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EFFECTIVENESS OF 4% ARTICAINE VERSES 0.5% BUPIVACAINE FOR LOWER MOLAR REMOVAL: A COMPARATIVE STUDY

Running title: Effectiveness of 4% articaine verses 0.5% bupivacaine

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Abstract

Introduction: Safe and efficient pain control is essential for today's dental practice. An effective surgical procedure requires painless treatment and local anesthesia (LA) is broadly used for control of pain in dentistry.

Objectives: This observational study was done to compare effectiveness of 0.5% bupivacaine with 4% articaine in lower molar extraction based on criteria; pain during injection, onset and duration of anesthesia, pain during procedure and after the procedure.

Materials and Methods*:*100 participants were classified into two groups with 50 samples each. Group A participants were managed with 0.5% bupivacaine1:200,000 epinephrine and group B participants with 4% articaine along with 1:100,000 epinephrine for extraction of mandibular first and second molar.

Results**:* There was faster onset (53.2 and 83.1 sec) and comparable duration of action (172.6 and 227.4 min) with articaine (group B) compared to bupivacaine (Group-A). Pain after procedure (0.87 and 1.35 min) and anesthesia administration (1.03 and 1.46 min) was less with articaine compared to lignocaine respectively. 38 (76.0%) participants in group A and 44 (88.0%) participants in group B did not need re- anesthesia whereas 10 (20%) in group A and 6 (12%) in group Bneededone-time re- anesthesia and 2 (4%) participants needed two times re- anesthesia in group A. ***Conclusion: There was faster commencement of action, extended duration of anesthesia and lesser requirement of re- anesthesia using articaine. Hence it can be concluded that articaine anesthesia can be efficiently recommended in oral surgical techniques.

Keywords: Action, **a**nesthesia, articaine, bupivacaine, onset

Introduction

Safe and efficient pain control is essential for today's dental practice. Pain is subjective symptoms and the strength may differ from subject to subject. An effective surgical procedure requires painless treatment and local anesthesia (LA) is broadly used for control of pain in dentistry. Consciousness of patient retains unchanged with LA administration whereas nerve transmission is blocked provisionally, specific and in reversible way. [1]

Lidocaine (lidocaine) is extensively used and considered as the gold standard. It has short duration of action and safer in relation to other anesthetics. Articaine and bupivacaine are both amide-type local anesthetic (LA) agents. Articaine is fast acting and bupivacaine is a long-lasting LA. Articaine and bupivacaine are effective and comparable to lidocaine. [2]

An idyllic LA deliversfull sensory obstruction and should provide a satisfactory period of action to comprise in the technique. Collins et al observed that bupivacaine is superior to lidocaine for quicker onset of action and extended period of action. Lidocaine has shorter duration of action and slows in onset of action. This makes search for alternative local anesthetic agent.[3]Severalresearchers have worked to check for an efficient local anesthetic agent with quicker onset, lower complications and reduced pain by altering the chemical and physical properties of LA.[4]Various alternative local anesthetic agents were tried to overcome the drawbacks of lignocaine such as articaine, bupivacaine.[1-5]Zhang et al observed faster action with articaine compared to lidocaine during third molar extraction procedure.[5]

Articaine is an amide type local anaesthetic, and, it has benzene ring. It is atransitional effective local anesthetics and it ispresented as a 4% solution with 1:100,000 epinephrine concentration. The presence of thiopene ring in its structure represent It as a potent agent amongst local anesthetic. It owns greater solubility in lipid and well allowed by tissues. It can be used for peripheral nerve block or local infiltration.[6] It has been perceived form previous researches that amongst numerous local anesthetic agents, articaine is observed to be relatively fast acting, harmless and appropriate for oral surgical practice.[1,4,6-8]

The preference of local anesthetic solution in tooth extraction is depends on 3importantscientific concerns: latency, anesthetic potency, and duration of the anesthetic

effect. Present comparative study was done to assess efficacy of 0.5% bupivacaine with 4% articaine in oral lower molar extraction based on objectives such as; pain during injection, duration of anesthesia, onset, and pain perception while oral surgical procedure.

Methodology

This *in vivo* observational research was conducted in the department of Oral and Maxillofacial Surgery from June 20017 to October 20019. The study comprises 100 patients of both sexes visited to the oral surgery department for lower molar tooth extraction. Conditions for inclusion was; systemically healthy participants of age ranged from 20to50 years. Exclusion conditions include; patients age below 20 years, pregnant or lactating women, allergic history to local anesthetics solutions, and disobliging patients. Ethical consent for the research was attained from Institutional Review Board (IRB). Informed agreement was attained from all the participating subjects. The study procedures were adhered to the ethical guidelines of Declaration of Helsinki.

Patient's demographic outline was recorded. The sample size collection was done seeing the success level of local anesthetic solutions ranges between 90% - 95%. Therefore, supposing (p)=90 as the frequency of achievement rate with 9% margin of error, formula used was n = $\frac{Z^2_{\alpha/2} pq}{d^2}$, where p is success rate, q = 1 – p, d is the margin of error, $Z_{\alpha/2}$ is the ordinate of standard normal distribution at α% level of significance.

Patients were categorized into group A & B with 50 samples in each group. Selected participants were randomly distributed to both the groups. Group Aparticipants were administered with 0.5 % bupivacaine(Livealth Biopharma Private Limited, India) with 1:200,000 epinephrine and 4% articaineHCl with 1: 100,000 epinephrine injection (Septocaine® , Septodent INC, Canada) was administered for Group B.

Prior to the study, investigator assigned the arrangement of subject's identification numbers to whichever the test (articaine) or control (bupivacaine) group. Patient necessitating surgical extraction of mandibular 1st and 2ndmolar teeth were delivered with 1.5 ml of anesthetic solution in both groups to anesthetize inferior alveolar nerve, buccal, and lingual nerve. All the extractions and anesthesia were consummate following aseptic standard surgical procedure by single trained investigator. Evaluation for anesthetic effect pertaining to pain during injection, onset and duration of anesthesia, pain throughouttechnique and after the technique was performed and recorded by same trained investigator.[8,9]Following extraction, patients wereput on analgesic and antibiotic coverage for 5 days.

Length of surgical method and period of post-operative anesthesia and pain were measured as mentioned:[8,9]

- Beginning of anesthesia was evaluated by detecting the injection time to patient's first indication of numbness. The inception of anesthetic agent was tested by both subjective (by absence of sensitivity tolower lip, half of the tongue and the buccal mucosa) and objective symptoms (by probing or pressure for onset of anesthesia around the gingival tissues).

- Pain evaluationsduring injection and effectiveness of anesthesia can bepredictableonce the extraction is done by means of the visual analog scale (VAS) where 0 indicatesabsence of pain and 10 indicatessevere pain

- Period of surgery after anesthetic administration was measured by,noting the onset timing of anesthesia and indicationof absence of numbness on soft tissues (mucosa, tongue, and lower lip) afterwards

The obtained data was tabulated and statistically assessed with SPSS version 20.0 (SPSS Inc., Chicago, IL, USA) using Chi square test and Independent *t*-test with $P< 0.05$.

Results

Table 1indicates demographic information of group A and B participants. In the age range of 20-50 years.' group I had 30 males and 20 females while Group-B had 27 males and 23 female participants.

Table 2indicates, assessment of clinical factors in both the groups. There was mean onset of local anesthetic action in group A was 83.1±13.3 sec and in group B was 53.2±5.8 sec, length of anesthesia in group A was 227.4±25.7 minand in group B was 172.6±27.6 minutes, duration of procedure was33.7±3.67 min in group A and31.1±10.4 min in group B, Pain throughoutprocess was 2.56±1.02 and in group B was 1.38±1.23, pain after procedure was 1.35±0.77 min in group A and 0.87±0.72 in group B, pain throughout anesthesia administration was 1.46±1.11 in group A and 1.03±0.51 min in group B. There wassubstantialvariance in both groups ($P< 0.05$) exceptinglength of method and pain throughout anesthesia administration ($P> 0.05$). It was found that, there was faster onsetand moderate duration of action with articaine (group II) compared to bupivacaine(Group-I). Pain after procedure and anesthesia insertionwas less with articaine compared to lignocaine.

Graph I indicates that 38 (76.0%) participants in group A and 44 (88.0%) participants in group B did not need re- anesthesia whereas 10 (20%) in group I and 6 (12%) in group Bneeded one-time re- anesthesia and 2 (4%) subjectsneeded 2 times re- anesthesia in group A. Chi square test showed non- significant alterationamong both groups ($P> 0.05$). In our study it was observed that; necessity of re-anesthesia was less with articaine compared to lignocaine.

Discussion

Bupivacaine is frequently selected due to its longer duration of analgesia and postoperative pain control. Thakare et al observed that bupivacaine group demonstrated constant pressure sensation and uneasiness, compared toarticaine group. [2]

The effectivenessof anesthetic agent can berefereed by its ability to relieve pain, time taken for onset of action and its extended duration of anesthetic result. Lignocaine, usuallyrecognized as "Lidocaine", which is anamide type of local anesthetic agent with shorterduration of action.[7] World Health Organization (WHO) has comprisedLignocaine in its necessary drug list. It displays its properties by blocking nerve fiber impulse.[10]Articaine also conveys its action

comparable to lidocaine by binding to voltage gated sodium channels and inhibiting influx of sodium ions.[11]

Bhattarai et al from a systematic review stated that bupivacaine demonstrated better anesthetic and analgesic efficacy but poor onset of action except compared to other local anesthetic agents evaluated for oral surgical procedures, similar to our findings.[12]Badr and Aps concluded from their review that, not a single dental local anesthetic agent (lidocaine, 0.5% bupivacaine,3% mepivacaine, 4% articaine, and 0.75% levobupivacaine) provided 100% anesthesia and efficient technique is required during tooth extraction.[13]Brajkovic et al compared the efficacy of Levobupivacaine over bupivacaine for third molar extraction and found that,0.5%Levobupivacaine was superior to 0.5 % bupivacaine in terms of intensity of longevity of postoperative analgesia and intraoperative anaesthesia. [14]Sancho-Puchades et al evaluated the efficacy of articaine over bupivacaine for third molar removal and concluded that, Bupivacaine provided significantly longer lasting soft tissue anesthesia, and it is effective over articaine because of its quick postoperative pain prevention capacity. [15]Similarly, we found longer duration of anesthetic action with bupivacaine but onset of action was faster with articaine.Adelusi et alcompared the efficacy of lidocaine over bupivacaine and found higher patient satisfaction for bupivacaine. [16]

Present research assessed the effectiveness of 0.5% bupivacainewith 4% articaine in extraction of molar teethwith objective criteria;pain during injection, duration and onset of action of anesthesia, pain during procedure and after the procedure.It was observed from our study that, there was faster onset and moderate duration of action with articaine (group II) compared to bupivacaine (Group-I). Duration of anesthesia was better with bupivacaine compared to articaine. Pain after procedure and anesthesia insertion was less with articaine compared to bupivacaine. Necessity of re-anesthesia was less with articaine associated to bupivacaine.

Finding formour results and previous study indicated that articaine is effective than 0.5% bupivacaine, henceforth it can be suggested for tooth extraction and other oral surgical techniques.

Limitation of the present is that; smaller sample size, only two groups were compared, anesthetic efficacy was not evaluated for other oral surgical procedures

Future research should be directed to evaluate the efficacy of articaine with other anesthetic agents for other oral surgical procedures and pulp therapy on larger sample size.

Conclusion

Both bupivacaine and article are effective in reduction of pain. However, articaine had faster onset and moderate duration of action, lesser pain after procedure and during anesthesia administration compared to bupicavaine. Necessity of re-anesthesia was less needed with articaine compared to bupivacaine.Articaine is effective in anesthetizing molars during extraction.

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Legends for illustrations

Tables

Table 1: Distribution of patients

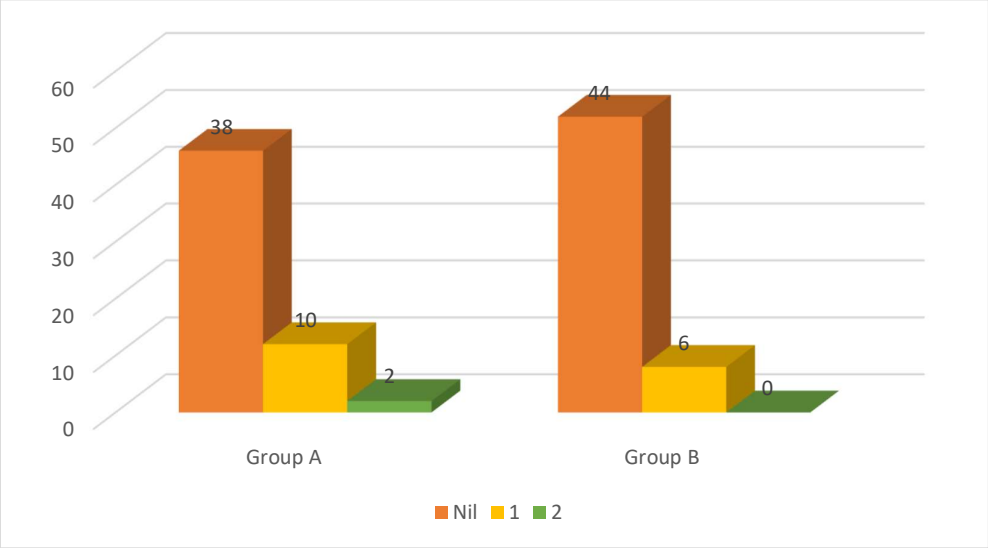
Groups	GroupA (n=50)	Group B (n=50)
Agent	bupivacainewith 1:200,000 epinephrine	4% articaine with 1:100,000 epinephrine
Male	30	27
Female	20	23

Table 2:Assessment of clinical parameters in both groups

Groups	Group A bupivacaine		Group B Articaine		t	P value
	Mean	SD	Mean	SD		
Onset of action (in seconds)	83.1	13.3	53.2	5.8	11.1	0.02
Duration of anesthesia (in minutes)	227.4	25.7	172.6	27.6	4.56	0.01
Duration of procedure (in minutes)	33.7	3.67	31.1	10.4	0.864	0.71
Pain during procedure	2.56	1.02	1.38	1.23	5.11	0.01
Pain after procedure	1.35	0.77	0.87	0.72	3.14	0.03
Pain during anesthesia insertion (VAS)	1.46	1.11	1.03	0.51	0.738	0.61

Independent t-test, Significant, P< 0.05

Graph 1:Indicates need for re- anesthesia in both groups



Chi square test, Significant, P< 0.05