Apical sealing ability of AH26, Apexit, and Dorifill following calcium hydroxide medication

Shiva Sadeghi 1* DMD, MS, Mitra Vosoghi 2 DMD
1. Assistant Professor of Endodontics, Dental School, Guilan University of Medical Sciences, Rasht, Iran.
2. Private practice.

Abstract

Introduction: The purpose of this in-vitro study was to investigate the influence of the remaining calcium hydroxide (CH) as an intracanal dressing on the apical sealing ability of three endodontic sealers.

Materials and Methods: Sixty-six single and straight canals of recently extracted human permanent maxillary central incisors were used. All canals were prepared and sixty of them were randomly divided into two groups with (group 1) and without (group 2) CH medication. Each of these groups was divided into three experimental groups using AH26 (group a), Dorifill (group b), and Apexit (group c). Six remained teeth were divided into positive and negative groups of three each. Root canals were filled with gutta-percha and AH26 (groups 1a, 2a), Dorifill (groups 1b, 2b) and Apexit (groups 1c, 2c) using lateral condensation technique. The apical third of the roots were placed in Pelikan ink for one week. Linear dye penetration was recorded using a stereomicroscope and a digital caliper. Data were compared with analysis of variance (ANOVA).

Results: Observed leakage in groups which were filled with Apexit sealer was significantly different (P<0.002). There was no significant difference among groups which were filled with Dorifill and AH26.

Conclusion: Calcium hydroxide did not influence the apical sealing ability of AH26 and Dorifill, while it did improve the apical sealing ability of Apexit sealer.

Keywords: Calcium hydroxide, Root canal therapy, Seal.

Received September 2005: accepted November 2006
*Correspondence: Dr. Shiva Sadeghi, Dept. of Endodontics, Dental School, Guilan University of Medical Sciences, Rasht, Iran. Email: Sadeghi_DDS@yahoo.com

Introduction

In modern endodontics, calcium hydroxide (CH) is the most commonly recommended intracanal medication (1-7). Several studies demonstrated that complete removal of this dressing is impossible (8-10). However, it is believed that the removal of this dressing before obturation of the root canal is important in obtaining a hermetic seal of the permanent root canal filling (11). Using 2% methylene blue d, Porkaew et al. found that leakage in groups which were medicated with CH-USP, Calasept and Vitapex was significantly less than non-medicated group when canals were filled with Grossman sealer (12). Holland et al. showed significantly less apical leakage in groups that received CH dressing compared to control groups, after the dressing was removed by irrigation and a reaming motion with files for sizes 40-70 (13). Using the fluid transport model, Kontakiotos et al. reported that trace amounts of CH left in the root canal did not significantly affect sealing ability when canals were filled with Tubliseal sealer. They also showed that leakage in medicated group was significantly less than non-medicated group when 1% methylene blue dye was used (14). Caliskan et al., observed less leakage for Diaket sealer in CH-water medicated canals using India ink for 7 days (11). Hosoya et al. showed that apical sealing abilities of all four sealers (Canals, Canals-N, Ketac Endo and Sealapex) were influenced by CH agents. The sealing ability of Sealapex improved with all CH agents (15).
However, there is no published research about the effect of CH dressing on sealing ability of AH26, Apexit and Dorifill sealers. The purpose of this in-vitro study was to investigate the influence of the CH dressing on the apical sealing ability of these three endodontic sealers.

Materials and Methods
Sixty-six recently extracted human permanent central incisor teeth with single canals and mature apices were used in this in-vitro study. All teeth were stored in normal saline after extraction and were disinfected by 5.25% sodium hypochlorite solution for 30 minutes before experimental procedures. To eliminate root length as a variable, the crowns were removed, so that the remaining roots were about 15±1mm. Patency and working length were determined by placing a #10 K-file (Maillefer, LD Caulk Co., Milford, DE) until it was just seen penetrating the foramen, after which 1mm was subtracted from this and the length was recorded. All root canals were cleaned and shaped with K-files using step-back technique to file # 40. Flaring was performed by Gates Gliddens # 1 through # 3. Irrigation with 1 mL of 2.5% sodium hypochlorite solution was performed using a 22-gauge needle between each file.

Sixty of roots were randomly divided into two groups with and without CH medication as groups 1 and 2, respectively. Each of these groups was divided into three experimental groups using AH26 (group a), Dorifill (group b), and Apexit (group c). The remaining six teeth were used for negative and positive leakage control of three each. In negative control group, orifices of the canals were filled with wax and the total root surfaces from orifice to the apex were covered with two layer of nail polish (Etude, France). The root surfaces of three teeth in positive control group were not covered with nail polish but their orifices were filled with wax to prevent coronal dye leakage.

In six experimental groups, each canal received 0.5 mL of Calasept (a water base injectable, premixed CH paste) (Nordiska Dental, Angelholm, Sweden). Specimens were then kept at 37°C in 100% humidity for 1 week. After storage, CH was removed from the root canals using the master apical file and one size larger K-file with alternating irrigation with 1mL of EDTA and 2.5mL of 2.5% sodium hypochlorite.

Canals were filled using lateral condensation technique and AH26 (1a and 2a) (Dentsply Detrey, Zurich, Switzerland), Dorifill (1b and 2b) (Dori Dent, Austria) and Apexit (3a and 3b) (Ivoclar, Liechtenstein) sealer according to manufacturer’s instruction.

All root surfaces except for 2mm apically were covered with two layers of nail polish, so that dye could penetrate only from apical. After keeping the apical part of all roots in Pelikan ink (Pelikan, Germany) for 7 days, the roots were washed with water and were left to dry for 24h. Nail polish was then removed by Acetone. Two grooves along the long axis of each root were made using a tapered bur in a turbine handpiece and a little water spray. All roots were then split longitudinally using a chisel. All preparations were completed by a single operator.

Apical microleakage was assessed blindly by two examiners measuring the most extensive linear dye penetration using a stereomicroscope (Olympus, Tokyo, Japan) and a digital caliper to accurate 0.01mm. The mean score was calculated. Finally, collected data were compared using analysis of variance (ANOVA) at a significant level of P<0.05.

Results
The negative leakage control demonstrated no dye penetration, while the positive leakage control showed dye penetration along the entire root canal.

The mean linear dye leakage of all groups are shown in Table-1 and illustrated in Figure 1. The mean leakage among groups which were filled with Apexit sealer was statistically different (p<0.002). There was no significant difference between the mean leakage among groups which were filled with Dorifill sealer and AH26 sealer.

Discussion
In this study, extracted central incisor teeth with large and straight canals were selected and were instrumented to file # 40 in order to minimize the variables such as anatomical variation, canal size and the diameter of the
Table- 1: Mean leakage (mm) in all groups.

<table>
<thead>
<tr>
<th>Sealer</th>
<th>group</th>
<th>N</th>
<th>Mean (mm)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH26</td>
<td>1a</td>
<td>10</td>
<td>2.7200</td>
<td>1.2576</td>
</tr>
<tr>
<td></td>
<td>2a</td>
<td>10</td>
<td>1.9630</td>
<td>0.8370</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>20</td>
<td>2.3415</td>
<td>1.1099</td>
</tr>
<tr>
<td>Dorifill</td>
<td>1b</td>
<td>10</td>
<td>5.9840</td>
<td>3.7924</td>
</tr>
<tr>
<td></td>
<td>2b</td>
<td>10</td>
<td>8.2540</td>
<td>5.0731</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>20</td>
<td>7.1190</td>
<td>4.5121</td>
</tr>
<tr>
<td>Apexit</td>
<td>1c</td>
<td>10</td>
<td>2.3090</td>
<td>0.8055</td>
</tr>
<tr>
<td></td>
<td>2c</td>
<td>10</td>
<td>6.2580</td>
<td>3.3009</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>20</td>
<td>4.2835</td>
<td>3.0939</td>
</tr>
</tbody>
</table>

1: with calcium hydroxide, 2: without calcium hydroxide
a: AH26, b: Dorifill, c: Apexit

Figure- 1: Mean leakage (mm) in all groups.

As Porkaew et al. (12) explained one possible reason for these findings may be that the residual CH is incorporated with the sealer during obturation, which may cause a change in permeability of the sealer itself. Another supposition may be that CH is transported or mechanically forced into the dentinal tubules and thus occlude the dentinal tubules and decreased permeability. In the present study, since applied mechanical force was similar for all groups, it seems that this factor is not as important as the sealer type and its incorporation with the remaining CH. Probably, the residual CH may be incorporated with CH-containing sealer easily and improved the sealing ability of the sealer (11).

However, the results of this study are based on measurements conducted over a short period of time using large and straight canals. As we know CH react to form calcium carbonate which is resorbable and this will most likely, in the long run, create voids at the root canal walls/filling interface (12). The improved initial apical seal found in this short-term in-vitro study may therefore be temporary (18, 19). Long term effects in teeth with small or curved canals should be evaluated.

Conclusion

According to the results of the present short-term in-vitro study, calcium hydroxide did not influence the apical sealing ability of AH26 and Dorifill while improved the apical sealing ability of Apexit sealer.
Acknowledgment
Authors wish to thank Guilan University of Medical Sciences for their financial supports and Dr. A. Hydarzadeh for his valuable help in statistical analysis.

References