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The Effectiveness of Different Volumes of Articaine for Inferior Alveolar Nerve Block for Mandibular Molar Teeth with Symptomatic Irreversible Pulpitis

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ABTRACT

Objective: To compare the efficacy of 3.6ml Vs 1.8ml articaine concentrations for lower alveolar nerve blocks with symptomatic irreversible pulpitis.

Study Design: Quasi experimental study

Place and Duration of Study: Operative Dentistry Department, Armed Forces Institute of Dentistry, Rawalpindi Pakistan, from Aug 2017 to Feb 2018.

Methodology: Five hundred Patients with symptomatic irreversible pulpitis were divided into 02 Equal groups A & B, 250 in each Group. Sample size was calculated by WHO calculator. All patients were asked to score their pain using a visual analogue pain scale (VAS). Then a standard Inferior Alveolar Nerve Block with a side-load cartridge device was administered. Group A was treated with 3.6ml articaine and group B was treated by 1.8ml of same solution. Patients were asked to rate their discomfort felt during the procedure. No or mild discomfort was considered as a success while serious or extreme pain was considered anesthesiological failure.

Results: In Group A, IANB was found to be effective in 92% of the subject (n=230) while in Group B, IANB was effective in 72% of the subjects (n=180). The difference in effectiveness of IANB between the 02 groups was statistically significant (p<0.001) where 3.6 ml of articaine was found to be statistically more effective than 1.8 ml of articaine

Conclusion: 3.6 ml volume of articaine was better as compared to 1.8ml volume of same solution for treating patients with acute irreversible pulpitis.

Keywords: Inferior alveolar nerve block, Local Anaesthesia, Root canal treatment

How to Cite This Article: *Khan WA, Yaseen S, Bibi A, Rana MA, Munir A, Malik N. The Effectiveness of Different Volumes of Articaine for Inferior Alveolar Nerve Block for Mandibular Molar Teeth with Symptomatic Irreversible Pulpiti. Pak Armed Forces Med J 2025; 75(Suppl-4): S512-S515. DOI: https://doi.org/10.51253/pafmj.v75iSUPPL-4.6100*

INTRODUCTION

Root canal therapy is a process in which the root canal system extracts pulp tissue and bacteria.[1] A major concern of dentists during root canal therapy is the availability of profound anaesthesia during the procedure.[2] Various studies have been performed to determine methods of pain and discomfort during roots channel treatment using different procedures, equipment and anaesthetic solution.[3] In endodontic therapy, IANB is the most common form of injection to receive local anaesthesia for mandibular molars.[4]

Teeth that have irreversible pulpitis have shown a greater problem with receiving anaesthesia during endodontic care.[5] In addition, achieving anaesthesiological care of mandibles molar teeth with irreversible pulpitis is more complicated compared to other posterior teeth in the same condition.[6] 1.8-mL volume can provide up to 28% efficiency, while 3.6-mL can provide 39% efficiency. Moreover, the anaesthetic solution will be exposed to a longer span of the lower alveolar nerve.[4-6]

Articaine has a requirement of anaesthesia for a fastened onset and a longer period of pulp anaesthetics than lidocaen.7 Articaine spreads more efficiently across soft tissue and bone than other local anesthetes.[7,8] The property of an articaine is an anaesthesia approved by the US Food and Drug Administration for dental use in 2000,9. Most previous research showed no major effects on the effectiveness of anaesthesia on-length. However, lidocaine was used only as an anaesthetic.[9,10]

The rationale of this study was to promote use of 3.6ml solution of articaine in symptomatic mandibular molars with acute irreversible pulpitis. Increasing the volume of articaine in such patients will lead to effective pain control and comfort during endodontic procedure.

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Received: 11 Jan 2021; revision received: 13 Sep 2021; accepted: 28 Dec 2021

METHODOLOGY

The quasi-experimental study was carried out at Department of Operative Dentistry, Armed Forces Institute of Dentistry Rawalpindi from August 2017 to February 2018 after seeking approval from Ethical Review Board (Letter no.) Using the WHO calculator, keeping confidence interval (1-α) at 95%, anticipated population proportion (P) at 0.42 and absolute precision required (d) at 0.431 a total sample size of 500 was calculated. Non-probability consecutive sampling was done.

Inclusion Criteria: Healthy adult patients with first molar jaws with a symptomatic irreversible pulpitis and a regular periapical presence of the radiation, aged 18–65 years, were included.

Exclusion Criteria: Patients with history of allergy to articaine and epinephrine, those with systemic diseases and pregnant females were excluded from the study.

Based on history, examination and periapical radiographs, diagnosis was made. Patients were divided by lottery method randomly into 2 groups (A and B). Group A was treated with 3.6 ml of articaine and Group B was treated with 1.8 ml of the same anaesthetic solution.

All patients were asked to assess their discomfort using the visual analogue pain scale (VAS) before, during, and after the anaesthetic solution was administered (Fig. 1). The cotton tip applicator was passively placed on the injection site for 1 minute before injection with a topical anaesthetic gel (20% Benzocaine; Premier, Philadelphia: PA). A conventional inferior alveolar nerve block (IANB) was administered with an aspirating syringe with a cartridge-loading system (CK ject; CK dial, Kor-Kyungji-do, Korea) and a 27-gauge 31 mm needle (C-K ject). Patients were asked whether lip numbness was present ten minutes after injecting. Teeth were then separated with a rubber dam, cavity removed and the endodontic cavity was prepared.

Each patient was given an explanation of the VAS before the start of the treatment. The patients were allowed to interrupt the practitioner at any stage of treatment (i.e., access cavity preparation, pulp chamber opening, or root canal instrumentation) if they experienced more than mild pain by raising their hand. The pain that they felt during the procedure was then rated by the VAS. The practitioner stopped working at the end of every stage of treatment and asked the patients to rate their pain if they had not raised their hand already.

A success was considered with no or mild discomfort (fainty, low and mild pain), while moderate or severe anaesthesia was considered a failure. 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 higher than mild pain was registered on the VAS at any point of care, then supplementary anaesthesia (intraperiodontal ligament or intrapulp injection) was used to provide patient comfort during the procedure. Every tooth was rooted with Protaper Next rotary instruments (DENTSPLY), after determining the working lengths. Data was anayzed using SPSS. Descriptive statistics were calculated. Categorical variables were presented as frequency and percentages while quantitative variables were depicted as mean±SD. Effectiveness (success vs failure) of IANB between the 02 groups was compared using Chi-squared test. *p*-value <0.05 was taken as significant.

RESULTS

A total of 500 patients were included in the study. Mean age of the study subjects was 41.09±11.69 years. There were 130 males (52%) and 134 females (53.6%). In Group A, IANB was found to be effective in 92% of the subject (n=230) while in Group B, IANB was effective in 72% of the subjects (n=180). The difference in effectiveness of IANB between the 02 groups was statistically significant (p<0.001) where 3.6 ml of articaine was found to be statistically more effective than 1.8 ml of articaine (Table-I).

No significant difference was observed in terms of efficacy of IANB in both groups between males and females or between different age groups (<40 years vs >40 years).

A statistically significant difference was seen in effectiveness of IANB for tooth#36 and #37 (p<0.001). IANB administered to Group A for tooth#36 and #37 was successful more frequently (85.7%) than Group B (70.6%). However, no such difference was observed for tooth #46 and #47 (Table-II)

Table-I: Comparison of Effectiveness Among Study Groups (n=500)

Effectiveness of IANB	Group A	Group B	*p*-value
Yes	230(92%)	180(72%)	<0.001
No	20(8%)	70(28%)	

Table-II: Comparison of Effectiveness of Ianb Between Study Groups in Terms of Tooth Involved

Tooth involved	Effectiveness	Group A	Group B	*p*-value
#36 & #37	Yes	120(85.7%)	96(70.6%)	<0.001
	No	20(14.3%)	40(29.4%)	
#46 & #47	Yes	110(100%)	84(73.7%)	0.040
	No	-	30(26.3%)	

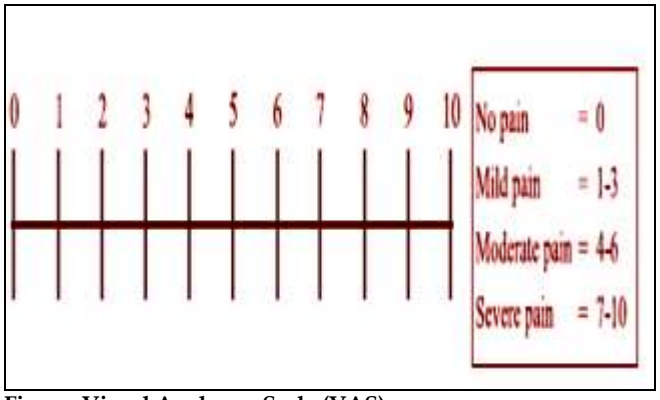

Figure: Visual Analogue Scale (VAS)

DISCUSSION

Local anaesthesia is one of the most effective methods of endodontic painless care, and most physicians favour the procedure. Ease of use, patient and clinician convenience, no tongue insensitivity and a very low risk of nerve damage or intravenous anaesthetic solution injection make buccal anaesthesia more useful than IANB. Studies done by Abazarpoor *et al*.[11] and Meechan JG.[12] have also compared oral anaesthesia and IANB success rates. The IANB anaesthesia technique failure in the mandibular molar teeth with pulpitis has been reported to be 23%.[13] In the irreversible pulpitis case an anaesthesia failure has been reported to be 8-fold more likely than in asymptomatic cases.[14] No previous research measured the discomfort endured during these two anaesthesia procedures by patients.

Articaine is unique to local anaesthetics since it includes an ester ring and a thiophen. Aggarwal *et al*.[15] reported that articaine is as effective in block anaesthesia and mouth penetration as lidocaine, mepivacaine, and prilocaine. In the present study, For mandibular molar teeth with symptomatic reversible pulpitis the efficacy level was 92% and 72% with 3.6ml vs. 1.8ml volumes of articaine respectively. The findings of a Fowler and Reader.[10] analysis showed that 1.8 mL volume provides 28% efficiency, while 3.6 mL volume provided 39% efficiency.

The application of topical anaesthetics in the appropriate area prior to the injection did not affect the patient's degree of perception of pain in a report on topical anesthesics prior to the application of local anesthetics.[16] This is why no real anaesthetic was used prior to injection in the current research.

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 case, the anaesthetic was administered steadily (1.7 ml/60 s).

In most research studies, cases with moderate pain levels, are graded as successfull when, in fact, they should not be classified in endodontics as a success.[17-19] In the present study, IANB was considered successful only when there was lack of pain (VAS = 0) and mild pain (VAS ≤ 3).

Monteiro *et al*.[20] reports close to our findings in case where IANB and mouth infiltration anesthesias were used together (66%), and in cases where IANB is used separately. 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% success. Corbett *et al*.[18] reported, in a study of 27 healthy volunteers, that 55.6% had success rates in the first molar mandibular tooth and 70.4% had oral infiltration anaesthesia, but the difference was not statistically significant.

CONCLUSION

A 3.6 ml volume of articaine was better as compared to 1.8ml volume of same solution for treating patients with acute irreversible pulpitis.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

WAK & SY: Data acquisition, data analysis, critical review, approval of the final version to be published.

AB & MAR: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AM & NM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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