

## Original Research

### Comparative analysis of efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals

Dr. Junaid Mohi u din<sup>1</sup>, Dr. Novsheba Showkat<sup>2</sup>

<sup>1</sup>Second year post graduate student, Dept. of conservative dentistry and endodontics, Govt. Dental College, Srinagar, Jammu and Kashmir, India;

<sup>2</sup>Private Consultant Endodontist, Srinagar, Jammu and Kashmir, India

#### ABSTRACT:

**Background:** Calcium hydroxide is the most common antimicrobial intracanal dressing used between the sessions of endodontic therapy, due to its antibacterial action and organic tissue dissolution capacity. Mechanical instrumentation with a master apical file (MAF) and copious irrigation with Sodium hypochlorite (NaOCl) and Ethylenediamine tetraacetic acid (EDTA) is the most frequently described method for the removal of CH from the root canal. However, several other methods have also been proposed over the years for e.g. Using rotary nickel-titanium (Ni-Ti) instruments, using a patency file, and using various devices for the agitation of an intracanal irrigating solution to increase its efficacy. **Aim of the study:** To compare 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 80 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. **Results:** The teeth were grouped into 2 groups, Group 1 and Group 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<sub>2</sub> from the canals, the canals did not attain its previous empty state. **Conclusion:** Within the limitations of the present study, it can be concluded that CaOH<sub>2</sub> removal from the root canals can be effectively done with manual instrumentation and ultrasonic technique. Both the techniques are equally effective.

**Keywords:** CaOH<sub>2</sub> removal, ultrasonic, root canal treatment

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**Corresponding author:** Dr. Novsheba Showkat , Private Consultant Endodontist , Srinagar ,Jammu and Kashmir, India.

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#### Introduction:

Calcium hydroxide is the most common antimicrobial intracanal dressing used between the sessions of endodontic therapy, due to its antibacterial action and organic tissue dissolution capacity.<sup>1</sup> Despite the unique properties, studies have advocated that calcium hydroxide should be removed totally before dentinal tubules obturation.<sup>2</sup> To date, there is no consensus on which method is the best for calcium hydroxide

removal. Several techniques have been described to remove calcium hydroxide from root canals. The most popular technique is instrumentation with the use of master apical file (MAF) at working length, in combination with copious irrigation.<sup>3</sup> Mechanical instrumentation with a master apical file (MAF) and copious irrigation with Sodium hypochlorite (NaOCl) and Ethylenediamine tetraacetic acid (EDTA) is the most frequently described method for the removal of

CH from the root canal.<sup>4</sup> However, several other methods have also been proposed over the years for e.g. Using rotary nickel-titanium (Ni-Ti) instruments, using a patency file, and using various devices for the agitation of an intracanal irrigating solution to increase its efficacy.<sup>5, 6</sup> Hence, the present study was conducted to compare 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 80 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<sub>2</sub>). Evaluation of the quality of filling was assessed by radiographs. After sealing the access cavity, the teeth were placed in an incubator at 37<sup>0</sup> C 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<sub>2</sub> from the canal. In Group 1, the removal of CaOH<sub>2</sub> paste was done manually using Size 30 Flexo file and NaOCl as irrigant. In Group 2, the removal of CaOH<sub>2</sub> 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.

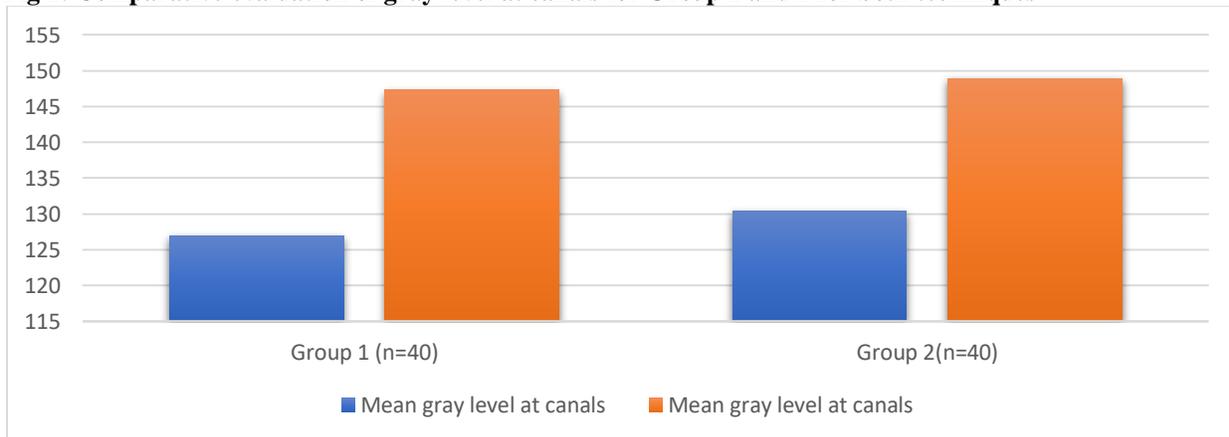
**Results:**

A total of 80 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 CaOH<sub>2</sub> and after removal of CaOH<sub>2</sub>. 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<sub>2</sub> 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: Comparison of gray level at canals**

Technique for removal of CaOH <sub>2</sub>	Mean gray level at canals		P value
	Before CH application	After Removal of CH	
Group 1 (n=40)	126.92	147.29	0.06
Group 2(n=40)	130.34	148.91	

**Fig 1: Comparative evaluation of gray level at canals for Group 1 and 2 for both techniques**



## 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. Parikh M et al systematically evaluated and summarized the outcomes of in vitro studies comparing Endoactivator irrigation and Endovac irrigation techniques for removing calcium hydroxide (Ca[OH]<sub>2</sub>) medicament from the root canals. The research question was developed according to the population, intervention, comparison, and outcome strategy. A computerized literature search was conducted in Medline, PubMed, Google Scholar, and Embase. A hand search of the reference lists of identified articles was performed to separate relevant articles. Two reviewers critically assessed the studies that fulfilled the inclusion criteria and processed. Evaluation of the risk of bias of the studies was performed independently by the two reviewers. 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. They concluded that Endoactivator irrigation technique showed better performance in removing Ca(OH)<sub>2</sub> 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. Bhuyan AC et al evaluated the effectiveness of different techniques in removing calcium hydroxide (Ca(OH)<sub>2</sub>) 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)<sub>2</sub> 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)<sub>2</sub>. The roots were disassembled, and photographs were taken. The amount of residual Ca(OH)<sub>2</sub> 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)<sub>2</sub> 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)<sub>2</sub> from the root canals. But the CanalBrush and ultrasonic techniques were significantly better than the rotary instrument and irrigant groups.<sup>7,8</sup>

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 (calcipect). 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, 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. 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)<sub>2</sub> 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)<sub>2</sub> 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)<sub>2</sub> 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)<sub>2</sub> followed by HERO shaper and hand file. It was concluded that PUI had the highest ability to remove Ca(OH)<sub>2</sub> from the root canal walls.<sup>9, 10</sup>

## CONCLUSION:

Within the limitations of the present study, it can be concluded that CaOH<sub>2</sub> removal from the root canals can be effectively done with manual instrumentation and ultrasonic technique. Both the techniques are equally effective.

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