

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

Shiva Sadeghi^{1*} DMD, MS, Mitra Vosogh² 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.

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*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% methylen 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, Kontakiotis *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% methylen 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 ± 1 mm. 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 1 mm 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 manufacture'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

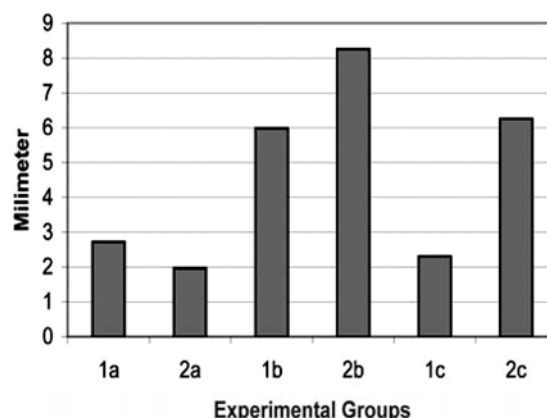
In this study, extracted central incisor teeth with large and straight canals were selected and were instrumented to file # 40 in order to minimize the variables such as anatomical variation, canal size and the diameter of the

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

Sealer	group	N	Mean (mm)	Standard Deviation
AH ₂₆	1a	10	2.7200	1.2576
	2a	10	1.9630	0.8370
	Total	20	2.3415	1.1099
Dorifill	1b	10	5.9840	3.7924
	2b	10	8.2540	5.0731
	Total	20	7.1190	4.5121
Apexit	1c	10	2.3090	0.8055
	2c	10	6.2580	3.3009
	Total	20	4.2835	3.0939

apical foramen. As it has been reported that longer roots have a potential for greater leakage, roots with 15 ± 1 mm length were used. To eliminate the operator variable, all preparations were completed by a same operator. Additionally, we chose Calasept because it is in the form of syringe, it is easy to handle and insert equal amounts of it into the canal. The amount of CH medication is variable which had not been considered in previous researches. In the present study, same amounts of Calasept were inserted in medicated canals and a combined approach with same volume of irrigants and reaming motion of master apical file (MAF) and one size larger K-file were used to remove the medicament (16). Linear dye penetration with Pelikan ink was used for 7 days in order to evaluate apical leakage, because this dye was not shown to be decolorized by CH (11,17). In fact, with precise control of effective variables in this study, the chance of having equal amounts of the left CH in the root canal was similar in medicated groups.

According to the results of the present study, CH-medicated root canals for Apexit (a CH containing sealer) showed significantly less apical leakage than the non-medicated control group. This was supported by the finding of Hosoya *et al.* (15). They reported that the sealing ability of Sealapex improved with all CH agents. There was no significant difference between medicated and non-medicated control groups for Dorifill and AH26 sealers. Our finding for Dorifill (a zinc oxide eugenol material) was in disagreement with Kontakiotis *et al.* and Porkaew *et al.* (12,14). For AH26 (a resin based sealer), our result was different from Caliskan *et al.* findings (11).



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.

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