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Original Research

Comparison of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals

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***ABSTRACT*:**

Background: If the Ca(OH)2 is not completely removed prior to obturation, then it has negative effect on root canal therapy success because it interferes with zinc oxide-eugenol (ZOE) based sealers and results in reduced setting time as well as crack in the sealer because it is loosened faster. Different irrigation techniques have been in use to determine this problem. Clinically, most commonly used technique for removal of (Ca[OH]2) medicament is master apical file combined with numerous irrigation solutions. **Aim of the study:** To compare 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 120 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. 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 $CaOH_2$from the canal with 60 teeth in each group. In Group 1, the removal of $CaOH_2$paste was done manually using Size 30 Flexo file and NaOCl as irrigant. In Group 2, the removal of $CaOH_2$paste was done using ultrasonic instrumentation and NaOCl as irrigant. **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 $CaOH_2$ 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. **Conclusion**: Within the limitations of the present study, it can be concluded that complete removal of calcium hydroxide was not achieved with both the techniques, however, both the techniques are fairly successful in removal of calcium hydroxide from the root canals.

Keywords: Calcium hydroxide removal, root canal treatment, ultrasonic, NaOCl

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Introduction:

Existence of microorganisms, their products, or necrotic pulp tissue can cause pathologic changes, several lesions, and bone resorption in the periradicular tissues. Therefore, one of the most important goals of dentistry treatment is elimination of microorganisms. In a root canal therapy attempts should be made to eliminate microorganisms existing in root canal by different chemical and pharmaceutical methods. [1,2] Calcium hydroxide (Ca(OH)2) was first introduced into endodontics by Herman in 1920. [3] Todays, Ca(OH)2 is widely used to disinfect the root canal system because of its alkaline pH. If the Ca(OH)2 is not completely removed prior to obturation, then it has negative effect on root canal therapy success because it interferes with zinc oxide-eugenol (ZOE) based sealers and results in reduced setting time as well as crack in the sealer because it is loosened faster. [4] Different irrigation techniques have been in use to determine this problem. Clinically, most commonly used technique for removal

of (Ca[OH]2) medicament is master apical file combined with numerous irrigation solutions. [5] It has been reported that irrigation of root canals with sodium hypochlorite (NaOCl) irrigating solution and ethylenediaminetetraacetic acid (EDTA) irrigating solution achieved better results in removal of (Ca[OH]2) than NaOCl used alone. [6] Numerous studies have also confirmed that it is difficult to remove (Ca[OH]2) completely from root canals using different irrigation solutions alone. Hence, the present study was conductedto compare 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 120 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 ($CaOH_2$). 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 $CaOH_2$from the canal with 60 teeth in each group. In Group 1, the removal of $CaOH_2$paste was done manually using Size 30 Flexo file and NaOCl as irrigant. In Group 2, the removal of $CaOH_2$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 version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

Results:

A total of 120 extracted maxillary central incisors were used in the study. The teeth were grouped into 2 groups, Group 1 and Group 2. Group 1 and 2 had 60 patients each. In Group 1, Size 30 Flexo file and NaOCl as irrigantwas used for removal of $CaOH_2$. In Group 2, Ultrasonic instrumentation and NaOCl as irrigant were used for removal of $CaOH_2$[Table 1]. **Table 2** represents the gray values for both the groups comparing gray values before application of $CaOH_2$ and after removal of $CaOH_2$. We observed that on comparing the gray values before application and after application, there was a statistically significant difference which means after removal of $CaOH_2$ 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]**

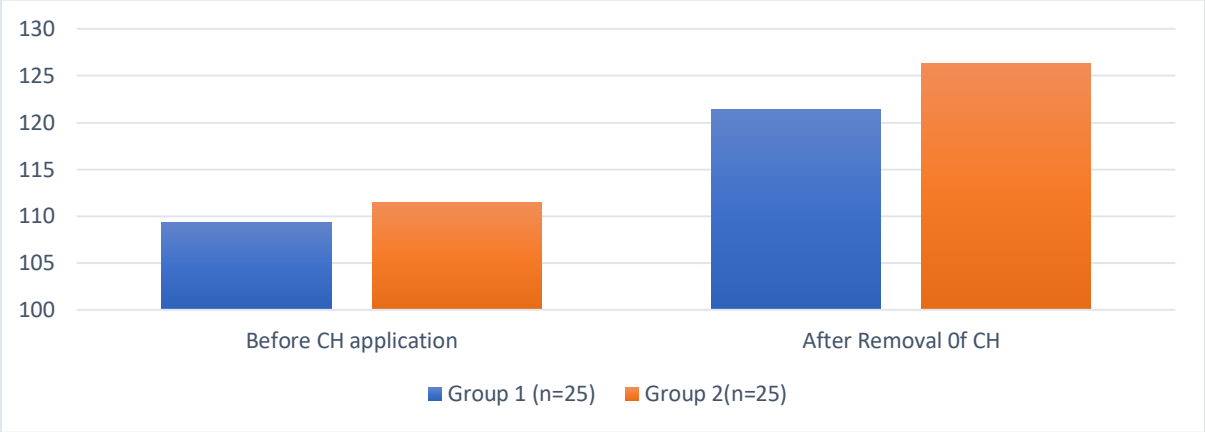
Table 1: Demographics of group 1 and 2

	Group 1	**Group 2**
Number of patients	60	60
Technique for removal of $CaOH_2$	Size 30 Flexo file and NaOCl as irrigant	Ultrasonic instrumentation and NaOCl as irrigant

Table 2: Mean gray level in canals for Group 1 and 2

Technique for removal of $CaOH_2$	**Mean gray level at canals**		**P value**
	Before CH application	**After Removal 0f CH**	
Group 1	109.29±7.04	121.41±4.05	0.028
Group 2	111.45±5.85	126.35±5.69	

Figure 1: Mean gray level



Discussion:

In the present study, removal efficacy of calcium hydroxide from root canals was studied in 120 maxillary incisor teeth. Two techniques were compared, first technique was removal of calcium hydroxide with Size 30 Flexo file and NaOCl as irrigant. Second technique was ultrasonic instrumentation and NaOCl as irrigant. We observed that even after the removal of calcium hydroxide, the root canals did not attain its previous state, thus, complete removal of calcium hydroxide was not achieved in either technique. Furthermore, we observed that the difference was statistically non-significant between both the techniques. The results were compared with previous studies from the literature and were fund to be consistent with the results. 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 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. 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. [7] 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. 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. There was no significant difference in the removal of calcium hydroxide between RinsEndo and PUI at cervical, middle and apical part of the root canals. They concluded that none of the irrigation techniques was able to completely remove calcium hydroxide from the root canal system. [8]

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). 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. They concluded that laser improved the removal of calcium hydroxide in comparison with conventional techniques. [9] 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. 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. They concluded that ultrasonic

group was more effective in removing Ca(OH)2 followed by HERO shaper and hand file. [10]

Kirar DS et al compared different irrigation and agitation methods for the removal of two types of calcium hydroxide medicaments from the root canal walls. Fifty extracted single rooted teeth were selected for this study. Samples were randomly divided into four groups. Group 1 (n=20) were filled completely with water based calcium hydroxide (CH), Group 2 (n=20) were filled with oil based CH using lentulo spiral, Group 3 (n=5) - the positive control group received the CH as intracanal medication, but no subsequent removal, Group 4 (n=5) - the negative control did not receive CH placement. Further on, Group 1 and Group 2 were divided into four sub-groups (n=5). In sub-group A we performed conventional syringe irrigation with side-vented needle sub-group B) manual dynamic agitation, sub-group C sonic agitation using endoactivator, sub-group D passive ultrasonic irrigation (PUI). Statistically significant differences were not found between the experimental groups and the negative group in any one third of the root canal. However, a difference did exist between the experimental groups and the positive control group. None of the experimental groups totally removed CH substances from root canal walls. They concluded that among all experimental groups, removal of CH was best achieved by sonic agitation using endoactivator followed by passive ultrasonic irrigation (PUI), manual dynamic agitation and conventional syringe irrigation with side-vented needle. [11]

Conclusion:

Within the limitations of the present study, it can be concluded that complete removal of calcium hydroxide was not achieved with both the techniques, however, both the techniques are fairly successful in removal of calcium hydroxide from the root canals.

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