

**ORIGINAL ARTICLE****Comparative Analysis of the Efficacy of Manual and Ultrasonic Technique for Removal of Calcium Hydroxide Medicament from Root Canals**Renu Bala<sup>1</sup>, Rajiv Bali<sup>2</sup>, Pranav Nayar<sup>3</sup>, Karanvir<sup>4</sup><sup>1</sup>PG student, <sup>2</sup>Principal and HOD, <sup>3</sup>Reader, <sup>4</sup>Senior lecturer, Department of Conservative Dentistry and Endodontics, Desh Bhagat Dental College, Mandi Gobindgarh, Punjab, India**ABSTRACT:**

**Background:** Calcium hydroxide (Ca(OH)<sub>2</sub>) has been shown to be an effective intracanal medicament during endodontic therapy. **Aim of the study:** To comparatively analyze the efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals. **Materials and methods:** On comparing the gray values before application and after application, there was a statistically significant difference which means after removal of Ca(OH)<sub>2</sub> from the canals, the canals did not attained its previous empty state. This difference was observed in both the techniques used. We observed that the difference was statistically non-significant between both the techniques. **Results:** We selected 30 extracted mandibular canines. Teeth with incompletely formed apex and having morphological and structural anomalies were excluded from the study. The root canals were prepared using NiTi rotary files at standardized canal length of 21 mm. After completion of canal preparation, canals were filled with Calcium Hydroxide (Ca(OH)<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°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 Ca(OH)<sub>2</sub> from the canal. 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. **Conclusion:** Within the limitations of current study we conclude that both the techniques are efficient in eliminating calcium hydroxide properly from the root canals.

**Keywords:** Calcium hydroxide, Endodontics, Root canal.

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**INTRODUCTION:**

Calcium hydroxide (Ca(OH)<sub>2</sub>) has been shown to be an effective intracanal medicament during endodontic therapy.<sup>1</sup> Various biological properties have been attributed to this substance, such as antimicrobial activity, high alkalinity, inhibition of tooth resorption, and tissue-dissolving ability. To be effective, it has to be adequately placed and condensed in the root canal space.<sup>2</sup> Although instrumentation procedures have improved considerably over the years, none of the existing techniques can completely clean the root canal system. Calcium hydroxide (Ca(OH)<sub>2</sub>) has been shown to be an effective intracanal medicament during endodontic therapy.<sup>3</sup> The elimination may be obtained by the mechanical action of instruments in reaming motion and the chemical and physical action of irrigants. Several studies have been done to assess the efficacy of various devices or techniques in removal of intra-canal dressing.<sup>4, 5</sup> However, conflicting results exist regarding the effectiveness of these techniques in removing the calcium hydroxide.<sup>6</sup> Hence, the present study is planned to comparatively analyze the 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 30 extracted mandibular canines. 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 (Ca(OH)<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°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 Ca(OH)<sub>2</sub> from the canal. In Group 1, the removal of Ca(OH)<sub>2</sub> paste was done manually using Size 30 Flexo file and NaOCl as irrigant. In Group 2, the removal of Ca(OH)<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 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 30 extracted mandibular canines 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 attained 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]

**DISCUSSION:**

All intra-canal interappointment dressing should be removed from the root canal walls prior to obturation. It has

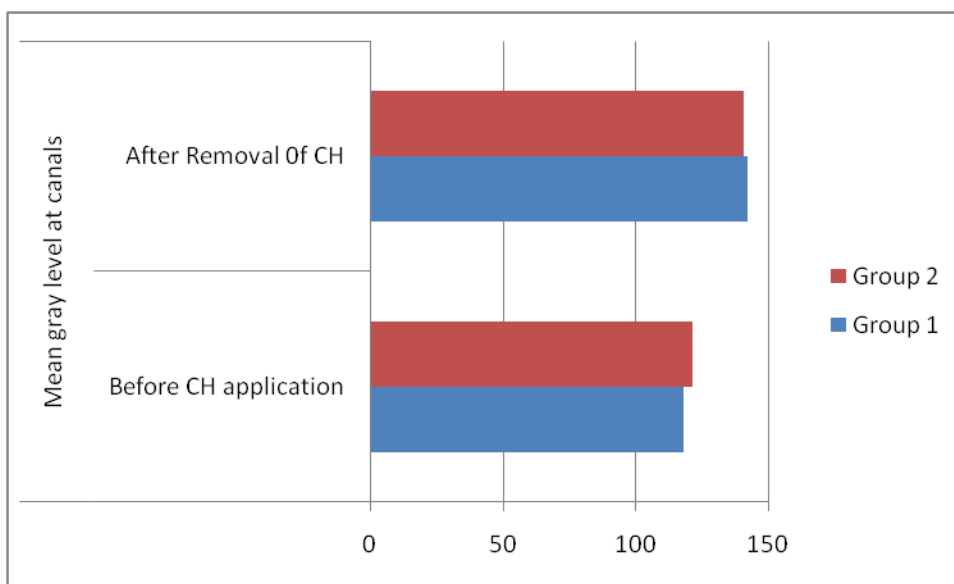
been reported that residual medicaments interact with the penetration of sealers into dentinal tubules, compromising the microleakage of the obturation.<sup>7, 8</sup> However, calcium hydroxide pastes are not easily removed from the root canal walls. The present study was planned to compare the efficacy 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.

Pabel AK et al compared four different techniques for removal of calcium hydroxide from straight root canals. One-hundred and ten extracted human teeth with straight root canals were prepared to ISO-size 50 and split longitudinally. Two lateral grooves were prepared, filled with calcium hydroxide and the root halves reassembled in a muffle. Calcium hydroxide was removed using one of five techniques: (1) passive ultrasonic irrigation, (2) hydrodynamic irrigation using RinsEndo®, (3) sonic irrigation using the EndoActivator®, (4) motor-driven plastic brush (CanalBrush™), and (5) manual irrigation with a syringe as the control group.

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

Technique for	mean gray level at canals removal of CaOH <sub>2</sub>		P value
	Before CH application	After Removal of CH	
Group 1 (n=15)	118.31±19.33	142.39±23.88	0.021
Group 2(n=15)	121.64±21.47	140.81±19.08	

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



Distilled water was used as irrigant. Cleanliness of the grooves was scored under a microscope with 40× magnification. For intraindividual reproducibility and interrater agreement, Cohens Kappa was calculated. Results of scoring were analyzed using a non-parametric test. Post hoc pairwise comparisons were used for irrigation techniques. Passive ultrasonic irrigation performed significantly better than all other groups in the apical groove. Significant differences were found between RinsEndo and CanalBrush and CanalBrush and syringe irrigation. In the coronal groove, passive ultrasonic irrigation performed significantly superior and hand irrigation performed significantly worse than all other groups. A statistically significant interaction was shown between irrigation technique and localization of the groove. The coronal grooves showed more remaining calcium hydroxide than the apical grooves. Complete removal of calcium hydroxide from the root canal could not be achieved with any of the techniques investigated. The highest degree of cleanliness resulted from the use of passive ultrasonic irrigation. Rödiger T et al compared the efficacy of ultrasonic irrigation and RinsEndo in removing calcium hydroxide and Ledermix paste from simulated root canal irregularities. The root canals of sixty extracted single-rooted teeth were prepared using FlexMaster rotary instruments to size 60, 0.02 taper. The roots were split longitudinally, and a standardized groove was prepared in the apical part of one segment. The teeth were randomly allocated into two groups (n = 30), according to the intracanal dressing. In the first group, grooves were filled with calcium hydroxide paste (Calxyl), whereas the grooves in the second group were filled with Ledermix paste. After reassembly, the root canals were completely filled with the respective medicament using a lentulo. The removal of medicament dressing was performed after 7 days with either passive ultrasonic irrigation or RinsEndo and 1% sodium hypochlorite for 3 min. The amount of remaining medicament was evaluated under a microscope with 30 × magnification using a four-grade scoring system. A regression analysis with  $P \leq 0.05$  was performed. Ledermix paste removal was significantly more effective than the removal of calcium hydroxide ( $P < 0.0001$ ), whereas irrigation technique was not a significant factor. The percentages of complete removal of calcium hydroxide and Ledermix paste were 11.7% and 51.7%, respectively. The authors concluded that none of the irrigation techniques was able to completely remove the intracanal medicaments from the apical part of the root canal. Irrespective of the irrigation technique, significantly less Ledermix paste was detected compared with calcium hydroxide.<sup>9, 10</sup>

Rödiger T in another study compared the efficacy of syringe irrigation, RinsEndo (Dürr Dental, Bietigheim, Germany) and passive ultrasonic irrigation (PUI) in the removal of dentinal debris from simulated irregularities in root canals with different apical sizes. Thirty extracted human premolars were randomly divided into three groups followed

by root canal preparation with rotary FlexMaster NiTi instruments to size 30, 0.02 taper (group 1), size 40, 0.02 taper (group 2) or size 50, 0.02 taper (group 3). The teeth were split longitudinally, and a standard groove and three hemispherical-shaped cavities were cut into the root canal halves. Grooves and cavities were filled with dentinal debris before each irrigation procedure and the root halves were reassembled. In all groups three different irrigation procedures were performed with 30 mL NaOCl (1%) and (i) syringe, (ii) RinsEndo and (iii) PUI. The amount of remaining debris was evaluated under a microscope with 30x magnification and a four score system. The data were analysed with a non-parametric analysis of covariance and multiple comparisons using the Tukey adjustment. Results Passive ultrasonic irrigation removed debris significantly better from the artificial canal irregularities than RinsEndo and syringe irrigation irrespective of the root canal diameter. Only in group 1 (30, 0.02 taper) the difference between PUI and RinsEndo was not statistically significant. RinsEndo demonstrated significantly better results than syringe irrigation in all groups. It was concluded that ultrasonic irrigation is more effective than syringe irrigation or RinsEndo in removing debris from artificial extensions in straight root canals. 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. After decoronation, the root canals of these teeth were prepared to the size F3 (30 no.) using rotary ProTaper file system. These 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). Roots were split longitudinally into mesial and distal halves. Digital images of the root canal walls were acquired by a Dental Operating Microscope (DOM) and assessed by using a scoring criteria at different thirds (coronal, middle and apical) of the root canal as follows: score 1, score 2, score 3, and score 4. Statistically significant differences were not found between the experimental groups and the negative group in any one third of the root canal. It was 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.<sup>11, 12</sup>

## CONCLUSION:

Within the limitations of current study we conclude that both the techniques are efficient in eliminating calcium hydroxide properly from the root canals.

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