

Comparison of Anesthetic Efficacy of Two Different Volumes of 4% Articaine for Inferior Alveolar Nerve Block During Endodontic Therapy of Mandibular Molars with Symptomatic Irreversible Pulpitis

HUMA SARWAR¹, SHAHBAZ AHMED², MESHAL MUHAMMAD NAEEM³, AMIR AKBAR SHAIKH⁴, SYED ALI RAZA⁵, IQRA KAMAL⁶

¹BDS MDS Operative Dentistry, Lecturer Dept of Operative Dentistry, Dr. IshratulEbad Khan Institute of Oral Health Sciences (DIKIOHS-DUHS)

²Associate Professor, Dept of Operative Dentistry, Dr. IshratulEbad Khan Institute of Oral Health Sciences (DIKIOHS-DUHS)

³BDS MDS Resident, Lecturer Dept of Periodontology, Dr. IshratulEbad Khan Institute of Oral Health Sciences (DIKIOHS-DUHS)

⁴BDS PG, Diploma Dental Public Health, Associate Professor & HOD, Dept of Community Dentistry, Sir Syed College of Medical Sciences

⁵Senior Registrar dept of Community Dentistry, Sir Syed College of Medical Sciences for Girls

⁶Lecturer & MDS Post Graduate Trainee, Dept of Operative Dentistry, Dr. IshratulEbad Khan Institute of Oral Health Sciences (DIKIOHS-DUHS)

Corresponding Author: Dr. Huma Sarwar, Email Address: huma.sarwar@duhs.edu.pk, Cell No. 03002552781

ABSTRACT

Objective: To compare the efficacy of 3.6ml versus 1.8ml of 4% articaine with 1:100,000 epinephrine for inferior alveolar nerve blocks in mandibular molars with symptomatic irreversible pulpitis.

Study Design: Randomized control trial

Place and Duration of Study: Conducted at the Department of Operative Dentistry, Dr. IshratulEbad Khan Institute of Oral Health Sciences (DIKIOHS-DUHS) Karachi 1st January to 30th October, 2020.

Materials and Methods: Patients with irreversible pulpitis and normal periodontium associated with mandibular molars were included in this study. A standard IANB with a side-load cartridge was administered according to the assigned group. Group A received 3.6ml where as patients in Group B received 1.8ml of 4% articaine with 1:100,000 epinephrine for IANB. Patients were asked to rate their pain using an analogue visual scale (VAS) before and during the endodontic therapy. Anesthesia was considered as a success when patient felt no or mild discomfort during the endodontic procedure. Anesthetic failure was considered when patient complaint of moderate or severe pain.

Results: The success rate of 3.6ml and 1.8ml of 4% articaine 1:100,000 epinephrine for IANB was found to be 92% and 72% respectively. This association was found to be statistically significant (p-value 0.000).

Conclusion: 3.6 ml of 4% articaine with 1:100,000 epinephrine was found to be more effective as compared to 1.8ml of same solution. Better pain control and comfort was observed when greater volume of articaine was administered for IANB.

Keywords: Root canal treatment, Inferior alveolar nerve block, anesthesia, irreversible pulpitis

INTRODUCTION

Endodontic therapy is performed for the treatment or prevention of periapical periodontitis. Root canal therapy is a process in which the inflamed or necrotic pulp containing bacteria is removed from the root canal space and filled with an inert material [1]. A major concern of endodontists during root canal therapy is the achievement of profound anesthesia during the procedure [2]. Various studies have been performed to determine the efficacy of methods of pain control during endodontic therapy using different procedures, equipment and anesthetic solutions [3]. In endodontic therapy, inferior alveolar nerve block (IANB) is given to anesthetize mandibular molars prior to endodontic therapy [4].

Greater challenge in achieving profound anesthesia for root canal therapy in teeth with irreversible pulpitis has been reported. [5]. Furthermore, anesthetizing mandibular molars with irreversible pulpitis is more challenging compared to other posterior teeth with same pulpal status. [6]. The volume of anesthetic solution administered has shown to affect the efficacy of the local anesthetic solution [4-6].

Articaine is a fast acting and provides longer pulpal anesthesia when compared to lidocaine [10]. Articaine spreads more efficiently across soft tissues and bone than

other local anesthetics [7,8]. Articaine is approved by the U.S. Food and Drug Administration for dental use in 2000 [7]. Previous studies showed no major effects on the effectiveness of anaesthesia on the duration. However, lidocaine was the only used local anesthetic agent in those studies [9,10]. Recent studies have shown better pain control and anesthetic effect of articaine during endodontic procedure [11].

Therefore, the objective of this study was to evaluate the effect of different volumes of articaine on pain control during endodontic therapy in mandibular molars with symptomatic irreversible pulpitis. If increasing the volume promote 3.6ml solution of articaine in symptomatic mandibular molars with acute irreversible pulpitis.

MATERIALS AND METHODS

This randomized controlled trial was carried out in the Department of Operative Dentistry, Dr. IshratulEbad Khan Institute of Oral Health Sciences (DIKIOHS-DUHS) Karachi from 1st January to 30th October, 2020. The study included 500 healthy patients with symptomatic irreversible pulpitis and normal periodontium associated with mandibular molars requiring endodontic therapy. Both males and females aging between 18 and 65 years were included in this study. Patients with systemic diseases, those who

refused to consent and female pregnant patients were not included in this study. After thorough history, clinical and radiographic examination, pulpal and periapical diagnosis was established. The cotton tip applicator with a topical anaesthetic gel (20% Benzocaine; Premier, Philadelphia: PA) was passively placed on the injection site for 1 minute. The patients were divided randomly by lottery method into 2 groups. Patients in Group A received 3.6ml of 4% articaine with 1:100,000 epinephrine for IANB prior to endodontic therapy whereas 1.8 ml of the same anesthetic solution was administered to patients in Group B. A conventional IANB was administered with an aspirating syringe with a cartridge-loading system (CK ject; CK dial, Kor-Kyungji-do, Korea) and a 27-G 31 mm needle (C-K ject) according to the assigned group.

Endodontic access was begun 15 minutes after solution deposition and all patients were required to have profound lip numbness prior to initiation of endodontic therapy. Fifteen minutes after the administration of the IANB, the teeth were re-evaluated with a cold examination. If the patients showed sensitivity to the cold test before commencing caries removal and access cavity preparation or if moderate/severe pain was registered on the VAS at any stage of treatment, then supplementary anaesthesia was used to provide patient comfort during the procedure. Such patients were also excluded from the study. After caries excavation, rubber dam was applied, access cavity to pulp chamber was prepared and single visit endodontic therapy was performed using Protaper Gold rotary instruments (DENTSPLY).

Each patient was explained about VAS before starting the procedure and asked to raise their hand if he/she experiences moderate or severe pain at any stage of the treatment (i.e., access cavity preparation, pulp chamber opening, or root canal instrumentation). The patients were asked to rate their discomfort/pain using the visual analogue scale (VAS) before and during the endodontic treatment.

SPSS version 20 was used for data analysis. P value less than 0.05 was considered as significant.

Using VAS, the pain was rated by the patient as none, mild, moderate or severe. Success was defined as none or mild pain whereas failure was defined as moderate or severe pain (VAS recordings) on endodontic access or initial instrumentation.

RESULTS

Mean age (years) in the study was 41.09±11.69. 130 males (52%) and 120 (48%) were females in group A while in group B 134 (53.6%) were males and 116 (46.4%) were females participated in this study. Table 2 shows the comparison of effectiveness of both the groups. The frequency of effective concentration of 4% articaine for 3.6 ml and 1.8 ml was 230 (92%) and 180 (72%) respectively. This association was found to be statistically significant (p-value<.001). Table 3 compares anesthetic effectiveness of both volumes of solutions to the age groups. Individuals in age group from 18-40 years in group A showed the highest efficacy of anesthesia (92.9%). Both males and females showed higher anesthetic success rate in Group A. (92.3% and 91.7% respectively). The association of anesthetic effectiveness and gender was found to be statistically

significant for both male and females (p<0.001) [Table-4]. Both right and left mandibular molars showed greater anesthetic success rate in group A than Group B (100%,85.7%,73.7% and 70.6% respectively).

Table 1: Baseline details of all the patients

Variables	Group A	Group B	P value
Male	130 (52%)	134 (53.6%)	<0.001
Females	120 (48%)	116 (46.4%)	

Table 2: Comparison of effectiveness among both the groups (n=500)

Effectiveness	Group A	Group B	P value
Yes	230 (92%)	180 (72%)	<0.001
No	20 (8%)	70 (28%)	

Table 3: Comparison of anesthetic effectiveness with age

Age (years)	Effectiveness	Group A	Group B	P value
18 – 40	Yes	130 (92.9%)	104 (72.4%)	0.000
	No	10 (7.1%)	40 (27.6%)	
41 - 65	Yes	100 (90.9%)	76 (71.7%)	0.000
	No	10 (9.1%)	30 (28.3%)	

Table 4: Comparison of anesthetic effectiveness with gender

Gender	Effectiveness	Group A	Group B	P value
Male	Yes	120 (92.3%)	84 (62.7%)	0.000
	No	10 (7.7%)	50 (37.3%)	
Female	Yes	110 (91.7%)	96 (82.2%)	0.040
	No	10 (8.3%)	20 (17.8%)	

DISCUSSION

Local anesthesia is one of the most effective methods for painless endodontic procedure. For endodontic therapy of mandibular molars, IANB is the most preferred type of local anesthesia. Various studies have compared oral anesthesia and IANB success rates [12,13]. The IANB failure in mandibular molars with symptomatic irreversible pulpitis is reported to be 23% [14]. Anesthetic failure in irreversible pulpitis has been reported to be 8-fold more likely than in asymptomatic irreversible pulpitis [15].

Articaine is the only local anesthetic to contain a thiophene ring, responsible for lipid solubility. Like lidocaine, mepivacaine and prilocaine, articaine is also effective when used as a block anesthetic. 4% articaine has shown better clinical performance than 2% lidocaine [16] due to its ability to penetrate hard tissues such as bone. In the present study, 4% articaine with 1:100,000 epinephrine was used to give block anesthesia (IANB) in two different volumes to perform endodontic therapies in mandibular molars with symptomatic irreversible pulpitis.

Kanaa et al [17] claimed slower IANB anaesthetic administration (1,7ml/60s) than rapid IANB (1,7ml/15s) was more suitable for patients. A progress analysis of computer-controlled slow injection systems has shown that patients do not decrease their injection pain level. In the

present study, the anaesthetic solution was deposited steadily (1.7 ml/60 s).

Some studies define no pain whereas other studies define moderate pain as anesthetic success during endodontic therapy [17,18]. In the present study, no pain or mild pain encountered during endodontic therapy was considered as anesthetic success.

Based on the findings of the study present, the pains ratings of the patients were statistically significantly less than those before the endodontic procedure in both groups. These findings are consistent with those from other studies of the permanent mandibular molars with irreversible pulpitis.

In the present study, the success rate for the IANB technique was 92% and 72% for Group A and Group B respectively. Aggarwal and al [19] [did not find any important statistic discrepancy between the incisive mental nerve (percent-55) block (percent-72) and the IANB technique in the mandibular premolars.

In our study, 9 patient required supplemental anesthesia prior to endodontic therapy. Foster et al [20] reports close to our findings where IANB and mouth infiltration anesthetics were used together (66%), The success / failure values of the research techniques of this study are consistent with those of the literature, with most reported studies failing to achieve 100 percent success. Corbett et al [21] reported, in a study of 27 healthy volunteers, that 55.6 percent had success rates in the first molar mandibular tooth and 70.4% had oral infiltration anaesthesia, but the difference was not statistically important.

This research reports a mean age (years) of 41.09 ± 11.69 years. In comparison, Aggarwal et al [9] analysed the age of 23-37 years for patients in the sample.

For mandibular molar teeth with symptomatic irreversible pulpitis, the efficacy level was 230 (92%) and 180 (72%) respectively for 3.6ml vs. 1.8ml volumes of 4% articaine corroborating with the results of a study by Fowler and Reader [10] that increasing the volume of anesthetic solution increases the anesthetic efficiency.

The results of a study by abazarpour et al [11] corroborate the findings of present study that the increasing volume of articaine provides significant higher anesthetic effects.

CONCLUSION

3.6 ml volume of 4% articaine with 1:100,000 epinephrine has been found to be more effective to provide IANB in mandibular molars with symptomatic irreversible pulpitis when compared to 1.8ml of 4% articaine with 1:100,000 epinephrine. Increasing the volume of articaine lead to effective pain control and patient's comfort during endodontic therapy.

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