A study on different irrigation systems for removal of intracanal medicaments

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Abstract

Background: To evaluate different irrigation systems for removal of intracanal medicaments.

Materials & Methods: A total of forty freshly extracted mandibular premolars were enrolled. Each tooth was longitudinally divided into two sections, with careful removal of any debris. Subsequently, the two halves were reassembled and filled with $Ca(OH)_2$ before being split into four distinct groups. For Group III, the teeth received irrigation with 5 mL of 2.5% NaOCl, along with the application of an ultrasonic unit. In Group IV, the teeth were irrigated using 5 mL of 2.5% NaOCl, and a CanalBrush was employed to eliminate the $Ca(OH)_2$.

Results: The research involved 40 specimens, divided into four distinct groups. The quantity of remaining $Ca(OH)_2$ was observed to be highest in Group I, followed by Group II and Group III. Group IV displayed the least amount of remaining $Ca(OH)_2$.

Conclusion: The CanalBrush and ultrasonic methods demonstrated notable superiority compared to the other irrigation groups.

Keywords: Canalbrush, Ultrasonic, Calcium hydroxide.

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Introduction

The occurrence of microorganisms into the root canal system plays a major role for the development of pulpal and periapical diseases of the tooth, so the elimination or removal of this microorganisms from root canal systems is considered one of the main goal of endodontic treatments. [1] The elimination of all microorganisms from the root canal system is accomplished by mechanical instrumentation supported by various irrigating solutions and placement of the different intracanal medicaments. [2] Although cleaning and shaping of root canal by means of mechanical instrumentation have been shown to significantly reduce the number of bacteria in infected canals, complete disinfection of the root canal is difficult to achieve. [3]

Calcium hydroxide {$Ca(OH)_2$ } has been widely accepted as the most frequently used intra-canal medicament owning to its antimicrobial properties, inhibition of osteoclast activities and favorable tissue repair response. [4] All interappointment dressing placed inside the root canal have to be removed before obturating the canals. [5] In vitro studies have shown that remnant calcium hydroxide hinder the penetration of sealers into dentinal tubules, hinder the bonding of resin sealer adhesion to the dentin, interact with zinc oxide eugenol sealers, increase the apical leakage of root canal treated teeth. [6,7] The elimination may be obtained by the mechanical action of instruments in reaming motion and the chemical and physical action of irrigants. [8] Several studies have been done to assess the efficacy of various devices or techniques in removal of intra-canal dressing. [6,7]

Several techniques have been proposed to remove the $Ca(OH)_2$ dressing from the root canal system, including the use of endodontic hand files, sonic activation, passive ultrasonic irrigation, the CanalBrush System, and nickel-titanium (NiTi) rotary instruments. [6,8,9] The most commonly described method for removing $Ca(OH)_2$ is instrumentation along with sodium hypochlorite (NaOCl) and ethylenediaminetetraacetic acid (EDTA) irrigant solutions combined with use of a "master apical file" at working length (WL). [10] However, there is still no consensus as to which is the best method for removal. Hence, this study was conducted to evaluate different irrigation systems for removal of intracanal medicaments.

Materials & Methods:

A total of forty freshly extracted mandibular premolars were enrolled. Each tooth was longitudinally divided into two sections, with careful removal of any debris. Subsequently, the two halves were reassembled and filled with $Ca(OH)_2$ before being split into four distinct groups. In Group I, the teeth were subjected to irrigation using 5 mL of 2.5% sodium hypochlorite (NaOCl) and 5 mL of 17% ethylenediaminetetraacetic acid. Group II underwent irrigation with 5 mL of 2.5% NaOCl, followed by utilizing a rotary ProTaper F3 instrument. For Group III, the teeth received irrigation with 5 mL of 2.5% NaOCl, along with the application of an ultrasonic unit. In Group IV, the teeth were irrigated using 5 mL of 2.5% NaOCl, and a CanalBrush was

employed to eliminate the $Ca(OH)_2$. Following these procedures, the quantity of remaining $Ca(OH)_2$ was assessed, and the obtained results were analyzed using SPSS software.

Results:

The research involved 40 specimens, divided into four distinct groups. The quantity of remaining $Ca(OH)_2$ was observed to be highest in Group I, followed by Group II and Group III. Group IV displayed the least amount of remaining $Ca(OH)_2$. Both Groups III and IV showed comparable effectiveness in $Ca(OH)_2$ removal, which was markedly superior to the removal methods employed in Groups I and II. However, no significant distinction in $Ca(OH)_2$ removal was noted between Groups I and II.

Table 1: Percentage of $Ca(OH)_2$ remaining in the root canals

Group	Number	Mean	P- value
NaOCl EDTA	10	48.95	<0.001*
Pro Taper	10	34.20	
Ultrasonic	10	22.85	
CanalBrush	10	21.75	

*: significant

Discussion:

Calcium hydroxide has been widely used in endodontic treatment as an intracanal medicament, due to its antimicrobial properties against the most of the endodontic microorganisms and its biological effects and also for their capacity to inactivate bacterial endotoxins. [11] Removal of $Ca(OH)_2$ medicament from root canals are necessary because the remnant of $Ca(OH)_2$ on the canal walls will influence dentine bond strength and also harmfully affect the quality of root filling material. Therefore, it has to be completely removed before obturation of the root canals is suggested. [12] Hence, this study was conducted to evaluate different irrigation systems for removal of intracanal medicaments.

In the present study, the research involved 40 specimens, divided into four distinct groups. The quantity of remaining $Ca(OH)_2$ was observed to be highest in Group I, followed by Group II and Group III. Group IV displayed the least amount of remaining $Ca(OH)_2$. A study by Parikh M et al, after study selection, 61 were assessed for eligibility. Of these, 13 met the inclusion criteria and were included in the systematic review. Since significant heterogeneity was found in the methodologies, it was not possible to conduct a meta-analysis. On the basis of available evidence, we determined that Endoactivator irrigation technique showed better performance in removing $Ca(OH)_2$ intracanal medicaments from middle third and coronal third area of the root canals and Endovac irrigation technique showed better performance from the apical third area of the root canals. [13]

In the present study, both Groups III and IV showed comparable effectiveness in $Ca(OH)_2$ removal, which was markedly superior to the removal methods employed in Groups I and II. However, no significant distinction in $Ca(OH)_2$ removal was noted between Groups I and II. Another study by Khademi AA et al, access cavities were prepared in 50 single-rooted anterior teeth. Cleaning and shaping were done using the Flexmaster rotary system up to size no. 30, 6%. The canals were filled with injectable calcium hydroxide (calcipex). After 7 days, the calcium hydroxide were retrieved using RinsEndo system in Group 1 (n = 20), with PUI system in Group 2 (n = 20). In positive control group (n = 5), no irrigation was performed. In negative control group (n = 5), root canals were not filled with any medicament. Following the removal of the calcium hydroxide with these two systems, teeth were split buccolingually into two sections and every third of the root canals was evaluated under stereomicroscope (×30) to analyze the residual medicament in each segment. There was no significant difference in the removal of calcium hydroxide between RinsEndo and PUI at cervical (P = 0.67), middle (P = 0.51) and apical (P = 0.75) part of the root canals. None of the irrigation techniques was able to completely remove calcium hydroxide from the root canal system. [14] Bhuyan AC et al, studied twenty-four freshly extracted mandibular premolars were instrumented using ProTaper rotary instruments. The teeth were longitudinally split into two halves, cleaned of debris. The two halves were then reassembled and filled with $Ca(OH)_2$ and were divided into four groups. In Group I, the teeth were irrigated with 5 mL of 2.5% sodium hypochlorite (NaOCl) and 5 mL of 17% of ethylenediaminetetraacetic acid. In Group II, the teeth were irrigated with 5 mL of 2.5% NaOCl and a rotary ProTaper F3 instrument was used. In Group III, the teeth were irrigated with 5 mL of 2.5% NaOCl and agitated using an ultrasonic unit. In Group IV, the teeth were irrigated with 5 mL of 2.5% NaOCl and a CanalBrush was used to remove $Ca(OH)_2$. CanalBrush and ultrasonic techniques showed significantly less residual $Ca(OH)_2$ than irrigants and rotary techniques. There was no significant difference between the rotary and irrigant techniques. None of the techniques used were completely able to remove $Ca(OH)_2$ from the root canals. But the CanalBrush and ultrasonic techniques were significantly better than the rotary instrument and irrigant groups. [15] Standardization of the canals was attained through their repeated use, thus eliminating the variables of canal morphology. [8] To date, few studies have evaluated the influence of rotary instruments on dressing removal. Kenee et al. [16] evaluated the amount of $Ca(OH)_2$ remaining in mesial canals of molars after removal with NaOCl and EDTA irrigation, hand files (size 35), rotary instrumentation (Profile System, instrument size 35, 0.04 taper), or ultrasonics (using a size 15 file). They found that rotary and ultrasonic techniques removed significantly more residues than the hand file and irrigating solution techniques. Kuga et al. [17] compared the efficacy of three rotary systems (K3, ProTaper and Twisted File systems) to remove $Ca(OH)_2$ from the root canal and found no significant difference between the three systems. Rödig et al. [18] compared the effectiveness of RinsEndo and ultrasonic irrigation for removal of calcium hydroxide and Ledermix paste from root canal. They split the teeth longitudinally and prepared a groove in the apical part of one segment and then all root halves were reassembled. There was no significant differences between RinsEndo and ultrasonic in the

removal of calcium hydroxide and Ledermix from root canal. Maalouf et al. [19] compared the removal efficiency of calcium hydroxide dressing from the root canal with RinsEndo, ultrasonic and syringe. They found no statistically significant difference among the irrigation techniques in the whole canal.

Conclusion:

The CanalBrush and ultrasonic methods demonstrated notable superiority compared to the other irrigation groups.

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