

Bond degradation resistance of self adhesive sealer bonded to radicular dentin using an alternative adhesive strategy

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Abstract

Objective: This study was carried out to evaluate the effect of an alternative adhesive strategy; double layering dentin bonding procedure in root canal obturation on the durability of root canal sealing using Resilon/Epiphany dual cure resin composite sealer system.

Materials and methods: One hundred and twenty freshly extracted human upper central incisors teeth with straight root canals were used. The crowns were removed at the level of Cemento-Enamel Junction (CEJ). All roots were instrumented with a crown-down technique. The root canals were filled with either single or double layering bonding techniques, aged for 7 days and 3 months, and then sectioned perpendicular to the longitudinal axis of each root into a series of 1.0 mm thick cross-sectional slices. Durability of sealing was tested by both micropush out and nanoleakage tests. For the micropush out test, each root slice was subjected to compressive loading via a computer controlled materials testing machine, while for nanoleakage, the slices were immersed in the tracing solution of ammoniacal silver nitrate for 24 h in complete darkness. Photomicrographs were obtained by Environmental Scanning Electron Microscope.

Results: The micropush out bond strength increased significantly with the double layering technique. On the other hand, it was not affected by aging. Only one nanoleakage pattern start to emerge as early as 7 days after sealing and continue after that.

Conclusions: The current study supports the concept that double layering bonding strategy might be successfully adapted to endodontics to optimize bond strength of endodontic self-adhesive sealers to radicular dentin and to reduce nanoleakage.

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Keywords: Double layering technique; Adhesive sealer; Micropush out; Nanoleakage

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Table 1
Materials' specifications, composition, manufacturers and batch number.

Materials	Specification	Composition	Manufacturer	Batch no
Epiphany	Soft Resin Endodontic Obturation system. Self-Etch Root Canal Sealer	Benzoyl Peroxide, Tertiary Amine, EBPADMA, BIS-GMA, HEMA, Proprietary acidic, Silane treated Barium glass, Ca ₃ (PO ₄), Bismuth oxychloride, Luting system	Pentron Clinical Wallingford, CT 06492 USA	173157
Resilon points	Root canal filling material.	Polyester, Difunctional methacrylate resin, Bioactive glass, Bismuth oxychloride, Barium sulfate, Coloring agent.	Pentron Clinical Wallingford, CT 06492 USA	162850

Abbreviations: Bis-GMA: Bisphenol A diglycidyl methacrylate; HEMA: 2-Hydroxyethyl methacrylate; EBPADMA: Ethoxylated Bisphenol Dimethacrylate-based Amorphous Calcium Phosphate Composites.

1. Introduction

Root canal obturation ideally confers prevention of coronal ingress of bacteria, and accumulation of fluid apically that could serve as nutrients for bacteria [1]. Success in endodontic treatment is predominantly determined by complete obturation of the canal system. Gutta-percha is considered the gold standard root canal filling material. However it does not bond to the internal tooth structure, resulting in the absence of a complete seal leading to leakage that takes place at the interface between the sealer and gutta-percha or the sealer and dentin [2]. Thus, finding a gutta-percha substitute that would provide a superior seal of the root canal system has become a challenge in modern endodontics.

The materials and techniques currently used for adhesive bonding to dentin in restorative dentistry have been developed over many years. The latest generation of dentin bonding systems achieved high bond strength and reduced microleakage by micromechanical bonding or forming a hybrid layer between the dentin and the resin. Studies have examined the potential of adhesive resin root canal filling materials as possible improvements in decreasing the amount of leakage when compared with conventional gutta-percha fillings and an improvement on the root fracture resistance as a consequence to establishing monoblock between the intraradicular dentin and adhesive root fillings [3]. Resilon/Epiphany³ is a resin-based obturation system that utilizes a dentin adhesive. It utilizes a resinous obturating material and an adhesive resin sealer, creating a monoblock of dentin/adhesive/obturator material [4].

Nanoleakage was originally used to describe microporous zones beneath or within the hybrid layer that permitted tracer penetration to occur in the

absence of interfacial gap, it occurs through submicrometer-sized spaces within dentin hybrid layer where disparities existed between the depths of demineralization and monomer diffusion [5]. Nano-leakage may allow the penetration of bacterial products which may result in hydrolytic breakdown of either the adhesive resin or collagen within the hybrid layer, thereby compromising the stability of the resin–dentin bond [6].

One of the advantages of the incremental technique used in cavities filled with resin composite is that the volume reduction of each increment could be compensated for by the next, and thus the consequence of polymerization shrinkage would be less harmful since only the volume reduction of the last layer would effectively damage the bond surface [7]. In a trial to mimic the benefits of this technique, a double layering technique was tried in obturation of endodontically treated teeth. Therefore, it is of value to shade a light on the bond degradation resistance of Resilon/epiphany obturation system to dentin using single and double layering techniques as assessed by micropush out bond strength and nanoleakage tests.

2. Materials and methods

One hundred and twenty freshly human upper central incisors teeth with straight root canal, fully developed apices and free of cracks, caries or fractures and had no previous root canal treatment extracted due to periodontal disease were selected. The crowns of the teeth were removed at the level of CEJ to obtain a 12-mm long root. Canal patency was determined by passing a size 10 K file through the apical foramen. The pulp tissue was first removed with barbed broach⁴. Canal working lengths (WL) were established 1.0 mm short of the apex. All teeth were instrumented with a

³ Pentron Clinical Wallingford, CT 06492, USA.

⁴ Dentsply Maillefer, Ballaigues, Switzerland.

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