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

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Abstract

Background: Microorganisms are the cause of apical inflammatory lesions, and the goal of endodontic treatment is the prevention and control of pulpal and periradicular infections. Incomplete removal of CH medicaments from root canal surface, prevents the sealer from penetrating into the dentinal tubules, interferes with the normal setting reaction resulting in potential reduction of sealer adaptation, thus, affecting the seal of obturating material leading to microleakage and subsequent treatment failure. Hence; the present study was undertaken for comparatively evaluating the efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals. Materials & methods: A total of 40 freshly extracted mandibular first premolars were included in the present study. After completion of canal preparation, canals were filled with Calcium Hydroxide (CH). Evaluation of the quality of filling was assessed by radiographs. All the specimens were divided into two study groups with 20 specimens in each group as follows: Group A: Specimens in which CH was removed manually using Flexo files and irrigant, and Group B: Specimens in which CH was removed with ultrasonic instrumentation. 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. Results: Mean gray levels at canals before CH application and after CH removal among specimens of Group A was 124.51 and 148.36 respectively. Mean gray levels at canals before CH application and after CH removal among specimens of Group B was 125.42 and 147.77 respectively. Significant results were obtained while comparing the mean gray levels at canals before CH application and after CH removal in both the study groups. However; while making the intergroup comparison, non-significant results were obtained. Conclusion: From the
above results, the authors concluded that for removing CH from the root canals, both the techniques have equal effectiveness.

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

**INTRODUCTION**

Microorganisms are the cause of apical inflammatory lesions, and the goal of endodontic treatment is the prevention and control of pulpal and periradicular infections. Numerous measures have been introduced to reduce the number of microorganisms from the root canal system, including various mechanical instrumentation techniques, irrigation regimes, and intracanal medicaments. It is difficult to eliminate all microorganisms from an infected root canal system by mechanical instrumentation alone. Therefore, chemical irrigation and disinfection are necessary to remove microorganisms, their byproducts, pulp tissue remnants, and other debris from the root canal. Intracanal medicaments may perform these roles by remaining in the root canal between treatment appointments. The merits of CH have also been disputed, not only concerning its efficacy as an antimicrobial agent, but also because of possible apical leakage of the obturated canal system after its use. Incomplete removal of CH medicaments from root canal surface, prevents the sealer from penetrating into the dentinal tubules, interferes with the normal setting reaction resulting in potential reduction of sealer adaptation, thus, affecting the seal of obturating material leading to microleakage and subsequent treatment failure. Hence; the present study was undertaken for comparatively evaluating the efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals.

**MATERIALS AND METHODS:**

The present study was undertaken for comparatively evaluating the efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals. A total of 40 freshly extracted mandibular first premolars were included in the present study. Soon after extraction, they were stored in normal saline until further use. Root canal preparation was done using NiTi rotary files. Working length was established with the help of radiographs. Intermittent irrigation of the root canals was done with sodium hypochlorite and EDTA. Afterwards, drying of the root canal space was done using paper points. After completion of canal preparation, canals were filled with Calcium Hydroxide (CH). Evaluation of the quality of filling was...
assessed by radiographs. All the specimens were divided into two study groups with 20 specimens in each group as follows: Group A: Specimens in which CH was removed manually using Flexo files and irrigant, and Group B: Specimens in which CH was removed with ultrasonic instrumentation. 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. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Chi-square test was used for evaluation of level of significance.

RESULTS

In the present study, a total of 40 tooth specimens were enrolled and were divided into two study groups with 20 specimens in each group as follows: Group A: Specimens in which CH was removed manually using Flexo files and irrigant, and Group B: Specimens in which CH was removed with ultrasonic instrumentation. Mean gray levels at canals before CH application and after CH removal among specimens of Group A was 124.51 and 148.36 respectively. Mean gray levels at canals before CH application and after CH removal among specimens of Group B was 125.42 and 147.77 respectively. Significant results were obtained while comparing the mean gray levels at canals before CH application and after CH removal in both the study groups. However; while making the intergroup comparison, non-significant results were obtained.

Table 1: Evaluation of mean gray level at canals for Group A and B.

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Mean Gray levels at canals</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before CH application</td>
<td>After CH removal</td>
</tr>
<tr>
<td><strong>Group A</strong></td>
<td>124.51</td>
<td>148.36</td>
</tr>
<tr>
<td><strong>Group B</strong></td>
<td>125.42</td>
<td>147.77</td>
</tr>
</tbody>
</table>
| *p<0.05 is considered statistically significant.

DISCUSSION

Calcium Hydroxide was introduced in endodontics as a direct pulp-capping agent and is highly recommended and widely accepted as an inter-appointment intracanal endodontic dressing. It demonstrates a pronounced antibacterial activity against most of the bacterial species identified in endodontic infections. It can be mixed with a variety of vehicles such as distilled water, saline solution, propylene glycol and glycerine. Most of the substances used as vehicles do not have significant antimicrobial activity. Before obturating the canal, complete removal of Ca(OH)$_2$ is mandatory as both in vitro and clinical case have shown that residual Ca(OH)$_2$ may have negative influence on success of root canal treatment. Thus, complete and predictable removal of Ca(OH)$_2$ before obturation is critical and several methods viz., ultrasonics, sonic, canal brush, etc. and irrigating agents including NaOCl, EDTA, their combination, maleic acid, etc. have been used to accomplish this task.$^{6-9}$ Hence; the present study was undertaken for comparatively evaluating the efficacy of manual and ultrasonic technique for removal of Calcium Hydroxide medicament from root canals.
In the present study, a total of 40 tooth specimens were enrolled and were divided into two study groups with 20 specimens in each group as follows: Group A: Specimens in which CH was removed manually using Flexo files and irrigant, and Group B: Specimens in which CH was removed with ultrasonic instrumentation. Mean gray levels at canals before CH application and after CH removal among specimens of Group A was 124.51 and 148.36 respectively. Mean gray levels at canals before CH application and after CH removal among specimens of Group B was 125.42 and 147.77 respectively. 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 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)\(_2\). 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. None of the techniques used were completely able to remove Ca(OH)\(_2\) from the root canals.\(^9\)

In the present study, significant results were obtained while comparing the mean gray levels at canals before CH application and after CH removal in both the study groups. However; while making the intergroup comparison, non-significant results were obtained. More recently, the effect of various techniques – including photon-initiated photoacoustic streaming (PIPS), ultrasonic, sonic and conventional irrigation – on the removal of calcium hydroxide from artificial grooves created in root canals was evaluated. It was concluded that PIPS, was superior to other techniques which mentioned, providing complete removal of the intracanal medicament. Other authors concluded that even though none of the techniques removed the calcium hydroxide dressing completely, laser-activated irrigation was significantly more effective than needle irrigation. In another study, it was showed that pulse energy, pulse length, pulse frequency, irradiation time, and position of the fiber tip all significantly affected the cleaning efficacy of laser. Higher pulse energy, shorter pulse length, longer irradiation time, placement of the fiber tip close to the groove, and to a lesser extent, higher pulse frequency resulted in better debris scores. On the other hand, the shape and diameter of the fiber tip had no statistically significant influence on the results.\(^10\)–\(^13\) Ismail Davut Capar et al compared the efficacy of conventional syringe, ultrasonic, EndoVac (Discus Dental, Culver City, CA), and Self-Adjusting File (SAF) (Re-Dent-Nova, Ra'anana, Israel) irrigation systems in removing calcium hydroxide (Ca[OH]\(_2\)) from simulated root canal irregularities. The root canals of 88 extracted single-rooted teeth were prepared using ProTaper rotary instruments (Dentsply Maillefer, Ballagues, Switzerland) up to size F4. The roots were
split longitudinally, and a standardized groove was prepared in the apical part of 1 segment. The root halves were reassembled, and Ca(OH)2 medicament was placed into the root canals using a Lentulo spiral. The roots were randomly divided into 4 experimental groups and 2 control groups according to the different irrigation systems used: conventional syringe irrigation, continuous passive ultrasonic irrigation (PUI), EndoVac irrigation, and SAF irrigation. Each group was then divided into 2 subgroups (n = 10) according to the irrigation protocol: subgroup 1: 10 mL 2.5% NaOCl and subgroup 2: 10 mL 17% EDTA + 10 mL 2.5% NaOCl. The amount of remaining medicament was evaluated under a stereomicroscope at 30× magnification using a 4-grade scoring system. In the NaOCl-irrigated groups, PUI removed significantly more Ca(OH)2 medicament than the other techniques (P < .05). There was no significant difference among the other groups (P > .05). In the EDTA/NaOCl-irrigated groups, the SAF and PUI removed significantly more Ca(OH)2 than the other techniques (P < .05). The use of the SAF system with the combination of EDTA and NaOCl enhanced Ca(OH)2 removal when compared with the use of only NaOCl irrigation with the SAF.\(^\text{14}\)

CONCLUSION

From the above results, the authors concluded that for removing CH from the root canals, both the techniques have equal effectiveness.

REFERENCES:


Conflict of Interest: None

Source of Support: NiL

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