
Efficacy of Profile .04 taper series 29 in removing filling materials during root canal retreatment—an in vitro study

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Objective. The aim of this study was to compare Profile .04 taper series 29 instruments and hand files for gutta-percha removal.

Study design. Twenty maxillary central incisors with a single straight canal were instrumented and filled. The teeth were divided into 2 groups of 10 specimens each, according to gutta-percha removal techniques: Group 1- Profile series 29 and Group 2- hand files and solvent. The amount of time for gutta-percha removal and the number of fractured instruments were evaluated. Radiographs were taken and the teeth were grooved longitudinally and split. The area of residual debris was measured using computer software.

Results. The time for filling material removal was significantly shorter when Profile series 29 was used ($P = .00$). Regarding cleanliness, there were no statistical differences in the teeth halves evaluations ($P > .05$). Hand instruments cleaned the canals significantly better than Profiles, in the radiographic analysis considering the whole canal. Overall, the radiographic analysis showed a smaller percentage of residual debris than the teeth halves analysis.

Conclusion. The Profile series 29 instruments proved to be faster than hand instruments in removing root filling materials; however, hand instruments yielded better root canal cleanliness. Some residual debris was not visualized by radiographs. (*Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;108:e46-e50)

Persistent apical periodontitis has been mainly caused by root canal bacteria that would have survived treatment; therefore, it has been frequently treated by using orthograde retreatment.¹

Gutta-percha has been the most widely used endodontic filling material in conjunction with several sealers. Their removal from inadequately prepared and filled root canal systems has been essential in root canal retreatment because these filling materials would be likely to uncover remaining tissue or bacteria that may be responsible for periapical inflammation and post-treatment disease.² However, their removal from apparently well-condensed root canals may be time consuming.³ Thus, a variety of instruments have been used to remove root-filling materials, including stainless steel hand instruments either alone or combined with solvents, rotary instruments, heat-carrying instruments, and ultrasonic devices.³⁻⁵

Currently, the use of Ni-Ti rotary instruments has been recommended for gutta-percha removal and various studies have reported their efficacy, cleaning ability, and safety. Different systems, such as Quantec,^{6,7} Profile,^{8,9} ProTaper,^{2,10-12} GT files,² RACE,^{10,13} and ProTaper Universal retreatment files^{9,14,15} have been evaluated for filling material removal and root canal reinstrumentation.

The Profile series 29 has proved to rapidly prepare canals and to create a good 3-dimensional form with minimal canal transportation.¹⁶⁻¹⁸ Also, it has been evaluated for gutta-percha removal. In a previous study¹⁹ the Profile series 29 proved to be faster than hand instrumentation for gutta-percha removal in oval-shaped root canals; however, the mean values of filling material remnants were significantly higher, except in the apical third, where no difference occurred. Another study²⁰ showed that Profile series 29 deeply penetrated into curved root canal compared to Gates-Glidden drills, during the initial phase of endodontic retreatment.

The evaluation of gutta-percha removal has been performed by rendering the teeth transparent,^{10,11,13,14} using teeth halves,^{2,6,7,9,15,19} and using radiographs.^{6,7,12,15} In most of the studies, the residual filling material has been measured in mm² using computer software.^{6,7,9,10-15}

According to our knowledge, the literature has shown only a few studies investigating the use of Profile series 29 instruments in retreatment,^{19,20} and none has tested

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them in straight and circular-shaped canals. Therefore, the purpose of this study was to compare Profile series 29 instruments to hand instruments, in straight canal retreatment, regarding the cleanliness of root canal walls and the time consumed for gutta-percha removal, using both teeth halves and radiographs.

MATERIALS AND METHODS

Twenty extracted maxillary central incisors with single straight root canals and completely formed apices were selected. Preoperative buccolingual and mesiodistal radiographs were taken to confirm the presence of a single straight canal. The study was accomplished according to Bauru School of Dentistry's Ethics Committee regulations concerning ex vivo experiments.

Canal preparation

The coronal access cavity was prepared using high-speed diamonds drills and water spray. A size 10 K-file (Dentsply Maillefer, Ballaigues, Switzerland) was placed into the canal until it was visible at the apical foramen. The working length was established 1 mm short of this length. The teeth were mounted in gypsum blocks. Root canals were prepared with a step-down technique, performed with a sequential use of .02 taper K-type files (Dentsply Maillefer, Ballaigues, Switzerland) up to size 40 at working length. Following, a step-back procedure in 1-mm increments was executed up to size 60. Canals were irrigated with 1 mL 1% NaOCl at each change of file. Then, canals were filled with 17% EDTA for 3 minutes and flushed with distilled water to remove the smear layer.

Canal obturation

Before obturation, canals were dried with absorbent paper points. The canals were filled with a zinc oxide eugenol sealer (Endométhasone- Septodont, Saint-Maur-des-Fossés, France) and gutta-percha using a cold lateral-compaction technique. The access openings were sealed with a temporary filling material (Coltosol, Coltene-Whaledent, Cuyahoga Falls OH). A single operator prepared and filled all the canals. Buccolingual and mesiodistal radiographs were taken to examine the obturation quality and, in particular, the apical extent and degree of condensation. The distance between the X-ray cylinder and the film was 10 cm and the main beam formed a 90-degree angle with the film. The exposure time was 0.4 second and the films were automatically processed using Peri-Pro II X-ray processor (Air Techniques Inc, Melville, NY). All teeth were stored at 37°C in 100% humidity for 1 year.

Retreatment technique

The teeth were randomly divided into 2 groups of 10 specimens each, treated according to the following gutta-percha removal techniques:

Group 1—Profile .04 taper series 29

Profile .04 taper series 29 instruments (Tulsa Dental, Tulsa, OK) used with a 16:1 reduction hand piece powered by an electric motor (NT company, Chattanooga, TN) were used to remove the gutta-percha and sealer from the canals. Profile rotary instruments sizes 5 to 8 were sequentially used up to working length to remove the root filling materials. A 1500-rpm speed was used based on a previous study that evaluated Quantec rotary instruments for gutta-percha removal,⁶ but no solvent was applied. The instrument was introduced with a light apical pressure up to working length, and then, an up-and-down motion was used to remove all the filling materials.

Group 2—Hand instruments

Following placement of Xyloil (0.5 mL) in the pulp chamber, a size 15 K-type file (Dentsply Maillefer) was inserted until it reached the working length. Then, Hedström files (Dentsply Maillefer) from size 20 to size 40 were used in a filing motion toward the canal walls.

The canals were irrigated with 1% NaOCl between files in both groups. Removal of filling materials was judged complete when no more gutta-percha/sealer could be seen on the last file used and the canal walls were smooth. Each hand instrument or Profile instrument was discarded after being used in 4 canals and a single operator prepared all samples.

Evaluation

Time taken to reach working length (T1). The time required for the size 5 instrument (in the Profile series 29 group) and size 15 K file (in the Hand group) to reach working length was measured (in seconds) with a stopwatch.

Time for gutta-percha removal (T2). The time for the removal of gutta-percha and sealer was measured (in seconds) with a stopwatch.

Total time (T1 + T2). The time to reach working length and for the complete removal of gutta-percha and sealer was calculated by adding T1 to T2.

Fractured instruments. The number of fractured instruments was recorded for each group.

Canal wall cleanliness. After filling removal, buccolingual and mesiodistal radiographs were taken as pre-

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