

## EFFECT OF MIXING CALCIUM HYDROXIDE PASTE AND 2% CHLORHEXIDINE GEL IN COMPARISON TO PURE CALCIUM HYDROXIDE PASTE ON POSTOPERATIVE PAIN IN TEETH WITH CHRONIC PERIAPICAL PERIODONTITIS: RANDOMIZED CLINICAL TRIAL

Yasser Mohamed Hendy\*<sup>ID</sup>, Geraldine Mohamed Ahmed\*\*<sup>ID</sup>,  
Hany Samy Sadek\*\*<sup>ID</sup> and Rania Abd El Moniem Khatab\*\*\*<sup>ID</sup>

### ABSTRACT

**Aim:** Assessment of post-operative pain in adult patients suffering from necrotic pulp condition with chronic periapical periodontitis by using mixture of calcium hydroxide paste and 2% chlorhexidine gel and pure calcium hydroxide paste and with mechanical preparation only without intracanal medications as a control.

**Methods:** Forty five patients with single rooted teeth suffering from necrotic pulp status were divided into 3 groups (n=15), the first group received mechanical preparation only, the second group received calcium hydroxide intracanal medication only, while the third group received mixture of calcium hydroxide and 2 % chlorhexidene gel intracanal medication. Numerical pain scale was used to assess the pain experience post operatively.

**Results:** Calcium hydroxide was superior in decreasing the postoperative pain at time interval 4 hours and 24 hours in comparison to the mixture of calcium hydroxide paste and 2 % chlorhexidene gel significantly

**Conclusion:** Using one of the intracanal medications for 2 week time interval in necrotic teeth can help to allivate postoperative pain and reduce the need for analgesics and antibiotics.

**KEY WORDS:** intracanal medications, calcium hydroxide, chlorhexidine gel, postoperative pain, pain scale

\* Ph.d. Candidate, Armed Forces

\*\* Professor, Endodontics Department, Faculty of Dentistry, Cairo University

\*\*\* Professor, Microbiology and Immunity Department, Faculty of Pharmacy, Cairo University

## INTRODUCTION

Intracanal medications, calcium hydroxide, 2% chlorhexidene gel, post-operative pain, pain scales. Bacteria play a role in pulp necrosis. Eradication of micro-organisms from necrotic root canal system is a sophisticated issue. Numerous trials to reduce the number of micro-organisms from the root canal system, including the use of various mechanical instrumentation and irrigation techniques and intracanal medications. Mechanical instrumentation alone will not be able to get rid of bacteria from root canal system (Mohammadi & Shalavi, 2012)<sup>1</sup>

Bacteria play a primary role in occurrence of apical periodontitis; the bacteria involved in endodontic infections are mostly gram negative anaerobic species that consists of lipopolysaccharide (LPS) in outer layers of their cell walls, which considers as virulence factor. Strong evidence correlates the presence of endotoxins and bone resorption of the periradicular tissues. A high content of endotoxins in the root canals is responsible for spontaneous pain, pain on percussion and palpation. (Martinho & Gomes, 2008)<sup>2</sup>.

Intracanal medications are antimicrobial agents that are injected inside the root canals between visits to destroy microorganisms and prevent reinfection (Weine, 2004)<sup>3</sup>.

The antimicrobial activity of calcium hydroxide is attributed to the release of hydroxyl ions (Siqueira, 2001)<sup>4</sup> damaging the bacterial components, protein denaturation and cellular DNA damage (Siqueira & Lopes, 1999)<sup>5</sup>

Chlorhexidene is widely used as intracanal medicament due to its penetration to cell wall of Gram negative cells attacking the cytoplasmic membrane leading to coagulation of the intracellular components (Macdonnel & Russel, 1999)<sup>6</sup>. Due to the unique antibacterial properties of intracanal medications, assessment of postoperative pain in necrotic teeth was carried on to verify the effect of intracanal medications between visits of endodontic treatment dispensing the need for administration of

analgesics and antibiotics between visits due to their side effects.

## MATERIALS AND METHODS

The interventions were done in the 1<sup>st</sup> appointment where all the procedure was explained to the patient then signing the informed consent.

The study was ethically approved by the research ethical committee in Cairo University. The trial design was single blinded randomized clinical trial which conforms the standards of reporting trials CONSORT\* statement where randomized clinical trials compare the results of treatment outcomes for two or more groups of patients. Patients were allocated by random or by chance to receive several clinical interventions and one of these interventions was control where the patients did not receive any intracanal medication.

Sample size calculations were carried on by a statistical equation at the statistical office, Cairo University according to the study classification and number of groups.

Patients were included according to eligibility criteria which include free medical history. Participants were presented with mature upper or lower single rooted teeth with necrotic pulp condition and radiographic evidence of periapical bone loss ranging from widening of lamina dura up to 3mm lesion size (as an indication of preoperative canal infection). Selected root canals did not receive any endodontic treatment previously. Males and females were included from age of 28 to 60.

The exclusion criteria were the examined teeth without infected necrotic root canal systems and/or radiographic evidence of periapical bone loss (hence no preoperative canal infection). Study carried out on failed, endodontically treated teeth (retreatment cases), extreme of ages and chronic depliting diseases or previously accessed canals and badly mutilated crowns.

Most of the participants were under sporadic use of analgesics due to the suffer of dull aching pain preoperatively.

Forty five patients were divided randomly into 3 groups each of 15 patients. At first pulp vitality test was done by thermal pulp testing at the facial aspect of the tooth structure when it is dry. Administration of local anesthesia (Mepivacain HCl2%- Levonordefrien 1:20000 Alexandria, Egypt) to the tooth required to be treated then isolation with rubber dam.

Disinfecting the tooth surface by 2.5% NaOCl (CLOROX) inactivated with sodium thiosulfate (El Nasr CO. for pharmaceuticals and chemicals).

Sterile burs were sterilized by the plasma sterilizer (HMTS-142) for caries removal and another one for pulp chamber penetration.

Working length determination was done using MORITA Root ZX Mini apex locator (Japan) for accuracy.

Cleaning and shaping procedure was established by Revo-S rotary system (Micro Mega, France) and gates glidden sizes 3 and 4 (Mani, Japan) to ensure adequate space for placement of the intracanal medicaments and proper removal of bacteria and debris, till size 25 taper 0.06 then the canal will be enlarged manually till size 35 k-file.

The irrigant solution 2.5% sodium hypochloride.

Placement of the intracanal medications by lentuolo spiral instruments, the first group (n=15) was the control without receiving any intracanal medicaments, while the second group (n=15) received calcium hydroxide ready-made paste only (Promedica, Germany), then the third group (n=15) received combination of calcium hydroxide paste (Promedica, Germany) mixed with chlorhexidene gel 2% (Gluc-Chex 2%, Cerkamed, Poland) by equal ratios mixed on sterile glass slab.

Temporary filling was done by resin modified glass ionomer to ensure adequate sealing and preventing micro leakage.

Pain experience measured by numerical pain rating scale after the treatment by 4, 24, 48 hours and after 14 days in a follow up card introduced to the patient.

After 2 weeks (second appointment) rubber dam was applied, local anesthesia received then a sterile paper point will be introduced into the canals after irrigation and removal of the remnants of the intracanal medicament with the saline solution for 60 seconds.

Obturation accomplished by cold lateral condensation technique with gutta percha, resin sealer and auxiliary cones size 25 or 30 according to the space beside the master cone then final restoration.

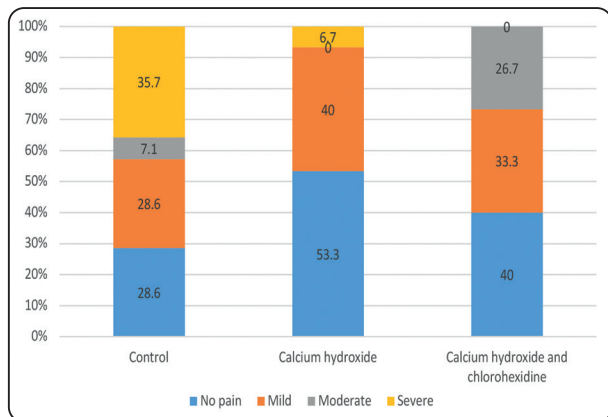
Post operative pain experience was evaluated in the final session after 4 hours, 24 hours, 48 hours and 2 week time intervals by aid of numerical pain scale.

### Statistical Analysis

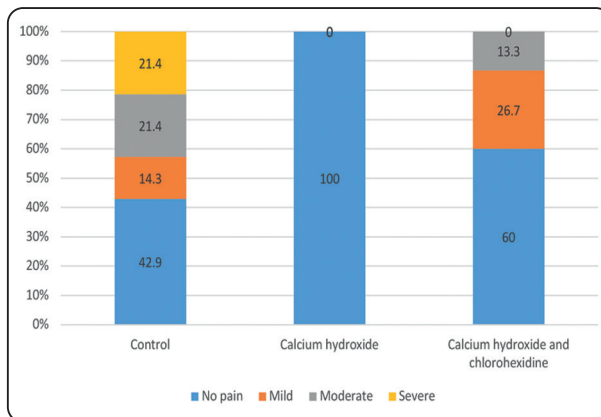
Statistical analysis were done by SSPS program version 15 software, Chi square test was done in comparison between qualitative variables. Qualitative data was presented as frequency and percentages.

### RESULTS

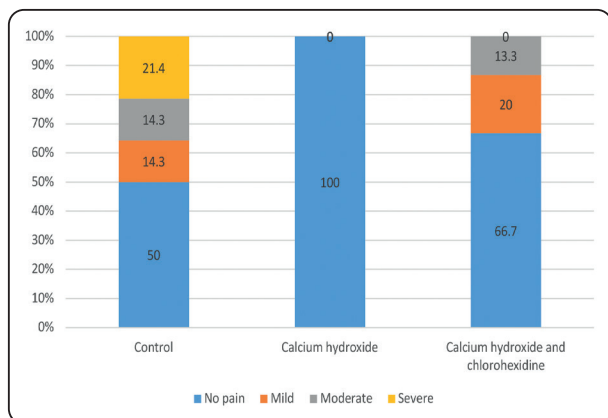
In this study 45 patients were divided into 3 groups (n=15) while a patient from the control group was exempted (n=14), giving 2 homogenous group with heterogeneity if compared with the control group which is 14 patients. The results are based on group of tables to describe the number of participants and their percentages. Gender presentation revealing number of males and females and their percentage in participation. The second part is the analytical part which reveals the percent distribution of degree of pain among three groups in the different time intervals supported with bar charts.



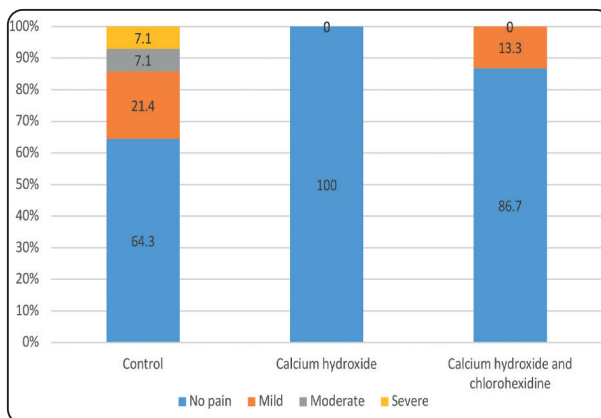
Bar chart (1) Percent distribution of degree of pain among three groups in 4 hour time interval.



Bar Chart (2) Percent distribution of degree of pain among three groups in 24 hour time interval.



Bar chart (3) Percent distribution of degree of pain among three groups in 48 hour time interval.



Bar chart (4) Percent distribution of degree of pain among three groups at time interval 2 weeks.

### DISCUSSION

The basic principle of root canal treatment is to eliminate gram negative bacteria and their byproducts as endotoxins. Endotoxins are released during bacterial multiplication and at cell death in necrotic cases. Endotoxins are causative factor for pain in endodontic infections, upon its emersion towards the periapex leading to apical periodontitis. **Seltzer S and Faber PA1994<sup>10</sup>, Mohammadi Z and Shalavi S 2012<sup>1</sup>, Martinho FC and Gomes FPFA 2008<sup>2</sup>** In case of asymptomatic apical periodontitis there is a balance between infectious micro flora and defensive mechanisms of human immune system

in periodontal tissues this is what is called “local adaptation syndrome. After mechanical preparation, extrusion of the debris from the apical foramen to periapical tissues leads to increase the inflammation due to imbalance between microorganisms and human immune system leading to vasodilatation and release of inflammatory mediators. **Seltzer & Naidorf 2004<sup>7</sup>** .In this study a comparison between ready-made calcium hydroxide paste alone against combination of 2% chlorhexidene gel mixed with calcium hydroxide paste to assess their efficacy on reducing postoperative pain. After the first visit as the patient can be worried about pain

severity and its duration. Calcium hydroxide paste is used as intracanal medication due to its alkaline pH 10-12 which considered unsuitable condition for bacterial growth<sup>12</sup>, it affects microorganisms by 3 different mechanisms: the hygroscopic action due to absorption of the inflammatory exudates, formation of calcium proteinate bridges due to combination of  $\text{Ca}^{2+}$  ions with the proteins in the intercellular substances of endothelial cells thus prevents inflammatory exudates from spreading towards the blood vessels, finally phospholipase inhibition by calcium hydroxide decreases cellular lysis and consequently the liberation of PG which is one of inflammatory mediators<sup>13</sup>. Chlorhexidene gel is used in combination to calcium hydroxide to get synergistic effect<sup>14</sup>. The alkalinity of the calcium hydroxide is unaffected on mixing with chlorhexidene.

**Saatchi et al. 2014**<sup>20</sup> showed that calcium hydroxide mixed with chlorhexidene did not significantly increases the antimicrobial activity of calcium hydroxide, also **Schafer and Bosmann 2005**<sup>12</sup> showed that 2 % chlorhexidene was significantly more effective than calcium hydroxide alone or mixture of calcium hydroxide and chlorhexidene, **Sousa et al. 2014**<sup>9</sup> showed that calcium hydroxide with chlorhexidine was very potent against endotoxins only after 30 days of application. There was no antagonistic effect between calcium hydroxide and chlorhexidene when they were mixed together according to the study of **Signoretti et al. 2011**<sup>13</sup> as the pH media inside the root canal is still alkaline, and ion release is not affected concerning calcium hydroxide. While in a study to **Lindskog et al. 1998**<sup>14</sup> positive ions of chlorhexidene attach to the negatively charged phosphate groups in the bacterial cell wall exerting its bactericidal effect.

The stomatognathic system is a very complex media showing fluctuation in temperature, masticatory forces, bacteria and saliva. The results from this study was limited to the patient's stomato-

gnathic system and the oral hygiene motivation on contrast to the in vitro studies where the specimens are stored in a safe media (incubators) not subjected to the previous detrimental factors which can affect the results at the end. The difference between the working lengths of the root canals and the width of root canals vary from patient to another and this is an important factor determining the amount (volume) of the intracanal medication applied.

## CONCLUSION

Within the limitations of this study cleaning and shaping step in necrotic pulp cases is mandatory but that was not enough therefore the use of any of intracanal medications like calcium hydroxide or mixture of chlorhexidene and calcium hydroxide paste is a must to reduce post-operative pain, decrease number of treatment visits and the use of vast amounts of analgesics and antibiotics sporadically. There is synergistic effect between chlorhexidene gel and calcium hydroxide and no interaction between them however calcium hydroxide was efficient in reducing postoperative pain than combination of both calcium hydroxide and 2% chlorhexidene gel with statistical significance.

## Recommendations:

Further studies are required to evaluate the post-operative pain sensation between males and females, and using more sample sizes with longer application time for intracanal medications.

## REFERENCES

1. Mohammadi Z and Shalavi S 2012. Is Chlorhexidine an Ideal Vehicle for Calcium Hydroxide ? A Microbiologic Review. Iranian Endodontic Journal; 7(3): 115-122.
2. Martinho FC & Gomes BPFA 2008. Quantification of endotoxins and cultivable bacteria in root canal infection before and after chemomechanical preparation with 2.5% sodium hypochlorite. Journal of Endodontics; 34(3): 268-272.
3. Weine FS 2004. Endodontic therapy; 6<sup>th</sup> edn. Mosby: 226-228

4. Siqueira JF 2001. Strategies to treat infected root canals. *Journal of California Dental association*; ;29(12):825-837.
5. Siqueira JF & Lopes HP 1999. Mechanisms of antimicrobial activity of calcium hydroxide: A critical review, *International Endodontic Journal*; 32(5):361-369.
6. Macdonnel G & Russell D 1999. Antiseptics and disinfectants: activity, action and resistance. *Clin Microbiol Rev*; (12):147-179.
7. Seltzer S & Naidorf IJ 2004. Flare-ups in Endodontics: I. Etiologic factors. *Journal of Endodontics*; 30(11):476-481
8. Seltzer S and Faber PA 1994. Microbiologic Factors in Endodontology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*; 78 (5) :634-645.
9. Safavi KE & Nicols FC 1993. Effect of Calcium Hydroxide on Bacterial Lipopolysaccharide. *Journal of Endodontics*; 19(2):76-78.
10. Souza V, Bernabe PFE and Holand R 1989. Tratamento nao cirurgico de dentes comlesos periapiciais. *Revista Brasileira de Odontologia*; 46:39-46.
11. Haenni S, Schmidlin PR, Mueller B, Sener B, Zehnder M 2003. Chemical and antimicrobial properties of calcium hydroxide mixed with irrigating solutions. *International Endodontic Journal*;36(2):100-105.
12. Saatchi M, Ali S, Hooman N, Mohammad RM and Hasan S 2014. Antibacterial effect of calcium hydroxide combined with chlorhexidine on *Enterococcus faecalis* : a systematic review and meta-analysis. *Journal of applied Oral Science*; 22(5): 356–365.
13. Schafer E & Bossmann K 2005. Antimicrobial Efficacy of Chlorhexidene and two Calcium Hydroxide Formulations against *E. Fecalis*. *Journal of Endodontics*; 31(1):53-56.
14. Signoretti C, Fernanda G, Brenda P, Figueiredo DAG, Francisco M, Fernanda BT, Rogério CJP and Porto A 2011. Influence of 2% chlorhexidine gel on calcium hydroxide ionic dissociation and its ability of reducing endotoxin. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*; 111(5): 653–658.
15. Lindskog S, Pierce AM, Blomlof L 1998. Chlorhexidine as a root canal medicament for treating inflammatory lesions in the periodontal space. *Endod Dent Traumatol*; (14):186-190.
16. \*CONSORT Statement 2010-check list:<http://www.concort-statement.org/concort-statement/>