A Comparison of Gutta-Percha and Resilon in the Obturation of Lateral Grooves and Depressions

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Abstract

The purpose of this study was to compare the flow of gutta-percha and Resilon (RealSeal; SybronEndo, Orange, CA) into lateral grooves and depressions in the apical 7 mm of a root canal by using warm vertical compaction. A split-tooth model was constructed with lateral grooves and depressions prepared at 1, 3, 5, and 7 mm from working length (WL). Groups A, B, and C were obturated with gutta-percha with a System B plugger placed 5 mm, 4 mm, and 3 mm from WL. Groups D, E, and F were obturated with Resilon with a System B plugger placed 5 mm, 4 mm, or 3 mm from WL. Gutta-percha and Resilon showed similar movement into lateral grooves and dentin depressions, with a significant difference found only with increased flow of gutta-percha into depressions at the 1-mm level when the System B plugger was placed 3 mm or 4 mm from WL ($p \leq 0.05$). *(J Endod 2007;33:749–752)*

Key Words

Flow characteristics with vertical compaction, gutta-percha, resilon

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One of the main objectives of obturation is to seal the root canal system in order to prevent leakage of microorganisms and microbial byproducts (1). The root canal system has a very complex morphology with many irregularities including fins, deltas, accessory canals, and lateral canals. Lateral canals have been shown to be present in 27.4% to 45% of teeth (2, 3) with the majority located in the apical third of roots (3, 4).

Gutta-percha is currently the most commonly used root canal obturation material. Numerous techniques using thermoplasticized gutta-percha have been developed in an attempt to enhance the replication of the internal surface of the root canal during obturation. The vertical compaction of warm gutta-percha was introduced by Schilder (1), and has been modified by Buchanan (5) with the continuous wave of condensation technique. Thermoplasticized gutta-percha techniques have been demonstrated to provide superior adaptation to canal walls and filling of lateral canals when compared to lateral compaction (6–8). Brothman (9) showed that vertical compaction of warm gutta-percha almost doubled the number of filled lateral canals compared with lateral compaction.

Several methods have been used to evaluate the adaptation of gutta-percha to the canal walls and the filling of lateral canals. These methods include postobturation radiographs of extracted teeth with artificially created lateral canals (10), examination of obturated and cleared teeth with artificially created lateral canals (4), and examination of epoxy blocks with artificially created lateral canals sectioned after obturation (11). Split-tooth models with artificially created depressions and lateral canals have also been used (6, 7). The split-tooth model facilitates the evaluation of root canal filling in a human tooth obturated using different techniques.

Resilon (RealSeal; SybronEndo, Orange, CA) is a polyester polymer-based obturating system. According to Shipper et al. (12), the core material used with the dual-cured resin sealer and self-etching primer forms a monoblock that bonds to dentin and has shown leakage characteristics superior to gutta-percha. Resilon is available in ISO cone sizes in 0.04 and 0.06 tapers and in pellet form, to be used for thermoplasticized techniques in the same manner as gutta-percha, with lower thermoplasticizing temperatures. The manufacturer claims that Resilon has similar handling characteristics as gutta-percha. Nielsen and Baumgartner (13) showed that Resilon allowed for deeper spreader penetration than gutta-percha with the same controlled pressure during lateral compaction.

The purpose of this study was to evaluate the flow of Resilon into lateral grooves and depressions in the apical 7 mm of a root canal in a split tooth model by using warm vertical compaction.

Materials and Methods

A maxillary canine with a straight, single canal was used to produce a single split-tooth model that was used for all obturations (Fig. 1). The tooth was accessed with a #4 surgical length round bur (Brasseler, Savannah, GA), and preflaring of the coronal third was performed with Gates Glidden drills #2, #3, and #4 (Brassler). The tooth was decoronated at the cementoenamel junction (CEJ) by using a 557-carbide bur (Brasseler), and the root was mounted in plastic casting resin (ETI, Fields Landing, CA) and left to cure for 48 hours at room temperature. A model trimmer was used to square the sides. A drill press was used to place a total of four holes through the acrylic in a buccal-lingual direction, two on the mesial and two on the distal. The tooth was then separated into buccal and lingual halves through the center of the canal with an Isomet saw (Buehler, Lake Bluff, IL) with a 150-μm diamond

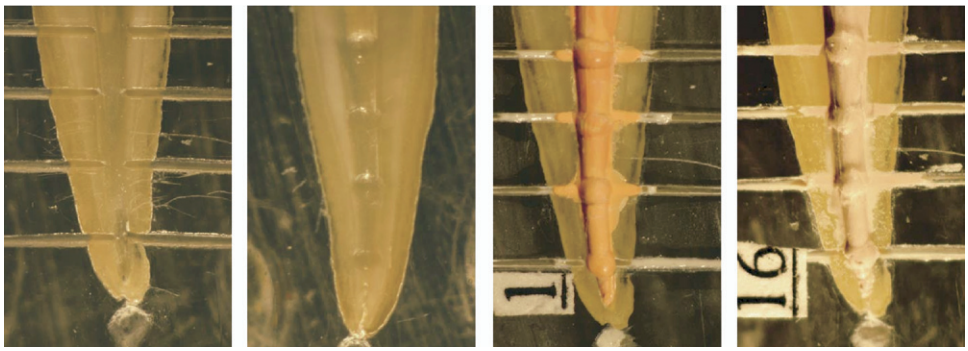

Figure 1. Photos from left to right illustrate split-tooth model with grooves and depressions placed at 1, 3, 5, and 7 mm from working length and examples of obturations with gutta-percha and Resilon with the System B plugger inserted to 3 mm from working length.

blade. The two halves were reapproximated by using four bolts that fit tightly into the predrilled holes. A #15 K-file (Brassler) was placed in the canal until the file tip was flush with the external surface of the tooth. One millimeter was subtracted from this length to establish a working length of 20 mm. Cleaning and shaping of the canal was performed by using .06 taper ISO ProFile rotary instruments (Dentsply, Tulsa, OK) in a crown-down method with RC prep lubrication (Premier Pharmaceuticals, Philadelphia, PA) and 5.25% sodium hypochlorite irrigation. The canal was prepared to #35/.06 at a working length. The model was separated into the two halves, and simulated lateral canals were placed on the buccal half of the model at 1, 3, 5, and 7 mm from working length with a 150-μm Isomet saw blade. Depressions were made at the same levels in the canal on the lingual half of the model with a high-speed hand piece to the width and depth of a [1/2]-round bur (Brassler). To allow for apical patency, an additional depression in the dentin was made with the [1/2]-round bur at working length. To ensure patency, a #15 K-file was passed from the canal into the depression after the two halves were reapproximated.

The tooth model was stored in an incubator with 100% humidity at 37°C and was removed during obturation. During each obturation, the apical two thirds of the tooth model was submerged in a water bath at 37°C. The model was placed on a scale during the entire obturation procedure to limit compaction force to less than 2.0 kg. A System B heat source with a fine plugger (SybronEndo, Orange, CA) was used in the continuous wave of condensation technique. A silicone stop was placed on the plugger at the desired depth before insertion. Heat was applied during the downpack to a depth of 3 mm from the silicone stop, following the manufacturer's instructions. Apical pressure was maintained for approximately 10 seconds, until the silicone stop reached the reference point. The heat button was then activated for 1 second for a separation burst of heat. After a 1-second pause, the plugger was removed with the coronal and midroot obturating material attached to the System B plugger. A #5 plugger (Thompson, Missoula, MT) was used to compact the gutta-percha. Backfilling was performed with the Obtura II (Obtura Spartan, Fenton MO) with a 23-gauge needle. A one-step backfill was performed by engaging the apical mass of the obturating material with the warm needle and expressing the material until a small excess was above the orifice. A #9 plugger (Thompson) was used to compact the material during cooling.

Six experimental groups were used. Ten obturations were performed for each experimental group. Groups A, B, and C were obturated by using a #35/.06 gutta-percha cone (DiaDent Group International Inc, Burnaby, British Columbia). Before insertion of the cone, Roth 801 sealer (Roth International, Chicago, IL), mixed following the manufacturer's instructions, was applied to the canal by using a paper point. For groups A, B, and C, the System B was set at 200°C and a power setting of 10. In group A, the System B plugger was inserted to a depth of 5 mm from working length. In group B, the System B plugger was inserted to a depth of 4 mm from working length. In group C, the System B plugger was inserted to a depth of 3 mm from working length. Backfilling was performed with a gutta-percha pellet (Obtura Spartan, Fenton MO) in the Obtura II set at 200°C, following the manufacturer's instructions. Groups D, E, and F were obturated by using a #35/.06 Resilon cone (RealSeal, SybronEndo, Orange, CA). Before insertion of the cone, Resilon primer was placed in the canal with a paper point followed by placement of Resilon sealer with a paper point. For groups D, E, and F, the System B was set at 150°F and a power setting of 10, according to the manufacturer's instructions. In group D, the System B plugger was inserted to a depth of 5 mm from working length. In group E, the System B plugger was inserted to a depth of 4 mm from working length. In group F, the System B plugger was inserted to a depth of 3 mm from working length. Backfilling was performed with a Resilon pellet (RealSeal) in the Obtura II set at 140°C, following the manufacturer's instructions.

After each obturation, the model was returned to the incubator and the obturating material allowed to cool for 5 minutes. The halves of the model were then separated and excess sealer removed by using a cotton pellet moistened with Isopropyl alcohol. While viewing with a microscope (Nikon, Tokyo, Japan), specimens were photographed with a digital camera (Canon USA, Lake Success, NY) at 10× magnification. The obturating material was then removed from the model, and both halves were cleaned of remaining sealer using a cotton pellet with Isopropyl alcohol. The model was then replaced in the incubator for a minimum of 10 minutes before the next obturation.

The digital images were coded, randomly ordered, and projected at 20× for evaluation. Evaluation of the obturation at each level (1, 3, 5, and 7 mm from WL) was scored as follows:

Lateral grooves: 0 = no gutta-percha or Resilon in groove and 1 = presence of gutta-percha or Resilon in groove.

Dentin depressions: 0 = no flow of gutta-percha or Resilon in depression, 1 = partial flow of gutta-percha or Resilon in depression, and 2 = complete flow of gutta-percha or Resilon in depression.

Each specimen was evaluated independently by two examiners (JCB and JGM). Statistical analysis was performed by using a Wilcoxon signed rank test ($p \leq 0.05$) for the presence of gutta-percha compared with Resilon in lateral grooves and depressions at the different levels.

Results

Scores for flow of gutta-percha and Resilon into dentin depressions and lateral grooves at 1 mm, 3 mm, 5 mm, and 7 mm for the different System B plugger insertion depths are presented in Tables 1