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Original Research

A Clinical Study of Efficacy of 4% Articaine Hydrochloride Versus 2% Lignocaine Hydrochloride in Dentistry

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Abstract:

Background: Articaine in an anesthetic agent, which is used less frequently in dentistry. It differs from other agents due to the presence of a thiophene ring in its molecular structure. Few groups of researchers claim that it is superior to lignocaine. Hence, the purpose of this study was to compare the efficacy of 4% articaine hydrochloride and 2% lignocaine hydrochloride in the orthodontic extraction.

Materials and Methods: The study was carried out in 50 patients who needed the orthodontic extraction in the age group from 15 to 25 years. Experimental sites were injected with 0.5-1 ml of 4% articaine HCL containing 1:100000 adrenaline, incrementally in the buccal vestibule without palatal anaesthesia. Control sites were injected with 0.8-1 ml of 2% lignocaine HCL containing 1:100000 adrenaline, incrementally in the buccal vestibule. All the parameters, that is volume, duration, time of anesthesia and pain rating were noted and statistically compared.

Result: When statistically compared mean volume of articaine (0.779 ± 0.1305) was less than lignocaine (1.337 ± 0.2369). Mean time of onset of articaine was 1.012 ± 0.2058 min, Whereas that of was 1.337 ± 0.2369. Pain rating showed not much difference, but in the lignocaine group palatal anesthesia was required in all the patients. Finally, the mean duration of anesthesia in articaine group was 69.08 ± 18.247, whereas in the lignocaine group was 55.66 ± 6.414.

Conclusion: Articaine has proved its usefulness in all regards. Literatures have proved its usefulness. Like other anesthetic, it is safe and more effective. It surpasses the need of additional palatal anesthesia. Rapid inactivation in liver and plasma reduces the risk of the drug overdose. All the above factors make it an ideal anesthetic agent to be used in dentistry.

Key Words: Articaine, lignocaine, tooth extraction

Introduction

Sole aim and the prerequisite for dentistry is an effective pain control during dental procedures. To achieve this goal local anesthesia is being used since long. In 1943, Lofgren synthesized the first modern anaesthesia.[1] It is lidocaine, which was an amide derivative of diethyl amino acetic acid. The most painful anesthetic procedure is the palatal anesthesia. It is because of the high density and the firm adherence of palatal mucosa to the underlying bone. Application of topical anesthetic agents in the only solution present till day.

Twenty-five years after lidocaine, articaine was first synthesized by Muschaneau in 1969. This was named as carticaine which, later in 1984 was changed to articaine. It has A thiophene ring in its molecule instead of usual benzene ring.[2,3] This is most commonly used in Germany. Commercially articaine for dental use is available in 4% solution with epinephrine 1:200000 or 1:100000. It also contains maximum 0.6 mg Na-Sulfite in 1.0 mL and sodium chloride. Molecular weight is 284 while elimination half time is 20 min. Maximum recommended dose is 7 mg/kg body weight. Once injected, absorption starts from the site of injection into the vascular compartment.[1] The unbound local anesthetic is distributed throughout all the body tissue. Due to the presence of thiophene ring, it is inactivated in the liver as well as by hydrolyzation in the tissue and blood.

The aim of the study was to evaluate and compare the efficacy of 4% articaine hydrochloride and 2% lignocaine hydrochloride for the orthodontic extraction.

Materials and Methods

The study was carried out on 50 patients at outpatient Department of oral and maxillofacial surgery who needed bilateral maxillary premolar extractions for orthodontic purpose. Patients included in this study were in the age group of 15-25 years, both genders and systemically healthy. Bleeding disorders, hypertensive, diabetic, pregnant, allergic to local anesthetics, reluctant and medically compromised patients were excluded from the study.

All the patients were checked for normal vital signs. Detailed medical history was taken along with clinical examination. All the patients were explained about visual analog scale (VAS) before injecting local anesthesia. Single practitioner injected anesthesia to all patients with slow injection.

Experimental sites (Group 1) were injected with 0.5-1 ml of 4% articaine HCL containing 1:100000 adrenaline, incrementally in the buccal vestibule. No palatal anesthesia was injected, but the desired anesthetic effect was achieved with the above.

On the other hand, control sites (Group 2) were injected with 0.8-1 ml of 2% lignocaine HCL containing 1:100000 adrenaline, incrementally in the buccal vestibule. When the objective symptoms were checked, it was found that palatal anesthesia was absent hence additional 0.5 ml was injected to obtain a desired result.

After assessing the signs and symptoms of obtaining complete anesthesia, maxillary first premolar were extracted using forceps techniques. In the process of extraction, patients were periodically questioned about the pain. They evaluated pain using 100 mm VAS during and after the extraction.

Table 1: Drug volume-paired samples statistics.

	N	Mean	Standard deviation	T	*P* value
Pair 1					
Group 1 (articaine)	50	0.779	0.1305	22.251	<0.0005
Group 2 (lignocaine)	50	1.337	0.2369		

Table 2: Time of onset-paired samples statistics.

	N	Mean	Standard deviation	T	*P* value
Pair 1					
Group 1 (articaine)	50	1.012	0.2058	22.396	<0.0005
Group 2 (lignocaine)	50	3.432	0.7323		

Table 3: Mean pain rating on VAS.

Buccal		Palatal	
Articaine	Lignacaine	Articaine	Lignacaine
1.3	0.7	1.8	99.1

VAS: Visual analogue scale

Table 4: Wilcoxon signed ranks test-pain ratings.

	N	Mean	Standard deviation	*P* value
Pair 1				
Group 1 (articaine buccal)	50	1.3	3.648	0.8892
Group 2 (lignocaine palatal)	50	1.8	4.115	
Pair 2				
Group 1 (lignocaine buccal)	50	0.7	1.824	<0.0005
Group 1 (lignocaine palatal)	50	98.68	0.6209	

Table 5: Duration of anaesthesia-paired samples statistics.

	N	Mean	Standard deviation	T	*P* value
Pair 1					
Group 1 (articaine)	50	69.08	18.247	5.948	<0.0005
Group 2 (lignocaine)	50	55.66	6.414		

Results

This study was conducted with 50 patients aged between 15 and 25 years. All the parameters, i.e., drug volume, time of onset, duration of anesthesia and pain rating were recorded for entire patients. Pain experience was analyzed on VAS. All the data were statistically analyzed.

The mean administered volume of articaine and lignocaine were 0.779 ± 0.1305 and 1.337 ± 0.2369 respectively. It should be noted that the articaine volume administered was almost half of the lignocaine (Table 1).

The mean onset time of lignocaine anesthesia was 1.337 ± 0.2369, whereas in articaine group the mean time was 1.012 ± 0.2058 min. This indicates that onset time of articaine was significantly less than lidocaine ($P < 0.0005$) (Table 2).

Pain rating showed that there was no significant difference in pain score in articaine palatal and buccal group ($P > 0.8892$), whereas a significant difference was noted in lignocaine palatal and buccal group (Tables 3 and 4). Duration of pain in Group 1 was 69.08 ± 18.247 and 55.66 ± 6.414 in Group 2 patients. Duration of anesthesia is articaine group is more than the lignocaine group. In the entire study, there was no injection complication (Table 5).

Discussion

Articaine is very widely used in few of the developed countries. It is because of its advantages. Unlike other anesthetic agents, it goes biotransformation in both liver and plasma and hence gets cleared much quickly. Recent studies have shown that Articaine carries lot of advantages over other anesthetic agents.[4]

In this study, we observed that the palatal infiltration was required in approximately 98% of cases when lignocaine was used, whereas in articaine group palatal anesthesia was never required. This gives immense comfort to patients as he is not exposed to second prick. This property can be attributed to a "thiophene ring" in its molecular structure, which makes it more lipophilic and this accounts for its diffusion properties across all the tissues.[5] Articaine is metabolized in the liver, tissues and blood and hence it is cleared out very fast from the body. This is the only anesthetic agent, which is inactivated from our body in two ways.

Zólkowska *et al.* has reported that like all other anesthetic agents articaine is safe in epileptic patients.[6] This study showed no adverse effects and no complications. It also showed articaine to be safer and more effective than others. This study is in accordance with study by Malamed *et al.* suggesting 4% articaine with 1:100000 adrenaline is safe and have a low risk of toxicity.[2]

Statistical analysis in this study showed no significant difference in extraction pain on VAS for test and control sites. This

shows that buccal anesthesia with articaine alone is enough to anesthetize palatal tissues. This inference relates to the study done by Fan *et al.*[7] Oertel *et al.*[8] Uckan *et al.*[9] and Evans *et al.*[10] When articaine is injected the local concentration of active drug is nearly twice of that obtained with lignocaine. This can be the possible reason for adequate palatal anesthesia. Oertel *et al.* in his study showed this by determining the concentration of 4% articaine and 2% lidocaine in alveolar blood using high-performance liquid chromatography.[11,12]

Thiophene derivative articaine blocks ionic channels at lower concentration than benzene derivative lidocaine.[13] Potocnik *et al. in vitro* study on rat surap nerve concluded that 2% and 4% of articaine is more effective than 2% and 4 % of lidocaine in depressing compound action potential of the a fibres.[14-16] This efficacy and safety factors are observed in this study too.

It is a well-known fact that palatal anesthesia is a very painful experience even though surface anesthesia is used. Hence, if articaine is used, patients can be relieved from the painful palatal anesthesia without compromising with safety and efficacy.

Conclusion

Articaine is one of the less used anesthetic agents in dentistry. Literatures have proved its usefulness about its efficacy and safety. It also relieves the patients from an additional injection. Reports of reactions are very rare and can happen in other agents too. Rapid inactivation in liver and plasma reduces the risk of the drug overdose. Certain added advantages like shorter time of onset, longer duration of action and greater diffusion property makes it an ideal anesthetic agent to be used in dentistry.

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