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Original article

Effect of eugenol-containing and resin endodontic sealers on retention of prefabricated metal posts cemented with zinc phosphate and resin cements☆

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Abstract

Purpose: The aim of this study was to compare the effects of two endodontic sealers on the retention of posts cemented with zinc phosphate or resin cement.

Materials and methods: Crowns of 72 mandibular premolars were removed at the cementoenamel junction. Root canals were prepared and specimens were randomly divided into two groups of 36. In each group, 12 specimens were obturated with gutta percha only; 12 specimens with gutta percha/ZOE sealer and 12 specimens with gutta percha/AH26. In the first group, 10 mm Post spaces were prepared with Peeso reamers size 4 and, size 5 stainless steel Paraposts were cemented in with zinc phosphate. In the second group, 10 mm Post spaces were prepared with Fiber Lux size 5.5 drills and size 5 Paraposts were cemented with Panavia $F_{2.0}$. After mounting in resin blocks, posts were pulled out by universal testing machine at 1 mm/min and results were analyzed by two-way ANOVA and Dunnett test.

Results: Mean forces (in Newtons) required to remove posts cemented with zinc phosphate in canals obturated without sealer, with ZOE, and with AH26 sealers were 270 ± 83, 281 ± 128 and 266 ± 67, respectively; and for posts cemented with Panavia $F_{2.0}$ were 520 ± 290, 464 ± 212 and 229 ± 108, respectively. Statistical analysis showed that AH26 significantly reduced retention of posts cemented with Panavia $F_{2.0}$ ($p < 0.05$).

Conclusion: Different sealers had no significant effect on retention of posts cemented with zinc phosphate. However posts cemented with Panavia $F_{2.0}$ showed reduced retention in canals obturated with AH26.

Keywords: Post retention; Sealer; Cement

1. Introduction

Retention and resistance to dislodgment of posts are important factors in the success rate of restorations, which gain retention from the intraradicular space. Cements are among the factors that influence retention of posts [1]. Their role has become more prominent since the introduction of adhesive resin cements. These cements have become quite popular in recent years.

During root canal therapy, a variety of different materials are used to clean and seal the root canal dentin. These materials might adversely affect the bonding of resin cements used later during the restorative phase [2–4]. Eugenol, a component in ZOE sealers, is a good example of such an effect. As a free radical scavenger, it inhibits polymerization of resin materials [5,6]. Development of resin sealers overcame this negative effect of eugenol-containing sealers. Moreover, resin sealers are able to adhere to dentin, a considerable advantage over ZOE sealers.

In order to place intraradicular posts in root canals, which are completely filled, gutta percha should be removed with hand or rotary instruments. In both methods, mechanical removal of sealer-impregnated dentin from canal walls is recommended before cementing the posts. Otherwise a fresh surface for resin cement to penetrate and to bond will not be obtained and the retention of cements will be compromised

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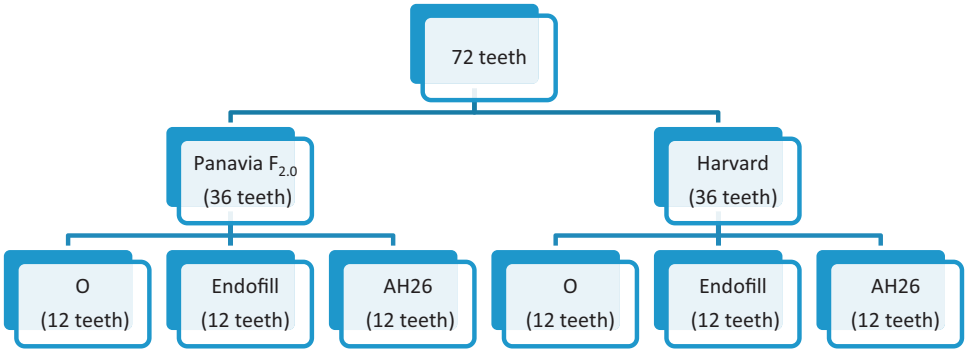

Fig. 1. Experimental group design: Panavia F2.0: resin cement; Harvard: zinc phosphate cement. O: obturation without sealer; Endofill: eugenol-containing sealer; AH26: resin sealer.

[7,8]. Removal of this impregnated dentin produces a smear layer rich in sealers. This layer should either be removed or penetrated through by the adhesive system. Some studies recommend removal of this layer by chemical irrigants like EDTA and sodium hypochlorite. However, these agents may affect bonding of resin cement to radicular dentin [2–4,9]. Moreover, rinsing canals with EDTA or NaOCl is not a routine or directly recommended practice in restorative procedures.

Another way for removing the smear layer is acid etching root canal dentin, which is a common step in restorative dentistry. Adhesive resin cements have an etching component, either separately as in etch-and-rinse adhesives, or incorporated into the bonding agent as in self-etch adhesives. In the latter, the infiltration of resin into dentin occurs simultaneously with the etching process. In these systems, adhesives should penetrate beyond the smear layer and etch the intact underlying dentin to form a true hybrid layer [6].

The question is whether resin sealers could have any negative effect on bonding capability of resin cements. The aim of this study was to compare the influence of an epoxy resin (AH26) and a eugenol-containing sealer (Endofill) on the retention of prefabricated metal posts cemented either with Panavia $F_{2.0}$ or zinc phosphate (Harvard Cement). Panavia $F_{2.0}$ is a self-etch adhesive resin cement. The manufacturer does not recommend any treatment on dentin before application of the bonding agent. Zinc phosphate cements are widely used due to their long history of success, as well as lower price and less technique sensitivity compared with resin cements. AH26 is an adhesive epoxy resin sealer, which lacks eugenol and thus promises a good compatibility with resin cements.

The null hypothesis of this study is retention of posts cemented with Panavia $F_{2.0}$ in canals obturated with AH26 is greater than canals obturated with Endofill.

2. Methods and materials

Seventy-two extracted single-canal human mandibular premolars were selected. Teeth were disinfected after extraction by formalin and stored in normal saline. To standardize canal dimensions of specimens, any tooth with aberrant canal shape and size, confirmed with radiographs, was discarded. Crowns of teeth were removed at the cementoenamel junction. Canals were filed up to size 30 K-files (Mani, Tochigi, Japan) and shaped to size 60 using step-back technique. After each filing, canals were irrigated with 2.5% sodium hypochlorite solution and then the coronal 10 mm of canals were sequentially enlarged with Peeso reamers size 1–3 and size 5 (1.25 mm) Parapost drills (Coltene/Waldent, Altstatten, Switzerland) in order to standardize the size and shape of the spaces as much as possible. Then specimens were divided randomly into two groups of 36 (Fig. 1). In each group 12 specimens were obturated with gutta percha without any sealer (control group); 12 others with gutta percha and a eugenol-containing sealer (Endofill; Dentsply-Herpo, RJ, Brazil). The last 12 specimens were obturated with gutta percha and an epoxy resin sealer (AH26; Dentsply, Maillefer, OK, USA). All specimens were obturated with master cone size 30 and accessory cones using lateral condensation technique. Excess gutta percha was removed at the CEJ and the orifice was covered with temporary filling material (Cavit; 3M ESPE AG, Seefeld, Germany).

After two weeks storage in 100% humidity at room temperature, in one group post spaces were prepared at the coronal 10 mm of canals with size 4 Peeso reamers (1.30 mm diameter). The canals were irrigated with water, cleaned with ethanol, again rinsed with water and dried with paper points. Then powder and liquid of the zinc phosphate cement (Harvard Cement; Harvard Dental International, Hoppegarten, Germany) were mixed according to manufacturer recommendations. A part of mixed cement was introduced to the canals by a file and immediately afterward, cement-coated size 5 Paraposts were pushed slowly into the canals. After removal of excess cement, specimens were stored in 100% humidity at room temperature.

In the specimens of the other group, post spaces were prepared at the coronal 10 mm of canals with size 4 Peeso reamers and Fiber Lux size 5.5 drills (1.4 mm diameter). Therefore canals in this group were prepared 100 μm larger than the previous group. Canals were irrigated with water, cleaned with ethanol, again rinsed with water and dried with paper points. Size 5 Paraposts were cemented in the canals with dual curing resin-based cement (Panavia $F_{2.0}$; Kurary Medical, Tokyo, Japan). Cementation was performed according to the manufacturer's instruction for use. No treatment was done on dentinal walls beforehand. Equal amounts of ED PRIMER II A&B were mixed and applied to the canals. After 30 s, excess primer was removed with paper points. Equal amounts of pastes