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ORIGINAL ARTICLE

The effect of root canal sealers and timing of cementation on the microlekage of the parapost luted with resin cement

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KEYWORDS

Root canal sealer;
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Abstract *Objectives:* The objectives of the study were to study the effect of root canal sealers either eugenol or non-eugenol and timing of cementation on microleakage of the parapost luted with resin cement.

Materials and methods: Seventy extracted human, single-rooted teeth were instrumented using a crown-down technique. All teeth were instrumented up to a size 50 .04 taper ProFile followed by the use of Gates Glidden drills from size 2 up to 5. Following instrumentation, the teeth were randomly divided into four experimental groups of fifteen teeth each, based on type of root canal sealer (eugenol or non-eugenol sealer) and timing of post cementation (immediate or delayed). The remaining ten teeth were divided into two control groups with five teeth per group. All teeth were tested for microleakage using a fluid filtration method.

Results: The microleakage of the paraposts luted with resin cement increased over time, irrespective of sealer type or timing of post cementation. Immediate post cementation following obturation with AH26 (non-eugenol sealer) produced the least microleakage at all three time periods at 24 h, 2 months and 3 months.

Conclusions: The microleakage paraposts luted with resin cement was not influenced by either sealer type or timing of post placement. All experimental groups demonstrated a significant increase in microleakage over time as well as the presence of voids at the resin–dentin interface.

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1. Introduction

Posts are often used to restore endodontically treated teeth (Robbins, 1990). In addition to providing retention for coronal restorations, they also provide a hermetic coronal seal. Coronal microleakage of endodontically treated teeth may result in recurrent caries and failure of the root canal treatment, therefore, the coronal seal is as important as the apical seal in determining long-term success of root canal treatment (Saunders and Saunders, 1994). Many studies (Saunders and

Saunders, 1990; Swanson and Madison, 1987; Torabinejad et al., 1990; Diaz-Arnold and Wilcox, 1990; Trope et al., 1995) have evaluated the microleakage of coronal restorations and root canal fillings but few have examined the coronal seal provided by various post systems.

Microleakage is one of the primary causes of endodontic failure. Friedman et al. (1986) showed that leakage of temporary restorations increased over time while Torabinejad et al. (1990) demonstrated that unsealed, obturated root canals were completely re-contaminated within 30 days. Therefore, endodontically treated teeth should be restored as soon as possible. Immediate post cementation at the time of obturation would be ideal provided that any residual effect of eugenol from endodontic sealers does not affect the coronal seal of the post system.

Post cementation using resin cement has been recommended for restoration of endodontically treated teeth (Wood, 1983). They have the advantage of increased retentive properties through micro-mechanical and chemical bonding to both dentin and metal (Burns et al., 1993). Studies by Fogel (1995) and Bachicha et al. (1998) had demonstrated that less microleakage occurred around posts cemented with resin cement when compared with zinc phosphate or glass-ionomer cements. However, the root canals were not obturated prior to post-space preparation in these studies. Any residual effects of the filling materials or sealers on microleakage of the post systems were, therefore, not considered. This is important because many of the endodontic sealers contain eugenol which has been shown to inhibit resin polymerization (Phillips, 1982; Rosenstiel and Gegauff, 1988; Al Wazzan et al., 1997; Watanabe et al. 1997; Paul and Scharer, 1997; Mayer et al., 1997; Schwartz et al., 1992; Woody and Davis, 1992; Hansen and Asmussen, 1987). The objectives of this study were: (i) to evaluate the microleakage of paraposts luted with resin cement following obturation with either eugenol or noneugenol sealer, and (ii) to evaluate the effect of immediate versus delayed post cementation on the resin cement.

2. Materials and methods

Seventy extracted human, single-rooted teeth were collected and used for this study within 6 months of extraction. All teeth were stored in saline solution with 0.5% chloramine-T to prevent bacterial growth. Specimens were radiographed from the buccolingual and mesiodistal dimensions in order to evaluate canal morphology and root integrity. Teeth with similar root morphology, size and shape were selected in an attempt to standardize the sample population. Roots that displayed cracks, resorptions or open apices were excluded from the study. An ultrasonic scaler was used to remove external root debris followed by rinsing with 5.25% NaOCl. A low speed diamond saw with water irrigation was used to remove the crowns of the teeth at the cemento-enamel junction. All specimens were stored at room temperature (23 °C) in saline solution with 0.5% chloramine-T until ready for use.

Using a crown-down technique, all teeth were instrumented up to a size 50 .04 taper ProFile (Dentsply, Tulsa, Oklahoma City, OK, USA), followed by use of Gates Glidden drills size 2, 3, 4 and 5 (Miltex Union Broach, York, PA, USA) to flare the coronal third of the canal. Canal length was determined by visualization of the tip of a #10 K-file (Dentsply, Tulsa, Oklahoma City, OK, USA) at the root apex. A working length of 0.5 mm from the apex was used. All instrumentation was performed using RC-Prep (Premier Product Company, PA, USA) lubrication and irrigation with 5.25% NaOCl in between changes in file sizes. Each rotary file was discarded after use in five canals.

Following instrumentation, the teeth were randomly divided into four experimental groups of 15 teeth each, based on type of root canal sealer (eugenol or non-eugenol sealer) and timing of post cementation (immediate or delayed). The remaining ten teeth were divided into two control groups with five teeth per group.

2.1. Experimental groups

(1) Eugenol sealer + Immediate post cementation with C&B Metabond.
(2) Eugenol sealer + Delayed post cementation with C&B Metabond.
(3) Non-eugenol sealer + Immediate post cementation with C&B Metabond.
(4) Non-eugenol sealer + Delayed post cementation with C&B Metabond.
(5) *Positive control:* Paraposts placed into the canals without any cement.
(6) *Negative control:* C&B metabond placed into the canals without any post.

Prior to obturation, canals were treated with 17% EDTA for ten seconds, followed by 5.25% NaOCl in order to remove the smear layer. After a final rinse with sterile water, the canals were dried with paper points and obturated with vertically condensed gutta-percha using one of two sealers: Roth's 801 Elite Grade eugenol-containing sealer (Roth International, Chicago, IL, USA) or AH26 non-eugenol sealer (Dentsply/Maillefer, Tulsa, OK, USA).

2.1.1. Immediate post cementation

In specimens that received immediate post placement (directly following obturation), apical tooth structure was removed using a low speed diamond saw with water irrigation to achieve a standardized root length of 10 mm. A 7 mm post-space was then prepared for a parallel-sided, stainless steel #4 parapost (Coltene/Whaledent Corp., Mahwah, NJ, USA) by sequential use of a series of parapost drills. All canals were treated with the etchant and dentin conditioner included in the C&B Metabond adhesive system in order to remove the smear layer. Post cementation was performed using C&B Metabond cement (Parkell, Farmingdale, NY, USA). The resin cement was mixed and placed according to the manufacturer's instructions. Cement was applied to the post surface as well as directly into the post-space. The posts were then placed into the canal to the predetermined depth and held in place with finger pressure until an initial set had occurred. Excess cement was removed flush on the top of the tooth. The remaining gutta-percha in the apical 3 mm was then removed using a System B unit (Analytic Corp., Orange, CA) prior to testing for microleakage.

2.1.2. Delayed post cementation

In specimens that received delayed post cementation (7 days after obturation), 3 mm of coronal gutta-percha was removed