

ORIGINAL RESEARCH

Assessment of Post-Operative Pain with Different Calcium Hydroxide Formulations Used as Intracanal Medicament in RCT

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ABSTRACT

Introduction: Effective eliminating the microorganisms from the root canal system is the utmost objective which determines the intensity of the post-operative pain and swelling. So, the aim of this study is that to evaluate the efficacy of water-based calcium hydroxide, iodoform based calcium hydroxide, calcium hydroxide with chitosan as vehicle and calcium hydroxide points as an intracanal medicament in reducing the post-operative pain and swelling.

Materials and Methodology: This prospective study included two hundred patients requiring root canal treatment on maxillary or mandibular anteriors, mandibular first and second premolars were comprised totally. After clinical examination and radiographic examination, patients were randomly assigned to five groups. Each group had sample size (n= 40) depending upon intracanal medicament used as follows: Group 1: Calcium hydroxide paste (Ivoclar) Group 2: Calcium hydroxide paste with iodoform (Metapex) Group 3: Calcium hydroxide points (Hygienic) Group 4: Calcium hydroxide paste using chitosan (0.2%) as vehicle and Group 5: Control group containing dry sterile cotton. The tooth that requires root canal treatment were anesthetised using 1.8ml, 2% lignocaine with 1:100,000 epinephrine.

Results: The present study results show that the application of calcium hydroxide with propylene glycol based paste (Group 1) in root canal greatly reduces the post operative pain after 12, 24 and 48 hour post-operative which is better in comparison to other groups. The post operative pain was recorded least with (Group 3) calcium hydroxide points and maximum in (Group 5) control group at 6 hour post-operatively. When observed after 12 hours, the post-operative pain was recorded minimum with Group1 followed by Group 3 and maximum in Group 5 that is the control group.

Conclusion: Calcium hydroxide paste containing propylene glycol/water based is the most effective in reducing the pain from 6 hours to 48 hours postoperatively. Calcium hydroxide points which is a new drug delivery device significantly showed lesser post-operative pain while the condition got worse at 12 hour, 24 hour and 48 hour. Control group which is left without any medicament showed maximum post operative pain as compared to other groups at 6 hour, 12 hour, 24 hour and 48 hour. To arrive at a

conclusion, calcium hydroxide with iodoform, calcium hydroxide points and calcium hydroxide with chitosan, can be correlated after comparing the findings of the present study with other clinical studies that had conducted earlier. Therefore, more researches have to be proposed to achieve a definitive conclusion.

Keywords: Post-Operative Pain, Calcium Hydroxide Medicament, Intracanal Dressing.

INTRODUCTION

The main objective of root canal treatment is to eradicate all the microorganisms from the root canal system thereby reducing the postoperative pain and swelling which are considered as the most common symptoms by the patient. Management of pain is considered as an important requirement for the success of root canal treatment. Numerous factors play a key role in alleviating pain during or after the end of endodontic procedures. Preoperative pain has been found to be an initiative factor for causing postoperative pain and flare-up after initiation of endodontic procedure^{1,2}. Apart from the pre-operative pain there are other factors which contribute to post-operative pain such as necrosis, persistent infection, inadequate/inappropriate preparation of canals, extrusion of debris and overpreparation of canals beyond the apex³⁻⁷. The endotoxins released by the persistent endodontic microorganisms and their enzymes in the periapical region also play a major role in causing post-operative pain^{8,9}. Hence, adequate instrumentation, irrigation and intracanal medicament helps in eradicating the microorganisms and aids in managing the inter-appointment pain and flare-up.^{3,10}

Ca(OH)₂ is considered to be the most commonly used intracanal medicament. Endodontic microorganism such as *E. faecalis*¹¹ and *Candida albicans*¹², are found to be resistant to Ca(OH)₂. The amount of viral load in the root canal is a major factor to be contributed to cause postoperative pain. Hence, efforts to improve the efficacy of Ca(OH)₂ medicament by addition of vehicles which helps in Ca(OH)₂ dissociation and helps to increase the antimicrobial activity of the paste¹³. Ca(OH)₂ alkaline pH has greater antimicrobial properties. It also acts in reduction of intracanal microbial load, bacterial cell wall synthesis, and denature the endotoxins of bacteria.

Ca(OH)₂ with vehicle as adjunct improves its work properties and helps in ion dissociation by changing the velocity, which cause the paste to be soluble at varied rates¹⁶. Numerous vehicles like glycol, saline, local anaesthesia and water is used to test the efficiency of the medicament in reducing the viral load and anti-inflammatory process, thereby reduction of pain¹⁷. The most common vehicle agents are viscous, aqueous, and oily based Ca (OH)₂¹⁸.

There are no studies on comparing the post operative pain following intracanal medicament with different vehicles of calcium hydroxide. Thus, this study is conducted to evaluate the efficacy of water-based calcium hydroxide, iodoform based calcium hydroxide, calcium hydroxide with chitosan as vehicle and calcium hydroxide points as an intracanal medicament in reducing the post operative pain.

MATERIALS AND METHODOLOGY

This prospective study included two hundred patients requiring root canal treatment on maxillary or mandibular anteriors, mandibular first and second premolars were comprised totally. An elaborated medical history, dental history & drug history (including drug intake and drug allergies) of all the study participants were noted before the beginning of the study. After obtaining the approval from the institutional ethical committee, the study was started and a written informed consent was obtained from all the participants. The age, gender and tooth number of patient was promptly recorded. Patient selection criteria was based on the following factors: 1. Those patients who had acceptance of the proposed treatment procedure. 2. When there is enough treatment time available to properly finish the procedure.

3. Vital teeth 4. Sinus tract 6. Teeth with irreversible pulpitis, with or without apical periodontitis 7. Teeth with periapical resorption. 8. No reported previous history of root canal intervention 9. Grade – 1 teeth mobility There are some furnished exclusion criteria 1. Patients with a positive history of antibiotic coverage within the past month. 2. Pregnant patients. 3. Patients requiring antibiotic prophylaxis before the beginning of the dental treatment 4. Allergic history 5. Teeth with root caries 7. Teeth with calcified canals 8. Teeth with periapical radiolucency which is greater than 0.5 cm.

The intensity of pain was recorded by instructing patients to complete a visual analogue scale (VAS) with the help of Verbal Descriptor Scale (VDS) as a guide. Before the beginning of the treatment procedure, all the patients were priorly advocated to note a mark on the horizontal scale to represent their postoperative pain intensity that they have experienced. The markings on the VAS were measured and the degree of pain was categorized as:

| | |
|-----------|---------------|
| 0 | No pain |
| 0.1 – 3 | Mild pain |
| 3.1 – 6.9 | Moderate pain |
| 7 - 10 | Severe pain |

After clinical examination and radiographic examination, patients were randomly assigned to five groups. Each group had sample size (n= 40) depending upon intracanal medicament used as follows: Group 1: Calcium hydroxide paste (Ivoclar) Group 2: Calcium hydroxide paste with iodoform (Metapex) Group 3: Calcium hydroxide points (Hygienic) Group 4: Calcium hydroxide paste using chitosan (0.2%) as vehicle and Group 5: Control group containing dry sterile cotton. The tooth that requires root canal treatment were anesthetised using 1.8ml, 2% lignocaine with 1:100,000 epinephrine.

Prompt rubber dam isolation was achieved and access cavity was made on each tooth and working length (WL) was established with #15 k-file using an electronic apex locator. WL was re-confirmed with a digital X-ray (Kodak RVG 5100). All canals were prepared with ProtaperNEXT file system (Dentsply) by following the crown down technique. Magnanimous irrigation was done alternatively with 3% NaOCl and 15% EDTA with the last flush of normal saline.

RESULTS

The present study results show that the application of calcium hydroxide with propylene glycol based paste (Group 1) in root canal greatly reduces the post operative pain after 12, 24 and 48 hour post-operative which is better in comparison to other groups. The post operative pain was recorded least with (Group 3) calcium hydroxide points and maximum in (Group 5) control group at 6 hour post-operatively. When observed after 12 hours, the post-operative pain was recorded minimum with Group 1 followed by Group 3 and maximum in Group 5 that is the control group.

When checked after 24 hours, the post operative pain was observed least in Group 1 followed by Group 3 and maximum in control group. After 48 hours, post operative pain was minimum in group-1 followed by Group 3 and maximum with control group. We had found that the medicament causing least operative pain are ranked according to superiority (in descending order) as Calcium hydroxide paste > Calcium hydroxide points > Calcium hydroxide with chitosan > calcium hydroxide with iodoform. After 6 hours post-operatively, statistically significant difference was noted in the incidence of post operative pain between all four calcium hydroxide groups (Group 1, Group 2, Group 3 and Group 4) with control group (Group 5). Also, statistically significant difference was revealed between Group 2 with Group 1 (calcium hydroxide with iodoform with calcium hydroxide paste) & Group 2 (calcium hydroxide with iodoform) with Group 3 (calcium hydroxide points). At 12th postoperative hour, no statistically significant difference was identified among all groups. At

24 hour post-operatively, relative difference in post-operative pain was observed between Group-1 and Group-5, Group-2 and Group-5, Group-3 with Group 5, Group-4 and Group-5 control group.

DISCUSSION

The thumb rule for a successful endodontic therapy is prompt elimination of an infection and attaining three dimensional obturation of the canal to put an end to subsequent reinfection. But, the currently available techniques of debridement might leave some parts of root canal space totally untouched by the endodontic instruments. Various media like normal saline, distilled water, chlorhexidine are being used for the manipulation of calcium hydroxide which thereby affecting its dissociation into ion forms such as Ca^+ and OH^- .¹⁹ But still, there is a void in the knowledge with respect to the best medium which can be used to mix with calcium hydroxide. Therefore, this study is carried out to determine the medium which is more efficient when mixed with calcium hydroxide in terms of reduction of the interappointment pain.²⁰ Apexcal is a viscous polyethylene glycol-based paste which comprises of 29% of calcium hydroxide, 22% of bismuth carbonate and 49% of other materials like polyethylene glycol, glycerine and water. When mixed it revealed homogenous and constant consistency mix for an extended period of time. *Estrela* et al briefed that the liberation of calcium and hydroxide ions was relatively faster and much more significant when used as calcium hydroxide distilled water paste.²¹ Metapex contains calcium hydroxide with iodoform in silicon oil in its composition.

In the year 1928, *Walkoff* introduced iodoform as an effective root canal filling material in primary teeth. The superior antimicrobial property exhibited by Metapex may be due to the combination with iodoform and to the viscous and oily vehicle which could easily prolong the action of the medicament. Based on a study by *Ho* et al showed that oily vehicles might reported to increase the antimicrobial effects of calcium hydroxide against *E. faecalis* and other bacteria.²²

The temporary calcium hydroxide points are the new device delivery for calcium hydroxide as an intracanal dressing containing calcium hydroxide at a concentration of about 50- 54% that can be easily inserted and removed from the pulp space when their role is achieved.²⁴ The product chitin is a straight homopolymer which consists of (1,4)- linked N-acetyl-glucosamine units, which is available in the exoskeleton of crustaceans species like crabs and shrimps. Chitosan is comprised of copolymers of glucosamine and N-acetyl-glucosamine. Chitosan is basically considered as biocompatible, non-toxic and biodegradable and is inherently antibacterial capability. As per the information available in the literature, various calcium hydroxide preparations have been used so as to utilize its inherent antibacterial potential.²³ The reason that Apexcal showed minimum post operative pain might be due to the fact that propylene glycol in its composition keeps it to remain as a paste form for a relatively extended period of time which proposes its good manoeuvrable qualities. Other paste preparations that are being used in the study dries up within a shorter period of time which is considered to be undesirable as it would be less convenient to be used as an intracanal medicament.²⁵ The results of this present study are generally in concurrence with the results obtained by *Paul K* et al 1997, *Shetty S* et al 2014 who inferred that the paste of calcium hydroxide with propylene glycol exhibits significant antibacterial action. According to *Shetty S* et al 2014, the relatively high pH of calcium hydroxide paste with propylene glycol as vehicle may be attributed to its high molecular weight (76.09), hygroscopic nature and viscosity which possess extended release of ions.²⁶ This demonstrates that the increased mobility of the hydroxyl ions released by the calcium hydroxide points when compared with aqueous calcium hydroxide paste. The alkalisation of outer root dentin is important to attain in certain clinical conditions where the aim is to revert the acidic environment which is

necessary for the root resorption by osteoclasts.²² According to *Likoloas Economides* et al 1999, the initial high pH value of calcium hydroxide points may be attributed to the increased amount of calcium hydroxide (50-52%) in its composition and the inherent ability of material to leach out in the wet environment inside root canal.²⁶ The results found in our study are in corroboration with *Larsen* and *Bindsvlev* who observed that the aqueous suspension maintains the highest pH and leaching of calcium ions.²⁵ They also revealed that the oil paste which contains calcium hydroxide was lacking in both ion release and inherent antimicrobial properties. *Tchaou* et al and *Pabla* et al reported that the least antimicrobial activity of Metapex against aerobic and anaerobic bacteria in comparison to zinc oxide, eugenol, KRI paste and MAISTO paste in their research.²⁷ The results of this study revealed variations between the hydroxyl ion release among various commercially available calcium hydroxide pastes. A low viscosity is generally acceptable to permit the flow of the content into root canal and a reported high penetration concentration. *Estrela* et al (2002) advocated that lower the viscosity, the higher is the ionic dissociation of calcium hydroxide.²¹

CONCLUSION

Calcium hydroxide paste containing propylene glycol/water based is the most effective in reducing the pain from 6 hours to 48 hours postoperatively. Calcium hydroxide points which is a new drug delivery device significantly showed lesser post-operative pain while the condition got worse at 12 hour, 24 hour and 48 hour. Control group which is left without any medicament showed maximum post operative pain as compared to other groups at 6 hour, 12 hour, 24 hour and 48 hour. To arrive at a conclusion, calcium hydroxide with iodoform, calcium hydroxide points and calcium hydroxide with chitosan, can be correlated after comparing the findings of the present study with other clinical studies that had conducted earlier. Therefore, more researches have to be proposed to achieve a definitive conclusion.

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