A COMPARATIVE EVALUATION OF THE ANESTHETIC EFFICACY OF BUCCAL INFILTRATION AND INTRALIGAMENTARY INJECTION USING 4% ARTICAIN IN ADULT PATIENTS WITH IRREVERSIBLE PULPITIS OF MAXILLARY FIRST MOLAR TEETH: AN IN-VIVO STUDY

Ghufran Alayfan 1, Abdulrahman Alshebel 2, Fazlur Rahman Sayed 3, Syed Ali Peeran 4, Muhamad Alqasir 5, Mohammad Alrabeelah 5, Bader Almehrej 5, Mohammed Alshahrani 5, Farheena Ustad 6, Shaeesta Khaleelahmed Bhavikatti 7

1 BDS, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia - Department of Maxillofacial Surgery and Diagnostic Sciences, Majmaah University, AlMajmaah, Saudi Arabia.
2 DMD, King Saud bin Abdulaziz University for Health and Sciences - Restorative Department, King Abdulaziz Medical City, Riyadh, Saudi Arabia.
3 Senior Laser Specialist Dentist in Badr Al samaa Group of hospitals, Oman - Al Khuwair branch.
4 Assistant Professor, Department of Prosthodontics, College of Dentistry, Jazan university. Gizan, Saudi Arabia.
5 BDS, Majmaah University, AlMajmaah, Saudi Arabia.
6 Department of Oral and maxillofacial surgery and diagnostic sciences. Dental College- Majmaah University, Saudi Arabia.
7 Department of Periodontics, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia

ABSTRACT

Aim: This study aims to compare and evaluate the anesthetic efficacy of buccal infiltration and intraligamentary injection using 4% articaine in adult patients with irreversible pulpitis of maxillary first molar teeth.

Methodology: The present in-vivo study includes 60 adult patients with symptomatic irreversible pulpitis in maxillary first molars. The patients were divided into two groups. The Group I patients receive Local Anesthesia by buccal infiltration, while the Intraligamentary injection method was used in Group II patients. The pain was measured using Heft-Parker Visual Analog Scale.

Result: The intraoperative success rate in Buccal infiltration was 70%, while intraligamentary injection achieved success only in 60% of the cases, but the difference is not statistically significant. There is a statistically significant difference in intraoperative pain experienced during the treatment for Buccal infiltration. It is 41.56, while for the intraligamentary injection is 51.67.

Conclusion: The anesthetic efficacy of 4% articaine in reducing pain delivered through buccal infiltration was significantly greater in comparison to intraligamentary injection

Key Words: Articaine, Pain, Intraligamentary injection, Buccal infiltration

I. INTRODUCTION

Though pain garners utmost attention from all health care providers, most of the patients relate to pain and dentistry to be synonymous. The principal reason why most of the patients visit dental clinics is pain. The pain can be either pulpal or periodontal. As the etiology of the pain is multifactorial, diagnosing and managing them is a crucial concern for patients and endodontists during the endodontic procedure. Management of pain is
achieved through local anesthesia. Preanesthetic agents, anesthetic agents, and techniques are essential in achieving good anesthesia (1).

It is easier to achieve good anesthesia in healthy pulp than in inflamed pulp, as each individual's perception of pain changes (2). The inflamed pulp can be either acute symptomatic (reversible, irreversible) pulpitis or chronic pulpitis. Among them, treating acute irreversible pulpitis is much more difficult. In endodontic treatment, local anesthesia is an essential part of pain control. Two ways can achieve local anesthesia either through primary techniques of anesthesia such as posterior superior alveolar nerve block (PSA) (3) or secondary anesthetic techniques like buccal infiltration(BI), buccal and palatal infiltration, Intra ligamentary, (PDL, ILI) intraosseous (IO) intrapulpal, intraseptal, WAND, C-CLAD system techniques have been administered in patients(4)

The conventional maxillary first molar anesthesia method is the superior posterior alveolar (PSA) nerve block, but it is usually associated with potential complications like hematoma, parasthesia, and accidental damage to the nerve trunk and blood vessels. As a result, several experiments have been conducted to find alternative anesthetic approaches like buccal and lingual infiltration, intraligamentary anesthesia, and intraosseous anesthesia. These alternative techniques show fewer side effects than PSA and can be used efficiently as the primary form of anesthesia in maxillary molars. Among the alternative anesthetic techniques, buccal infiltration(BI) anesthesia is the most widely employed technique for maxillary molars (3)

As indicated by few authors, there was no critical distinction between the buccal infiltration and buccal plus palatal infiltration, and also, buccal infiltration is less painful than palatal. The intraligamentary injection technique, otherwise known as (peridental or Periodontal ligament injection), was introduced by Cassamani et al. in 1924. (1) It delivers local anesthesia solution via the gingival sulcus to the periodontal tissue to relieve nerve block. This technique was reported to have a high success rate when used either as a primary or secondary anesthetic technique, which was highlighted by various authors (3,5–9). The intraligamentary injections additionally demonstrate points of interest like the quick onset of action, i.e., approximately 10 sec and less anesthetic is required. However, to date, no study was directed to contrast buccal infiltration and intraligamentary injection in a maxillary first molar. The study aims to compare and evaluate the anesthetic efficacy of buccal infiltration and intraligamentary injection using 4% articaine in adult patients with irreversible pulpitis of maxillary first molar teeth.

II. METHODOLOGY

The present In Vivo Study is a prospective Randomized Comparative study conducted in the Oral Surgery department of Dental College after obtaining Ethical clearance from the College review committee. The study includes 60 adult patients with symptomatic irreversible pulpitis in maxillary first molars based on inclusion criteria; subjects in-between age groups 20–40 years, moderate to severe pain in the maxillary first molar tooth, A positive response to cold testing with endo ice spray, and an electric pulp tester—the ability of the subject to understand the use of pain scales. Patients with systemic disorders like diabetes, hypertension, asthma, etc., having active pain in more than one maxillary molar, non-vital teeth, patients on analgesic medication, and having swelling associated with the tooth are excluded from the study.

The written informed consent was obtained from each patient before including in the study. Preoperative radiographs were obtained. The patients were explained the pain scale and the procedure and asked to rate their pre-treatment pain on Heft-Parker visual analog scale (VAS) (10). The patients were instructed to point to the position on the scale to indicate how much pain they were currently feeling. The far-left end marked '0mm' indicates 'No pain,' and the far-right end marked '170mm' indicates 'Maximum possible pain.'

The VAS scale is divided into four categories:
a) No pain corresponds to 0 mm.
b) Mild pain was defined as > 0 mm and ≤ 54 mm.
c) Moderate pain was defined as > 54 mm and < 114 mm.
d) Severe pain was defined as ≥ 114 mm.
Further, the patients were randomly divided into two groups, with 30 patients selected by simple randomization procedure (Coin toss method) in each Group: GROUP 1: Buccal infiltration using 4% articaine with 1:100,000 epinephrine & GROUP 2: Intraligamentary injection using 4% articaine with 1:100,000 epinephrine.

2.1 Group 1 patients:
A topical anesthetic gel was placed with a cotton tip applicator buccally to the involved tooth for 60 sec. On a random basis (using the coin toss method), 30 patients were given buccal infiltration (Group 1) with 4% Articaine with 1:100,000 epinephrine. An approximate tooth length was measured on the preoperative radiographs, and a rubber stop will be placed accordingly on the needle. The needle was gently placed into the mucobuccal fold depth with the bevel towards the alveolar bone. The needle advanced until it reached the root apices because the stopper would level with the buccal cusps. After reaching the target area, aspiration was performed, and 1.7 ml of solution was deposited at the rate of 1ml/min.

After 7 minutes of injection, the patients were again be asked to rate their pain on Heft-Parker VAS. The involved teeth were isolated with a rubber dam, and conventional access opening was initiated using endo access bur no. 2. Patients were instructed to raise their left hand if any pain was felt during the procedure. In case of pain during the treatment, the procedure stopped, and patients were asked to rate the pain on Heft-Parker VAS. The extent of access preparation and instrumentation was recorded as within dentin/ within pulpal space/ during insertion of the first instrument in the canal till the working length using apex locator.

The success was defined as "no pain" (0mm) or "weak/mild pain" (>0mm &≤ 54mm) during endodontic access preparation and file insertion. The failure was defined as "moderate pain (> 54 mm and < 114 mm)" or "severe pain (≥ 114 mm)" during access preparation/ the first FI till working length. The findings were recorded onto a Microsoft Excel Sheet for statistical evaluation.

2.2 Group 2 patients:
A topical anesthetic gel was placed with a cotton tip applicator onto the injection site for 60 sec. On a random basis (using the coin toss method), 30 patients will be given Intraligamentary injections (Group 2) with 4% articaine with 1:100,000 epinephrine. The needle was inserted in the gingival sulcus at 30° to the long axis of the tooth at the mesiobuccal line angle, distobuccal line angle, and at the center of the palatal aspect of the maxillary first molar. The needle was forced to maximum penetration until it was wedged between the tooth and the crestal bone. The needle bevel was facing the alveolar wall (Figure 1). After positioning the needle, 0.2 ml solution of 4% articaine with 1:100,000 epinephrine was deposited into the periodontium of each root by maintaining the needle position for about 5-10 sec.

Anesthesia was achieved within 30 secs or can be immediate. After 30 secs the patient was asked to rate their pain on Heft-Parker VAS. Now the remaining procedure was the same as described for Group 1 patients.

Figure 1: Administration of Local Anesthetic Solution VIA Intraligamentary Technique
III. RESULT

The present study evaluates the anesthetic effectiveness of buccal infiltration and intraligamentary injection using 4% articaine in adult patients with irreversible pulpitis. The maxillary first molar with irreversible pulpitis was taken as a standard parameter for inclusion criteria. Sixty patients with irreversible pulpitis were included in the study. They were separated into two groups based on the technique used for delivering Anesthesia, i.e., buccal infiltration Anesthesia and intra Ligamentary injection.

The study subjects are Group matched regarding age and gender. The groups show no significant difference in mean pain threshold among the groups, i.e., 97.70 for the buccal infiltration group while 94.10 in the intraligamentary injection group with a statistically nonsignificant difference. (Table 1, Fig 1)

Table 1: Description of the Study subjects

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Age</th>
<th>Gender</th>
<th>Preoperative Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D</td>
<td>Male</td>
</tr>
<tr>
<td>Buccal infiltration</td>
<td>30</td>
<td>41.56</td>
<td>8.05</td>
<td>17</td>
</tr>
<tr>
<td>Intraligamentary injection</td>
<td>30</td>
<td>42.00</td>
<td>7.22</td>
<td>16</td>
</tr>
<tr>
<td>Test value</td>
<td></td>
<td>t=0.21</td>
<td></td>
<td>X²=0.67</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td>0.82#</td>
<td></td>
<td>0.79*</td>
</tr>
</tbody>
</table>

#Unpaired t-test, *Chi-Square test

The pain that occurred during the treatment is categorized, and based on these categories, success or failure of treatment was determined. None of the patients feels pain in dentin during access opening. The majority of the
cases that fail occur when we reach the pulp. Patients with moderate and severe pain did not proceed further for instrumentation in the root canal.

Buccal infiltration achieved anesthesia in 70% of teeth while intraligamentary injection achieved success only in 60% of the cases but the difference is not statistically significant with p> 0.05 (Table 2, Fig 2), but there is a statistically significant difference in intraoperative pain experienced during the treatment for Buccal infiltration it is 41.56 while for the intraligamentary injection is 51.67(Table 3, Fig 3)

Table 2: Success and Failure of the treatment modalities based on the pain scale

<table>
<thead>
<tr>
<th>Group</th>
<th>Success</th>
<th>Failure</th>
<th>Chi-square</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buccal infiltration</td>
<td>21</td>
<td>9</td>
<td>.65</td>
<td>.59</td>
</tr>
<tr>
<td>Intraligamentary injection</td>
<td>18</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Mean Intraoperative operative pain during the root canal treatment using Buccal infiltration and Intraligamentary injection

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>S.D.</th>
<th>Chi-square</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buccal infiltration</td>
<td>41.56</td>
<td>3.88</td>
<td>2.33</td>
<td>.03*</td>
</tr>
<tr>
<td>Intraligamentary injection</td>
<td>51.97</td>
<td>7.41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3: Success and Failure rates of the Buccal infiltration and Intraligamentary injection
Figure 4: Mean Intraoperative operative pain during the root canal treatment using Buccal infiltration and Intraligamentary injection

IV. DISCUSSION:

Pain is a process that starts with some injury or disease which produces nociceptive impulses that are sent to the cerebral cortex to be interpreted. This perception of pain is influenced by several factors, such as experience, attention, anxiety, and depression. (11) Though the main objective of administering an LA is to eliminate pain, the process of delivering these drugs using syringes is the most frightening and uncomfortable experience for most patients. (12)

Self-reported measurements, such as the VAS, can quantify this pain such as the VAS. The VAS pain score was chosen for this analysis because it is simple to use, requires little effort from the patient, and has better sensitivity and validity than the Verbal Rating Scale (VRS). (13) The selection of patients to be included in this study was made after a thorough examination and randomization for each patient. The sample size was fixed at 30 for each Group. The armamentarium used for the study included standard 27G dental syringes, 4% Articaine.

The present study compared the VAS scores between intraligamentary injection and Buccal Infiltration during the treatment procedure. The t-test values show that the VAS scores during treatment were significantly high in intraligamentary injections with a mean score of 51.97 compared with 41.56 for buccal infiltration, and the success rate of buccal infiltration was more remarkable in comparison to the intraligamentary injection, but the difference was statistically significant.

This reduction in pain is mainly attributed to the abundance of free nerve endings in the porous maxillary bone. The study has shown a score greater than 30 during needle penetration in supraperiosteal injections, which was also reported in other studies. (14)

The onset of anesthesia after this technique is reached either instantly or within 30 seconds after administering the anesthetic solution; the periodontal ligament injection was given just 1 minute before testing the teeth with the stern test in this analysis. (15)
The success of the buccal infiltration technique mainly depends on the diffusion of the local anesthetic agent through the porous cortical plates. (3) Whereas various authors like Mohammed D Kanna2012, Narasimhan S 2008, Vivek Aggarwal 2011 (3,16,17) highlighted the reduced success rate of the local anesthetic techniques and maxillary molars with acute symptomatic irreversible pulpitis. Vivek Aggarwal et al. (3) reported that none of the tested methods gave 100% anesthetic success rates in maxillary molars with acute symptomatic irreversible pulpitis.

Dental intraligamentary anesthesia delivers the local anesthetic agent via the gingival sulcus to the peridental region to produce a reversible neural block. Intraligamentary injection can be used as primary and secondary techniques to achieve adequate pulpal anesthesia in healthy and inflamed teeth. (6–8)

Michael Childers et al. (9) reported a success rate of 78%, Song Fan et al. 68achieveda success rate of 83.33%, Vivek Aggarwal et al.(3) reported a success rate of 83%, M Parirokh et al.(8) achieved 58% of success rate.

V. CONCLUSION:

In irreversible pulpitis of maxillary first molar teeth, patients receiving anesthesia using Buccal infiltration show a significantly higher intra operative success rate than the patients receiving Intraligamentary injection. The anesthetic effectiveness of 4% of articaine in reducing pain delivered through buccal infiltration was significantly greater than intraligamentary injection.

REFERENCES:

1. Johnson DA. Evaluate and Compare the Anaesthetic Efficacy of Intraligamentary, Intrarossous Techniques as the Primary Anaesthetic Technique in Maxillary First and Second Molars with Long Distobuccal and Palatal Roots in Patients with Acute Symptomatic Irreversible Pulpitis: An Invivo study [PhD Thesis]. Ragas Dental College and Hospital, Chennai; 2019.