfort score to be filled after the procedure.

For the Visual Analogue Scale: A scale of 10cm was drawn and each patient was asked to mark on the scale.

(Table 1)

Score	Response
0 cm	No pain
0-2cm	Very mild pain
2-4cm	Mild pain
4-6cm	Moderate pain
6-8cm	Severe pain
8-10cm	Very severe pain

A comfort score was designed to evaluate the overall rating of the procedure:

(Table 2)

Score	Response
0	Significant discomfort
1	Moderate discomfort
2	Mild discomfort
3	Satisfactory
4	Comfortable
5	Very comfortable

Patients who were excluded from the study were: Pregnant mothers, Bony fully impacted teeth or maxillofacial surgery, known or suspected allergies or sensitivities to sulfites, amide – type local anesthetics or any ingredients in the anesthetic solutions, concomitant cardiac or neurological disease. History of severe shock, paroxysmal tachycardia, frequent dysrhythmia, severe untreated hypertension or bronchial asthma. Evidence of soft tissue infection near the proposed injection site. Patients who have taken aspirin, acetaminophen, nonsteroidal anti Inflammatory Drugs (NSAIDs) or other concomitant use of mono-amine oxidase (MAO) inhibitors, TAD (Tricyclic Anti Depressants), phenothiazine, butyrophenon vasopressor drugs or ergot – type oxytocic drugs and analgesic agents within 24 hours before administration of the study local anesthetic[5,6]

RESULT

Chi square test was taken to test the significance of the study. For VAS Vs Age $p = 0.011$ (<0.05); VAS Vs Sex $p = 0.024$ (<0.05). Comfort score Vs Age $p=0.018$ (<0.05) gave statistically significant results.

Demographic data: (Table 1, 2)

Table 3: COMFORT SCORE

COMFORT SCORE	FREQUENCY
Very comfortable	56
Comfortable	38
Satisfactory	6
Mild discomfort	0
Moderate discomfort	0
Significant discomfort	0

Table 4: VAS

VAS	FREQUENCY
No pain	55
Very mild pain	42
Mild pain	3
Moderate pain	0
Severe pain	0

Very severe pain	0

DISCUSSION

Although the local anesthetic in current use are acceptable, there is interest in new chemical agents that may offer improvements in local anesthesia. New agents should possess greater efficacy. In addition, they should produce fewer systemic effects and be less toxic compared to those in use at the present time[4]. Although Articaine was introduced as a clinically useful anesthetic agent in Germany in 1976. It took 24 years for it to get approval from FDA. (Food and drug administration) Articaine is an amide-type anesthetic. Uniquely for an amide, it is metabolized by plasma esterase. This is because it contains an ester component. The fact that initial metabolism occurs in plasma decreases the systemic toxicity of articaine compared to the other amide agents, which are primarily metabolised in the liver. The half life of articaine (about 30 minutes) is much shorter than that of the other amide local anesthetic (Lidocaine has t ½= 90 minutes) .

Although it has a rapid metabolism, the use of articaine requires care when calculating the maximum number of cartridges for each patient, especially in pediatric dentistry. This is because the anesthetic is presented in relatively high concentration as a 4% solution. Maximum recommended doses of articaine are 7 mg/kg (up to 500 mg) in adults and 5mg / kg in children. A 1.7 ml cartridge of 4% articaine contains 68 mg. The larger 2.2 ml cartridge has 88 mg articaine. Thus 7 of 1.7 ml cartridges may be used in a healthy adult of 70 kg, compared to only 5.5 of the larger cartridges. The efficacy and systemic safety along with onset, duration of action are well documented in the literature. Owing to the fact that early metabolism is performed by plasma esterase, it is probably wise to avoid articaine in patients deficient in plasma pseudo cholinesterase (that is those patients who suffer from a delayed breakdown of suxmethonium) Articaine with epinephrine is a relatively new choice of amide local anesthetic in the United Kingdom. It is as effective as Lidocaine with epinephrine. Its rapid metabolism makes it a safe drug systemically but its high concentration may produce neurotoxicity leading to long-lasting numbness when used as a regional block.

The rapid inactivation of articaine by plasma esterases may explain the apparent lack of overdose reactions reported following its administration even though it is marketed as a 4% solution[6]. When reinjection of anesthesia is anticipated because of long appointments required for cosmetic dentistry, full mouth restoration, full mouth periodontal surgery, multiple implant placements, articaine may be considered as a desirable anesthetic. Prepared by: H. Rusching et al in 1969. Articaine is the only amide-type local anesthetic that contains a thiophene group. In addition, because articaine hydrochloride is the only widely used amide-type local anesthetic that also contains an ester group, biotransformation of articaine hydrochloride occurs in both the plasma (hydrolysis by plasma esterase) and liver (hepatic microsomal enzymes)[4,5,7,8].

90 to 95% of articaine is metabolized in the blood and only 5 to 10% is broken down in the liver. Degradation of articaine is initiated by hydrolysis of the carboxylic acid ester groups to give free carboxylic acid[9,10]. Maximum recommended dose: manufacturer's maximum recommended dose is 3.2 mg/lb or 7.0 mg/Kg of body weight for the adult patient and 500 mg is absolute maximum (approximately).

Calculation of Anesthetic Toxicity:

For an average 70 Kg adult person 490 mg is the maximum dose. 40 mg of local anesthetic component is present in 1ml of solution. 1 mg contains 1/40, therefore, 490 mg will contain 490 / 40 = 12.25 mL. Thus a maximum of 12.25 mL of Articaine can be injected[10]

The Lipid solubility: 1.5 (thiophene ring increase lipid solubility) Protein binding: 95% (Lidocaine: 65%) Articaine effectively penetrates tissue and is highly diffusible. Its plasma protein binding of approximately 95% is higher than most local anesthetic.

Composition: Each ML of solution contains:

contents	amount
Articaine Hydrochloride	40.0mg
Epinephrine	0.005mg
N/10 hydrochloric acid	0.30mg
Sodium metabisulphite	0.50mg (anti-oxidant)
Sodium chloride	1.00mg
Water for injection q.s ad	1.00mL

Originally known as "Carticaine", the generic nomenclature of this local anesthetic was changed to Articaine. Articaine is the only anesthetic of the amide type to possess a thiophene ring as its Lipophilic moiety. It has many of the physico-chemical properties of other local anesthetics, with the exception of the aromatic moiety and the degree of protein binding. It has been claimed that Articaine is able to diffuse through soft and hard tissues more reliably than other local anesthetics. Clinically, it is claimed that maxillary buccal infiltration of articaine, on occasion, prevents administration of palatal injection which, in many hands, is traumatic. Furthermore, it is claimed that articaine can provide pulpal and lingual anesthesia when administered by infiltration in the adult mandible. Reports of paresthesia (usually in the mandible) have been heard following the administration of articaine. Methemoglobinemia, a cyanotic condition is also a potential side effect of administration of large dose of articaine.

But, such reactions had been noted after the intra-venous administration for regional anesthetic purposes. Articaine Hydrochloride with Epinephrine is contraindicated in persons with known sensitivity to amide type local anesthetics and persons with sulfite – sensitivity such as some asthmatics (with allergic type asthma). Articaine should be used with caution in persons with hepatic disease and significant impairments in cardiovascular function because amide – type local anesthetics undergo biotransformation in the liver and possess myocardial depressant properties. Safe use during pregnancy and lactation has not been established. Use in children less than 4 year of age is not recommended because no data exist to support such usage. In the present Descriptive study, 100 patients were taken up for evaluation of efficacy of Articaine – a new amide local anesthetic. The procedures undertaken were extractions of teeth, alveoloplasty, surgical exposure of tooth for placement of orthodontic traction chain and arch bar removal, all in the maxillary arch. All these procedures were performed after administration of 4% Articaine Hydrochloride with 1:200,000 epinephrine via a buccal infiltration technique. No palatal injection of any kind was given.

The measurement parameter used were VAS (Visual Analogue Scale) from 0 to 10 cms for pain scale and comfort score from 0 to 5, with 0cm indicating no pain and comfort score of 5 indicating maximum comfort for the patient and 10cms indicating very severe or unbearable pain and comfort score of 0 as very discomfortable for the patient. This study was primarily undertaken to test the superior diffusion properties or that palatal anesthesia could be induced following buccal infiltration. Although this aspect of articaine had been claimed by few authors, but there had not been any concrete study done on the same. Articaine being metabolised by both plasma and liver reduces its systemic toxicity. Its half life being 25-30 minutes, leads to its breakdown faster than any standard local anesthetic (lidocaine t ½ = 90 minutes). As Articaine is less toxic, metabolizes rapidly, safe to use and has a superior diffusibility property into the palatal tissues obviating the need for any traumatic palatal injection; it should be considered as a good choice among the local anesthetics.

CONCLUSION

Articaine can be used in maxillary arch by administration via buccal infiltration obviating the need for the painful palatal block.

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