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Research Article

ANESTHETIC EFFICACY OF COMBINATION OF TWO PERCENT LIDOCAINE WITH 1:80,000 EPINEPHRINE AND 0.5 MOL/L MANNITOL FOR INFERIOR ALVEOLAR NERVE BLOCKS IN PATIENTS WITH SYMPTOMATIC IRREVERSIBLE PULPITIS: AN IN VIVO STUDY

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ABSTRACT

The purpose of this prospective randomized single blind study was to determine the anesthetic efficacy of combination of 2 % Lidocaine with 1 : 80,000 Epinephrine and 0.5 mol / L Mannitol in Inferior Alveolar Nerve (IAN) Blocks in patients with symptomatic irreversible pulpitis. 60 subjects randomly received IAN Blocks using the following two anesthetic formulations: one formulation comprised of 2.5 ml of 2 % Lidocaine with 1 : 80,000 Epinephrine and the other formulation comprised of 1.6 ml of 2 % Lidocaine with 1 : 80,000 Epinephrine and 0.9 ml of 0.5 mol / L Mannitol. The pain response of the patient was recorded on endodontic access and initial instrumentation using the Heft-Parker Visual Analogue Scale. From the statistical analysis obtained following this study the addition of 0.5 mol / L Mannitol to lidocaine with epinephrine formulations significantly improved effectiveness in achieving a greater percentage of total pulpal anesthesias compared with a lidocaine formulation without Mannitol for IAN blocks. There is a significant improvement in the efficacy of IAN blocks when 2 % Lidocaine with 1 : 80,000 Epinephrine is administered in combination with 0.5 mol / L Mannitol. Based on the results of this study we can conclude that this combination of local anesthetic should be used on a regular basis to obtain successful anesthesia. However there is a need for more research as there are very few studies done on this aspect.

Keywords: Mannitol, Symptomatic Irreversible Pulpitis, Inferior Alveolar Nerve Block, Visual Analogue Scale.

INTRODUCTION

In patients with symptomatic irreversible pulpitis, clinical studies have found failure with the inferior alveolar nerve (IAN) block occurring between 44 % and 81 % .[1] There are several hypothesis given for the failure of inferior alveolar nerve blocks. One possible reason for failure is that the perineural barrier around the nerve might not allow complete diffusion of the anesthetic solution into the nerve trunk[2]. Mannitol is a 6-carbon sugar alcohol which occurs naturally in fruits and vegetables and is an osmotic diuretic. After intravenous injection, Mannitol is confined to the extracellular space, metabolized only slightly and excreted rapidly by kidneys. Mannitol is used in medicine to reduce the risk of perioperative renal failure and to treat cerebral edema. Mannitol is also used to enable chemotherapeutic agents cross the blood brain barrier. The ability of Mannitol to open up the perineural membrane to allow for enhanced penetrability for macromolecules[2] and it might affect nerve conduction[3]; it might also increase the success of an IAN block when administered concurrently with a local anesthetic solution[4].

MATERIALS AND METHODS

60 adult subjects participated in this prospective, randomized, single blind study. The subjects were in good health and were not taking any medication that would alter pain perception. Exclusion criteria were as follows: allergies to Mannitol, local anesthetics or sulfites, below the age of 18 years, history of significant medical conditions (ASA Class II or higher), taking any medications, which may affect pain assessment, active pathogenesis at the site of injection and inability to give informed consent. Ethical clearance was obtained by the ethical committee at the A. B. Shetty Memorial Institute of Dental Sciences affiliated to the Nitte University, Mangalore and written informed consent was obtained from each subject. The study design comprised of 30 adult subjects who were administered inferior alveolar nerve blocks (IAN) of a combination of 0.5 mol / L Mannitol and 2 % Lidocaine with 1 : 80,000 Epinephrine. The block consisted of 0.9 ml of 0.5 mol / L Mannitol and 1.6 ml of 2 % Lidocaine with 1 : 80,000 Epinephrine. The control group consisted of 30 adult subjects who were IAN blocks consisting of 2 % Lidocaine with 1 : 80,000 Epinephrine. Heft-Parker visual analogue scale was used to evaluate the pain response on endodontic access and initial instrumentation. A score of zero corresponded to no pain, mild pain corresponded to scores from 0 to less than or equal to 54, scores from 55 to less than or equal to114 corresponded to moderate pain and severe pain was recorded for scores more than 114. Commercially available 20 % Mannitol was taken up and a formulation of 0.5 mol / L Mannitol of a volume of 60 ml was prepared under sterile conditions. Sterile sealed vials were used to store the formulation of Mannitol prepared at the pharmaceutical institute. Prior to each administration of the local anesthetic, under sterile conditions 1.6 ml of Lidocaine with Epinephrine was withdrawn from standard dental cartridges into a 2.5 ml Luer-Lok disposable syringe. All solutions used were checked to ensure that they had not expired. For the control group a formulation of 2.5 ml of Lidocaine with Epinephrine was withdrawn from dental cartridges into 2.5 ml Luer-Lok disposable syringes. The formulation for the study group comprised of 1.6 ml of the local anesthetic withdrawn into a 2.5 ml Luer-Lok disposable syringe followed by addition of 0.9 ml of the Mannitol from the stored sterile sealed vials into the same syringe. The syringe was then inverted 20 times to mix the solution. No precipitate formed when the Mannitol was mixed with Lidocaine. Selected components and selected formulations had their pH Values determined using Ph / millivolt meter. A standard IAN block was administered with a 27gauage 1.5 needle using each anesthetic formulation. Following needle penetration and as the needle was advanced during placement, 0.2 ml of the solution was deposited. After the target area was reached and aspiration was performed, 1

minute was used to deposit all the anesthetic formulations. Following 20 minutes after administration of the anesthetic solutions pain response was assessed using the Heft-Parker visual analogue scale on endodontic access and initial instrumentation. Pain response was graded as no pain, mild, moderate or severe corresponding to the range of scores as mentioned earlier. Comparisons between the two anesthetic formulations were made using the Mann Whitney U Test.

Table 1: The Average (Mean) Heft-Parker Vas Score

Group Statistics				
	Group	N	Mean	Std. Deviation
Heft Parker Score	Control	30	40.03	24.593
	Study	30	24.60	27.018

The standard deviations are higher than the mean so we have to use the Mann Whitney u test to compare the score Mann-Whitney U test results. Mean rank: 36(control group) 25(study group) Z Value: -2.444. Pearson's value- 0.015

Mann Whitney U Test-Heft Parker Score Results

There are significant lower values in pain scores in the study group.

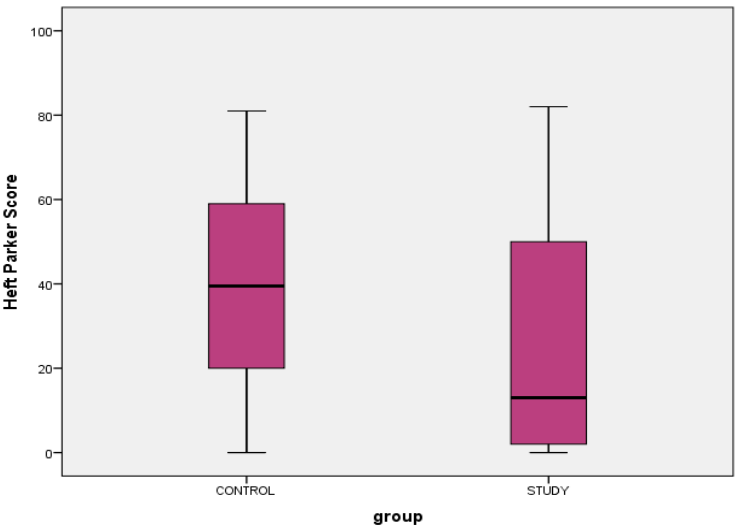
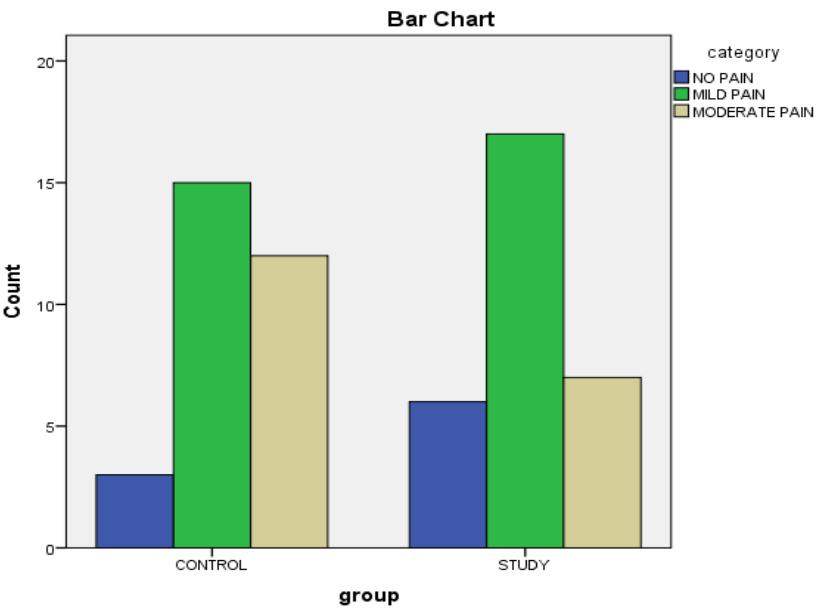


Figure 1: Mann Whitney U Test – Illustration by a Block Chart



Graph 1: Depicts the Segregation of Subjects of Study and Control Groups on the Basis of Pain Response

RESULT

Based on the analysis of our study there is higher mild and no pain categories in the study but not significant. There is significant reduction in the Heft-Parker VAS Scores observed in the study group. Mannitol has proven to increase the efficacy of the local anesthetic in IAN blocks. There are reported instances of failure of Lidocaine with Epinephrine hence there is a need to make the patient dental visit a pleasant one, free of pain. As Mannitol helps in increasing the efficacy of anesthesia there needs to be a use of this on a regular basis. However as there are few studies conducted based on the relationship of Mannitol with the local anesthetic there is a need to conduct more research on this aspect.

DISCUSSION

In the present study we found that Mannitol was effective in increasing the efficacy of the local anesthetic solution in IAN block. This is in support to the mechanism of Mannitol as mentioned earlier. The result of our study is in accordance to similar studies done by Timothy Kreimer *et al*[4] and Ronald Wolf *et al*[5]. In the study 4 patients administered with Mannitol reported prolonged effect of the local anesthetic. There has been no complication observed with the use of Mannitol in our study. The results obtained following statistical analysis shows increased efficacy of the IAN block on use of 2 % lidocaine with epinephrine with 0.5 mol / L Mannitol. The study conducted showed a significant increase in the efficacy of the local anesthetic on addition of Mannitol. In the study conducted, based on the Heft-Parker VAS scores on endodontic access or initial instrumentation recorded 30 patients who were administered Lidocaine with epinephrine showed an average pain response of 36 and patients administered with Mannitol and Lidocaine with Epinephrine showed an average pain response of 25. This study is in accordance with similar studies done by Timothy Kreimer *et al*[4] and Ronald Wolf *et al*[5] and contradictory to the studies done by Andrew Haase *et al*[6], Ridenour *et al*[7] and Michael Whitcomb *et al*[8]. Andrew Haase *et al*[6] concluded in a study, with the use of 4 % Articaine formulation, successful anesthesia occurred 88 % for the first molar in comparison to 2 % Lidocaine formulation where successful anesthesia occurred 71 % for the first molar. For a mandibular buccal infiltration of a first molar after a standard IAN block 4 % Articaine showed higher success rate. S. Ridenour *et al*[7] concluded in a study, adding Hyaluronidase to a buffered solution of Lidocaine with epinephrine didn't statistically increase the incidence of pulpal anesthesia in IAN blocks and because of its potential tissue damaging effect, it should not be added to local anesthetic solutions for IAN blocks. Michael Whitcomb *et al*[8] concluded in a study, buffering a 2 % Lidocaine with 1 : 100,000 epinephrine with Sodium Bicarbonate, didn't statistically decrease the pain of injection, provide faster onset, or increase the profoundity of anesthesia when compared with unbuffered 2 % Lidocaine with 1 : 100000 Epinephrine for an IAN block. The improved efficacy of the local anesthetic solution with 0.5 mol / L Mannitol is due to the increased permeability of the perineurium brought about by Mannitol. Thus there is better distribution of the local anesthetic macromolecules resulting in the increase in its efficacy and reduction in pain response on endodontic access and initial instrumentation. As there is a possibility of failure of local anesthetic in IAN block, there is a need to increase the efficacy of the IAN block. Mannitol is a proven effective component to be used along with local anesthetic solution as it increases efficacy of the IAN block with no complications.

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