



EFFICACY OF DIFFERENT IRRIGATING SOLUTIONS IN REMOVING THE INTRA CANAL MEDICAMENT FROM ROOT CANALS WITH AND WITHOUT ULTRASONIC ACTIVATION: AN IN VITRO STUDY

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ABSTRACT

Many irrigation solutions and irrigation devices and protocols have been proposed for removal of CaOH₂ dressing. The most frequently described method for removal of Ca(OH)₂ from the root canal is instrumentation of the root canal with the master apical file in combination with copious irrigation of sodium hypochlorite (NaOCl) and EDTA. The aim of this study was to evaluate the removal efficiency of a Ca(OH)₂ by 5% sodium hypochlorite and 17% EDTA, Qmix and SmearClear with and without activation by ultrasonic U file. One hundred twenty premolars were prepared with ProTaper files under irrigation with 5% NaOCl, with a master apical file F3 in all samples. Then, the canals were filled with a pasted of CaOH₂ (Calplus) and sealed with temporary filling. The length of each split root was photographed with a Nikon digital camera attached to a stereomicroscope. A modified scoring system was defined to assess the quantity of the residue on the canal walls. Evaluation scales used were: score 0 – no visible remnants, score 1 – scattered remnants, score 2 – distinct masses, score 3 – densely packed remnants. Data was scored in table and mean percentage calculated. The differences between techniques were evaluated by Mann-Whitney U test. The level of significance was set at P < 0.05. None of the techniques used in this study removed the inter-appointment root canal medicaments effectively. The results indicate that PUI with NaOCl, QMix or SmearClear as irrigant was more effective in removal of Ca(OH)₂ paste from canals than the irrigants alone.

Keywords: calcium hydroxide, irrigation, Ultrasonic

Introduction

The use of intracanal dressing to disinfect the root canal system has been advocated to enhance the success of root canal treatment. Calcium hydroxide (Ca(OH)₂) is used widely as an intracanal medicament between treatment sessions because of its well-documented antibacterial activity.¹ When medicaments are used between visits, a natural concern that arises is the extent to which all traces of the medicament can be removed from the canal, so as not to interfere with the placement, setting or polymerization of the materials used for the final root canal filling.² Moreover, there is evidence that these residues may react with zinc oxide and eugenol-based cements, forming

calcium eugenolate, which hinders the penetration of cement into the dentin tubules.³ Many irrigation solutions and irrigation devices and protocols have been proposed for removal of CaOH₂ dressing.^{4,5} The most frequently described method for removal of Ca(OH)₂ from the root canal is instrumentation of the root canal with the master apical file in combination with copious irrigation of sodium hypochlorite (NaOCl) and EDTA.⁶ However, none of the above techniques is efficient in removing all the material from the canal walls, leaving up to 45% of the root canal surface covered with remnants. Studies have showed that irrigation with sodium hypochlorite alone is not efficient

to remove CH medication.⁷ Considering the importance of the complete removal of intracanal dressing before root canal filling and with the introduction of newer irrigants into market, present study was undertaken with the aim of checking the efficacy of these solutions with an adjunct ultrasonic activation to clean the canals of CaOH₂ intracanal medicament. The aim of this study was to evaluate the removal efficiency of a Ca(OH)₂ by 5% sodium hypochlorite and 17% EDTA, Qmix and SmearClear with and without activation by ultrasonic U file.

Materials and methodology

One hundred twenty freshly extracted single rooted mandibular and maxillary premolars were used. Criteria for tooth selection included: a single root canal, no visible root caries, fractures or cracks, no signs of internal or external resorption or calcification and a completely formed apex. The teeth were decoronated, working length established by passing a #10K file through apex. The working length was established 1.0 mm short of the total tooth length and confirmed radiographically. Cleaning and shaping of the root canal was performed with ProTaper System, under irrigation with 5% NaOCl, with a master apical file F3 in all samples. A single operator instrumented all teeth, which were held in the hand. The solution was removed by aspiration and the canals were dried with paper points. Then, the canals were filled with a paste of CaOH₂(Calplus) and sealed with temporary filling. Radiographs were taken in mesiodistal and buccolingual directions to confirm complete filling of the root canals. Teeth were stored at 37°C and 100% relative humidity for 10 days. Teeth were divided randomly into six experimental groups with 20 samples in each. Groups 1A for 5% Sodium hypochlorite and 17% EDTA irrigation with ultrasonic activation, Group 1B for 5% Sodium hypochlorite and 17% EDTA, Group 2A for

QMix irrigation with ultrasonic activation, Group 2B for QMix irrigation, and Group 3A for Smear Clear irrigation with ultrasonic irrigation and Group 3B for Smear Clear irrigation. These irrigants were delivered using either a conventional 27 gauge open-ended notched needle tip. The roots were grooved longitudinally from buccal and lingual directions at the maximum buccolingual diameter without entering the root canal, and were split into halves with a pair of pliers. Sections were cleaned from any remaining dust with a short blast of air.

Digital image analysis

The length of each split root was photographed with a Nikon digital camera attached to a stereomicroscope with the image showing the entire length of the root. Images were analysed using Image J software. A single examiner evaluated the cleanliness of root canal walls, by assigning each specimen with a score. A modified scoring system was defined to assess the quantity of the residue on the canal walls. Evaluation scales used were: score 0 – no visible remnants, score 1– scattered remnants, score 2 – distinct masses, score 3 – densely packed remnants. Remnants were evaluated in each third of all sections (apical, middle, cervical) and the highest score observed was recorded.⁶

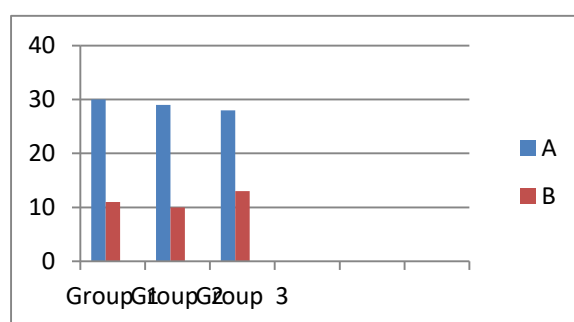
Results

Statistical analysis was performed by Statistical Package for Social Sciences (SPSS) 11.5 software (SPSS Inc., Chicago, IL, United States). Data was scored in table and mean percentage calculated. The differences between techniques were evaluated by Mann-Whitney U test. The level of significance was set at P< 0.05. The results of the study are shown in Table 1. Remnants of medicament were found in all experimental teeth and none of the groups showed complete removal of Ca(OH)₂ dressing.

Table 1:

Group	N	Score				Percentage mean
		Score 0	Score 1	Score 2	Score 3	
Group 1A	20	2	4	10	2	30
Group 1B	20	0	16	4	0	11
Group 2A	20	0	2	6	12	29
Group 2B	20	0	10	8	2	10
Group 3A	20	0	2	8	10	28
Group 3B	20	0	6	8	6	13

Intra group comparison regarding presence of CH residues on root canals walls shows statistically significant difference ($p < 0.05$) between Group 1A and 1B, Group 2A and 2B and between Group 3A and 3B. While as the inter group comparison shows statistically insignificant difference between different groups.



Graph1:

Discussion

Intracanal medicaments used in clinical practice should have good antimicrobial activity, ensure effective sealing of root filling material and be easy to introduce and remove from the root canal system. Depending on the filling material used and the type of sealer selected for obturation the remnants of calcium hydroxide could interfere with its adaptation on the canal walls and jeopardize the outcome of the root canal treatment.⁹ In addition to chemical cleansing of the root canal by different irrigants, mechanical agitation by various methods should be used to clean canals of the intracanal medicament. Traditionally the same irrigation protocol used for cleaning and shaping of canals is used to remove intracanal medicament. The effectiveness of newly introduced QMix and SmearClear irrigants have not been studied. Previous studies have reported that use of ultrasonic irrigation improves the removal of CH from the root canal system.¹⁰ Hence, in the present study irrigants were agitated with the use of

ultrasonic tips. Passive ultrasonic irrigation is based on the transmission of energy from an ultrasonically oscillating instrument to the irrigant inside the root canal.¹¹ In the present study, a scoring system was used to facilitate comparison among groups instead of calculating the percentage ratio of medicament coated surface area to the total canal surface area as previously reported.⁴ In this study, the complete removal of calcium hydroxide pastes from the canal walls was not obtained, leaving remnants mostly in the apical third, regardless of the irrigant and agitation method used. This result is similar to the findings of previous studies, which showed considerable amounts of calcium hydroxide lingering on the canal walls, notwithstanding the removal technique used.^{4,9,12-14} Calcium hydroxide paste was significantly more effectively removed from the root canal when using irrigation delivered agitation by ultrasonic U file. The results indicate that PUI with NaOCl, QMix or SmearClear as irrigant was more effective in removal of Ca(OH)₂ paste from canals. During ultrasonic activation, acoustic microstreaming

and cavitation can occur which cause a streaming pattern within the root canal from the apical to the coronal. Because of this microstreaming, more dentine debris can be removed from the root canal compared with syringe delivery of the irrigant.¹⁵The results of the present study emphasize the importance of using ultrasonic activation of irrigants.

Conclusion

None of the techniques used in this study removed the inter-appointment root canal medicaments effectively. The use of the passive ultrasonic activation by U file facilitated removal of the calcium hydroxide intracanal medicament by three different irrigants used in this study.

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