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Original Research

The efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals: A comparative study

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***ABSTRACT*:**

Background: The presence of microbes within the root canal plays a key role in causing endodontic infections. The main aim of root canal therapy is getting a microbial diminution and subsequent elimination of their byproducts from the root canal system. 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. **Aim of the study:** To study efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals. **Materials and methods:** The study was conducted in the Department of Conservative Dentistry and Endodontics of Dental Institution. For the study we selected 50 extracted maxillary central incisors. Teeth with incompletely formed apex and having morphological and structural anomalies were excluded from the study. The selected teeth were immersed in sodium hypochlorite solution for 3 days to remove any organic debris. In Group 1, the removal of $_{CaOH2}$ paste was done manually using Size 30 Flexo file and NaOCl as irrigant. In Group 2, the removal of $_{CaOH2}$ paste was done using ultrasonic instrumentation and NaOCl as irrigant. After, removal of calcium hydroxide, evaluation of empty canals was done by taking radiographs of roots. **Results:** We observed that on comparing the gray values before application and after application, there was a statistically significant difference which means after removal of $_{CaOH2}$ from the canals, the canals did not attain its previous empty state. We observed that the difference was statistically non-significant between both the techniques. **Conclusion**: Within the limitations of the present study, it can be concluded that both the techniques for removal of calcium hydroxide from the root canals are quite efficient.

Keywords: Root canal medicaments, Calcium Hydroxide, Root canals, Endodontic medicament

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INTRODUCTION

The presence of microbes within the root canal plays a key role in causing endodontic infections. The main aim of root canal therapy is getting a microbial diminution and subsequent elimination of their byproducts from the root canal system. However, chemo-mechanical debridement cannot completely eliminate the microbes from the root canal. Hence, the use of intracanal medicaments has been recommended.[1,2] CH is commonly used as an intracanal medicament with excellent antibacterial activity against most of the commonly seen bacterial strains identified in root canal infections. CH along with a suitable vehicle, and placed in the root canal for several days or weeks, has been widely accepted in endodontic therapy. However it should be completely removed before the final obturation of the root canals because its remnants may prevent the penetration of the sealers into the dentinal tubules, hinders the sealer adhesion to dentin, and may increase the micro apical leakage of the canal obturation.[3] 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.[4, 5, 6] Hence, the present study was conducted to study efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals.

MATERIALS AND METHODS

The study was conducted in the Department of Conservative Dentistry and Endodontics of Dental Institution. The ethical approval for the study was obtained from ethical committee of the institute before commencing the study. For the study we selected 50 extracted maxillary central incisors. Teeth with incompletely formed apex and having morphological and structural anomalies were excluded from the study. The selected teeth were immersed in sodium hypochlorite solution for 3 days to remove any organic debris.

The root canals were prepared using NiTi rotary files at standardized canal length of 21 mm. during the canal preparation, the canals were irrigated using normal saline with 27 gauze needles. The smear layer was removed using NaOCl (5%) and EDTA as final irrigants. Paper points were used to dry the canals. After completion of canal preparation, canals were filled with Calcium Hydroxide ($_{CaOH2}$). Evaluation of the quality of filling was assessed by radiographs.

After sealing the access cavity, the teeth were placed in an incubator at 37^0C for 30 days. After 30 days, teeth were removed from incubator and were divided into two groups, Group 1 and Group 2 based on the method of removal of $_{CaOH2}$ from the canal. In Group 1, the removal of $_{CaOH2}$ paste was done manually using Size 30 Flexo file and NaOCl as irrigant. In Group 2, the removal of $_{CaOH2}$ paste was done using ultrasonic instrumentation and NaOCl as irrigant. After, removal of calcium hydroxide, evaluation of empty canals was done by taking radiographs of roots. The optical thickness of radio opaque area was recorded in view of a size of 256 conceivable shades of grey, with dark symbolizing zero and white symbolizing 255.The statistical analysis of the data was done using SPSS software for windows. Chi square test and Student's t-test were employed to ensure statistical significance of the data. A P-value of less than 0.05 was predetermined to be statistical significant.

RESULTS

A total of 50 extracted maxillary central incisors were used in the study. The teeth were grouped into 2 groups, Group 1 and Group 2. **Table 1** represents the gray values for both the groups comparing gray values before application of $_{CaOH2}$ and after removal of $_{CaOH2}$. We observed that on comparing the gray values before application and after application, there was a statistically significant difference which means after removal of $_{CaOH2}$ from the canals, the canals did not attain its previous empty state ($p<0.05$). This difference was observed in both the techniques used. We observed that the difference was statistically non-significant between both the techniques ($p>0.05$). **[Figure 1]**

Table 1: Comparative evaluation of mean gray level at canals for Group 1 and 2 for both techniques

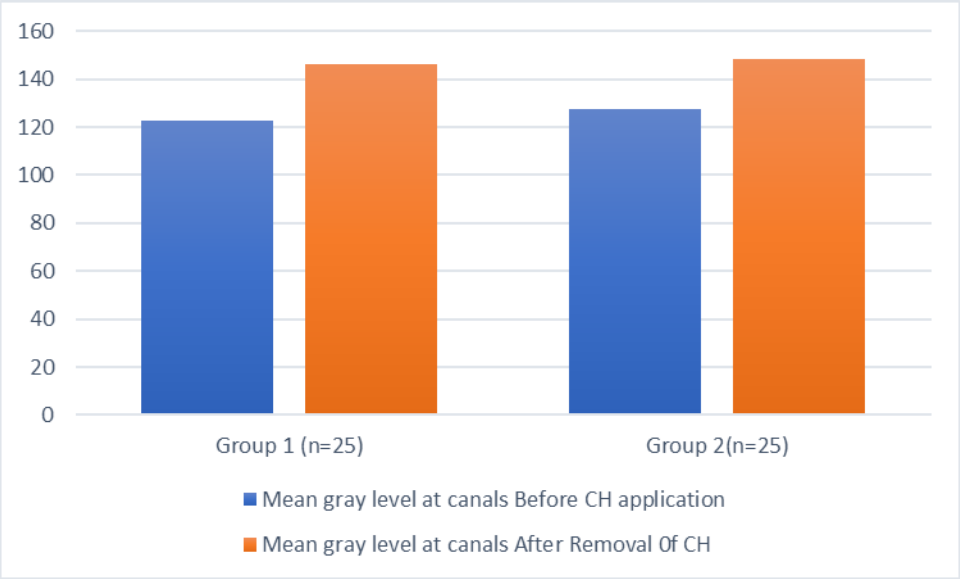
Technique for removal of $_{CaOH2}$	Mean gray level at canals		P value
	Before CH application	After Removal 0f CH	
Group 1 (n=25)	122.45±20.020	146.14±22.65	0.098
Group 2(n=25)	127.38±22.65	148.56±20.56	

DISCUSSION

The present study was planned to compare the efficacy of manual and ultrasonic techniques for removal of Calcium hydroxide from canals. We observed that both the techniques were significantly efficient in removal of Calcium hydroxide from the canals. The results are significant. On comparing both the techniques we conclude that ultrasonic technique is slightly more efficient in removal of calcium hydroxide from the canals but the results were statistically non-significant. The results were compared to other similar studies from the literature.

Bhuyan AC et al evaluated the effectiveness of different techniques in removing calcium hydroxide (Ca(OH)2) from the root canal. 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 ethylene diaminetetraacetic acid.

Fig 1: Showing comparative evaluation of mean gray level at canals for Group 1 and 2 for both techniques



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. The roots were disassembled, and photographs were taken.

The amount of residual Ca(OH)2 was calculated using an image analysis software as a percentage of the total canal surface area. 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. They concluded that 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. Kourti E et al compared the efficiency of different irrigations systems to remove calcium hydroxide from root canal walls, especially from the apical third by using scanning electron microscopy (SEM). Eighty-four single-rooted teeth were divided into 4 groups of 20 teeth each, according to different irrigation protocols using a 30-gauge slot-tipped needle, ultrasonic irrigation system, erbium-doped yttrium aluminum garnet laser (Er: YAG) laser, and EndoVac system. The rest 4 teeth were used as control groups (2 positive and 2 negative control groups). After coronal access, all teeth were instrumented by Protaper Next rotary files (Dentsply-Maillefer, Ballaigues, Switzerland) up to size X3, followed an irrigation protocol and filled with pure calcium hydroxide powder mixed with saline. Teeth were stored in an incubator for 7 days, and then, calcium hydroxide was removed using 3 techniques: Manually (Group 1), by ultrasonic irrigation (Group 2), by laser Er: YAG and x-pulse tip (Group 3), and by EndoVac system (Group 4). The teeth of control groups were instrumented as the experimental groups; no removal technique was applied in positive group, whereas in negative one, the root canals were left empty. Teeth were sectioned longitudinally and observed under SEM Results were statistically analyzed with the Kruskal–Wallis Test and Mann–Whitney Test. The results showed a significant difference between laser and the other three groups in coronal and middle root third, but no statistic difference in apical third. It was concluded that laser improved the removal of , calcium hydroxide in comparison with conventional techniques. [7, 8]

Khademi AA et al compared the efficiency of passive ultrasonic irrigation (PUI) and RinsEndo system in the removal of calcium hydroxide from root canal system. 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. Data were analyzed using the Kruskal-Wallis and Mann-Whitney tests. 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. It was concluded that none of the irrigation techniques was able to

completely remove calcium hydroxide from the root canal system. Tamil S et al compared the effectiveness of hand file (K-file), rotary file (HERO shaper), and passive ultrasonic irrigation (PUI; U-file) in removing Ca(OH)2 from the root canal. Thirty single-rooted teeth were collected and decoronated to standardize the length to 14 mm. Cleaning and shaping were conducted using HERO shaper rotary files (up to no. 25, 4% taper). Ca(OH)2 powder was mixed with normal saline and filled into the canals using lentulo spiral and the orifice was sealed with zinc oxide eugenol. After 7 days of incubation, samples were divided into three groups of 10 samples each: Group I (hand files)—no. 20 K-file; Group II (rotary files)—no. 25, 4% HERO shaper; Group III (PUI)—no. 20 U-file. Ca(OH)2 paste was removed using 2 mL of 3% sodium hypochlorite solution followed by 1-minute activation of the respective file system. All the samples were finally irrigated with 17% ethylenediaminetetraacetic acid and flushed with distilled water. Ultrasonic group was more effective in removing Ca(OH)2 followed by HERO shaper and hand file. It was concluded that PUI had the highest ability to remove Ca(OH)2 from the root canal walls.[9,10]

CONCLUSION

Within the limitations of the present study, it can be concluded that both the techniques for removal of calcium hydroxide from the root canals are quite efficient.

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