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Original Article

Assessment of calcium hydroxide removal efficacy from root canal using two different techniques-An In vitro study

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***ABSTRACT*:**
Background: Calcium hydroxide (Ca(OH)2) is mainly used for intracanal material; it needs to be removed in entirety before obturation. However, complete removal of Ca(OH)2 is very difficult from canal walls resulting in its residues on canal wall which interfere with bonding of sealers and reduce success of root canal treatment. **Materials and Methods:** The present study included forty freshly extracted human mandibular canine teeth with intact mature apices. All teeth were prepared and Lentulo spiral was used to carry the Ca(OH)2 and placed into the canal until the medicament is seen at the apex of the working length. A cotton pellet is kept inside the access cavity and covered with temporary filling material. The teeth were categorized into two groups (20 each) as per the Ca(OH)2 dressing removing protocol used: Group A: EndoVac system, Group B: Rotary Files. After the preparation, all the sample teeth were sectioned buccolingually. Sectioning of the teeth was followed by observation of individual teeth under a stereo microscope (40X magnification). **Results:** EndoVac system (3.10± 0.14) showed the maximum removal of the medicament followed by Rotary Files (2.18 ± 0.62). A significant difference was found between the apical and coronal third of the root was noticed in EndoVac system with a P value of 0.001 statistically. There was no significant difference was observed with Rotary Files. **Conclusion:** On conclusion, Ca(OH)2 could not be completely removed in both the techniques. EndoVac system showed better calcium hydroxide removal efficacy from root canal.
Key words: Calcium hydroxide, EndoVac system, Root canal preparation, Rotary Files.

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INTRODUCTION:

Overwhelming evidence indicates that microorganisms have a fundamental role in the pathogenesis of periradicular diseases. To eliminate the remaining microbes after root canal preparation and to prevent an inter appointment reinfection of the root canal system, intracanal medications are recommended.[1] Calcium hydroxide [Ca(OH)2] has been widely used as an intracanal medication owing to its good antibacterial properties and biocompatibility. However, some studies have indicated that Ca(OH)2 inactivates endotoxin and impedes the increase in cytokine chemical inflammatory mediators to inhibit periapical inflammation after a root canal cleaning procedure.[2]

Calcium hydroxide (Ca(OH)2) was first introduced in endodontics by Herman in 1920. It is alkaline in nature with a pH of approximately 12.5. It has antimicrobial activity, has tissue dissolving ability and

inhibits tooth resorption.[3] It even leads to hard tissue formation. Because of these abilities, Ca(OH)2 has been recommended for use in several clinical situations, its most common indication is as an antimicrobial agent in endodontic therapy.[4]

However, removal of the Calcium hydroxide is as crucial as removal of smear layer and debris from the root canal before obturation as it will help in better adaptation of the filling material to the canal walls. The residue of Calcium hydroxide on root canal walls negatively affects the adaptation of the filling material to the root canal walls and influences the dentine bond strength.[5] So the present study was conducted to assess the calcium hydroxide removal efficacy from root canal using two different techniques.

MATERIALS AND METHODS:

The present study included forty freshly extracted human mandibular canine teeth with intact mature apices. All included teeth were single rooted with a single canal, which was confirmed with multiple angulated radiographs. Following extraction, all teeth were scaled with ultrasonic instruments, washed with distilled water, and immersed in 10% formalin solution until use. The crowns were removed at the cementoenamel junction with a water-cooled diamond disc at low speed to obtain a standardized root length of 15 mm.

The working length was determined 1 mm short of the length at which a #15 K file extruded apically. The root canals were prepared using hand ProTaper instruments (DENTSPLY‑Maillefer, Ballaigues, Switzerland) up to master apical file F3. Between each instrument, the canals were conventionally irrigated with 5 ml of 5.25% sodium hypochlorite (NaOCl) and rinsed with 5 ml 17% EDTA, followed by a final rinse of 5 ml distilled water. During the irrigation, the needle was used in an up‑down motion within the apical third. And dried using paper points. Lentulo spiral was used to carry the Ca(OH)2 and placed into the canal until the medicament is seen at the apex of the working length. A cotton pellet is kept inside the access cavity and covered with temporary filling material. All specimens were kept for 7 days at 37 ± 1°C with a relative humidity of 100%.

The teeth were categorized into two groups (20 each) as per the Ca(OH)2 dressing removing protocol used:

Group A: EndoVac system

Group B: Rotary Files

After the preparation, all the sample teeth were sectioned buccolingually using a carborundum disc preceded by fabrication of a groove on buccolingual direction with a diamond bur. Sectioning of the teeth was followed by observation of individual teeth under a stereo microscope (40X magnification).

STATISTICAL ANALYSIS

The data analysis was done using Kruskal-Wallis tests with the help of Statistical Packages for Social Sciences (SPSS) software, version 17.0 for Windows. The P value of less than 0.05 was considered significant statistically.

RESULTS:

Table 1 shows the mean and standard deviation of the two techniques used to remove the $Ca(OH)_2$ intracanal medicament. EndoVac system (3.10± 0.14) showed the maximum removal of the medicament followed by Rotary Files (2.18 ± 0.62).

Table 2 reveals the intracanal calcium hydroxide removal of two different techniques at Coronal and Apical third. A significant difference was found between the apical and coronal third of the root was noticed in EndoVac system with a P value of 0.001 statistically. There was no significant difference was observed with Rotary Files.

Table 1: Mean and standard deviation of two techniques

Groups	N	Mean± Std. Deviation
Group A- EndoVac system	20	3.10± 0.14
Group B- Rotary Files	20	2.18 ± 0.62

Table 2: Intracanal calcium hydroxide removal of two different techniques at Coronal and Apical third

Techniques	Coronal (Mean ± SD)	Apical (Mean ± SD)	K ANOVA Value	P value
EndoVac system	0.42 ± 0.08	2.68± 0.06	23.46	**0.001****
Rotary Files	0.72 ± 0.38	1.46± 0.24	24.40	0.08

** – Highly Significant

DISCUSSION:

Ca(OH)2 paste is an inorganic material that is commonly used as an intracanal medication during root canal therapy, due to its antimicrobial efficacy and biological properties. The only problem associated with Ca(OH)2 use is the accumulation of particles on the root canal wall. Failure to remove these particles increases canal permeability, which may interfere with the sealing ability of endodontic sealer, potentially leading to the failure of treatment. In addition, Ca(OH)2 remnants may cause an adverse chemical reactions with root canal sealer, rendering prognoses unpredictable.[6]

Root canal morphology and its complexities can affect the application and removal of CH. Hence, in the present study, the extracted single‑canal human teeth were used as the experimental model to compare the efficacy of different irrigation agents as well as different techniques for the removal of CH from the root canal walls.[7]

EndoVac is mainly used to deliver the irrigants safely till the apical portion using a negative pressure system, which optimally removes the smear layer and minimizes the seepage of the solution through the apical foramen. As recommended by the manufacturers, the microcannula is placed till the working length to suction the sufficient volume and to displace debris and remove the smear layer.[8]

The current study showed the efficacy of the EndoVac system significantly better in calcium hydroxide removal compared to Rotary Files at the apical and coronal third. These results were similar to the SA Turker et al[9]'s study, which proved that the EndoVac has better flushing mechanism and vacuum aspiration effect during calcium hydroxide removal from the apical third. Furthermore, the microcannula orifices may help the Ca(OH)2 to exit, which in turn helps in removal of the medicament form apical third.

In the present study, Ca(OH)2 was removed more effectively in the apical third of the root. Similar to our finding, Fariniuk *et al*[10]. in a study found that apical third exhibited smaller amount of remaining filling material as compared to coronal third.

CONCLUSION:

On conclusion, Ca(OH)2 could not be completely removed in both the techniques. EndoVac system showed better calcium hydroxide removal efficacy from root canal.

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