

A comparative evaluation of efficacy of protaper universal rotary retreatment system for gutta-percha removal with or without a solvent

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Abstract

Aim: The aim was to evaluate and compare the efficacy of ProTaper Universal rotary retreatment system with or without solvent and stainless steel hand files for endodontic filling removal from root canals and also to compare retreatment time for each system. **Materials and Methods:** Thirty extracted mandibular premolars with single straight canals were endodontically treated. Teeth were divided into three major groups, having 10 specimens each. Removal of obturating material in group 1 by stainless steel hand files with RC Solve, group 2 by ProTaper Universal retreatment instruments and group 3 by ProTaper Universal retreatment instruments along with RC solve was done. Retreatments were considered complete for all groups when no filling material was observed on the instruments. The retreatment time was recorded for each tooth. All specimens were grooved longitudinally in a buccolingual direction. The split halves were examined under a stereomicroscope and images were captured and analyzed. The remaining filling debris area ratios were considered for statistical analysis. **Results:** With ANOVA test, statistical analysis showed that there was statistically no significant difference regarding the amount of filling remnants between the groups ($P < 0.05$). Differences between the means of groups are statistically significant regarding the retreatment time. **Conclusion:** Irrespective of the technique used, all the specimens had some remnants on the root canal wall. ProTaper Universal retreatment system files alone proved to be faster than the other experimental groups.

Keywords: Endodontic retreatment, gutta-percha, hand files, ProTaper Universal rotary files

Introduction

The principle objective of endodontic therapy is to retain the tooth in proper form and function. But in few cases, patients may report with failure. In such cases, retreatment is the treatment of choice.

During endodontic therapy gutta-percha (GP) is the most widely used core material for obturation in conjunction with different sealers.^[1] Various techniques are used for removal of GP such as hand instruments with or without chemical solvents, heat, rotary instruments and ultrasonic devices.^[1,2]

The present study was undertaken to evaluate and compare

the efficacy of ProTaper Universal rotary retreatment system with or without solvent and stainless steel hand files with solvent for removal of obturating material from root canals and the total time required for retreatment was also determined and compared.

Materials and Methods

This study was carried on thirty freshly extracted noncarious human mandibular premolar teeth with straight canals and fully formed apices. Teeth with calcification or internal resorption were excluded. They were cleaned thoroughly to remove hard and soft debris and sterilized in autoclave at 15 lbs pressure, 121°C for 30 minutes and then stored in physiologic solution up to the time of the experiment. The crowns were sectioned horizontally with a diamond disk to leave a 16 mm root length. An ISO size 10 K-file (DENTSPLY Maillefer, Ballaigues, Switzerland) was used to establish the working length 1 mm short of the apical foramen. The cervical third was flared with sizes 3 and 2 Gates-Glidden drills (Mani Inc., Tochigi, Japan) in decreasing order with a slow speed handpiece (NSK NAKANISHI INC Japan). Cleaning and shaping were performed using a crowdown technique up to a size 50 K-type file (DENTSPLY Maillefer, Ballaigues, Switzerland) cervically and were flared apically up to a size 35 K-type file (DENTSPLY Maillefer, Ballaigues, Switzerland). A total of 5.25% sodium hypochlorite and 17% ethylenediaminetetraacetic acid and isotonic saline were used as irrigants. The root canals were dried with paper points and obturated with GP (DENTSPLY Maillefer, Ballaigues, Switzerland) and zinc oxide eugenol sealer

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by using the cold lateral compaction technique and radiographed for assessing quality of obturation.

The teeth were randomly divided into three groups with 10 specimens each. Removal of GP was performed by using one of the following techniques. In group I, GP was removed from the coronal and middle thirds with sizes 3 and 2 Gates-Glidden drills. Softening of the GP was performed by placing 0.5 ml of RC Solve (PRIME DENTAL products pvt. Ltd.) into the root canal. ISO sizes 35--20 Hedstrom files were used sequentially in a circumferential quarter turn push-pull filing motion to remove the root fillings from the middle and apical portions until the working length was reached. In group II, ProTaper Universal retreatment instruments (DENTSPLY Maillefer, Ballaigues, Switzerland) were used in a crowdown method to remove the filling material. D1, D2, and D3 files were used sequentially in a brushing action until the working length was reached. These files were connected to an electric motor (Endomate DT NSK Nakanishi Inc., Japan) which was running at a constant speed of 500 rotations per minute (rpm) for D1 and 400 rpm for D2 and D3, with a torque of 3 N cm. In group III, the technique used was similar to that used in group II, but after using D1 file, 0.5 ml of RC Solve was placed into the root canal to soften the GP. Then D2 and D3 files were used sequentially to remove the softened GP until the working length was reached.

Upon withdrawal of the file, adherent filling material was removed before being reintroduced in the root canal. Each file was discarded after being used in five teeth. Retreatments were deemed complete when remnants of the obturating material were not observed on the instruments. The retreatment time was recorded for each tooth.

All specimens were grooved longitudinally in bucco-lingual direction with a diamond disk and split into halves with a chisel. The split halves were examined with a camera (Olympus DP-17, 12 megapixels; Olympus Corporation, Tokyo, Japan) adapted to a stereomicroscope (Olympus SZX16) with 12.5 × magnification and images were captured. These images were analyzed with specific software (Image Pro Plus, Windows 2007) to measure the areas of remaining filling material in group I [Figures 1a and b], group II [Figures 2a and b], and group III [Figures 3a and b]. The remaining filling debris area ratios and the total time required for removal of GP were considered for statistical analysis. Data were analyzed by the ANOVA test.

Results

The remaining endodontic filling material was observed in all the examined specimens. The mean amounts of remaining gutta-percha or sealer in each group are tabulated [Table 1]. There was a statistically significant difference between groups I and II (unpaired t-test

$P < 0.05$). The difference between the means of groups I, II, and III is not statistically significant as analyzed by ANOVA, $P = (0.144)$.

Retreatment time taken is minimum for group II, and maximum for group I [Table 2]. The difference between the means of groups I, II, and III is statistically significant as analyzed by ANOVA, ($P = 0.00$).

Discussion

Successful endodontics can be achieved by judicious instrumentation, microbial control, and complete obturation of the root canal system. In the case of failure of endodontic therapy, conventional retreatment is often preferred to extraction.

GP is the most widely used and accepted obturating material. It is relatively easy to manipulate and to retrieve from the

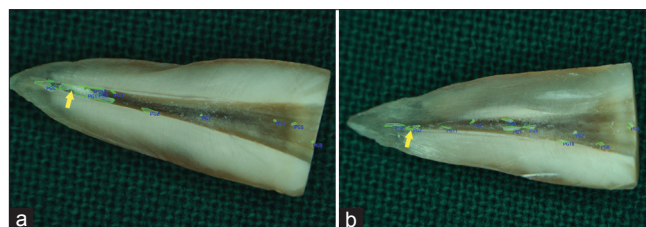


Figure 1: (a) Remnants of filling material on one-half of the specimen in group I. (b) Remnants of filling material on another half of the specimen in group I

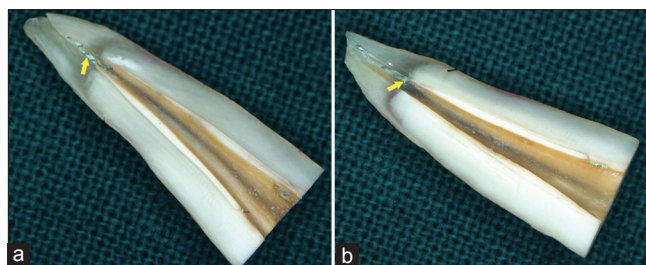


Figure 2: (a) Remnants of filling material on one-half of the specimen in group II. (b) Remnants of filling material on another halves of the specimen in group II

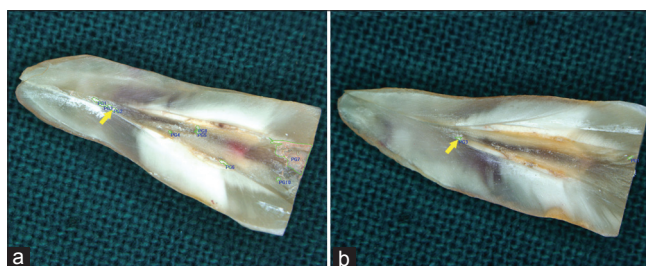


Figure 3: (a) Remnants of filling material on one-half of the specimen in group III. (b) Remnants of filling material on another halves of the specimen in group III. PG: Gutta-percha and Sealer Remnants

Table 1: Scores of remaining GP in all groups

Group	Minimum (mm ²)	Maximum (mm ²)	Mean (mm ²)	Standard deviation
I	0.2531	1.7102	0.96633	0.412074
II	0.1224	1.5424	0.53362	0.440701
III	0.2452	1.9016	0.79931	0.567824

canal, for retreatment.^[3] Nonsurgical retreatment techniques include hand files, rotary instruments, solvent dissolution or their combination which will remove the obturating material and debride the canal walls.

Hand instruments are undoubtedly the most commonly practiced, but they may be time consuming and occasionally yield limited results.^[3] The rotary technique is considered to be fast and safe for removal of well-condensed obturation, even in curved canals. ProTaper Universal retreatment system comprises three flexible retreatment files D1, D2, and D3^[4] designed specifically to remove obturation material from root canals. The combined use of solvents along with hand or rotary files complicates debridement, because these solvents dissolve, flow into, and coat inaccessible canal irregularities or penetrate into the periradicular tissues.^[5]

The results of the study showed that the cleaning efficacy is in the order of group II > group III > group I [Table 1]. This may be explained by the small differences between the taper and diameter of the hand and rotary instruments used in the reinstrumentation of the root canals. ProTaper retreatment files having larger tapers^[6] can be expected to result in a cleaner canal than stainless steel hand files. The better performance of ProTaper Universal retreatment instruments may be attributed to their design. D1, D2, and D3 have three progressive taper and lengths. These features may enable them to cut and pull the GP into the file flutes and direct it toward the orifice.^[7]

In the present study, although group II showed better results than the other two groups, [Table 1], the procedure was not able to completely remove GP or sealer from root canals.^[8] This is inconsistent with other studies. Further root canal refining is necessary because the apical diameter of the last instrument, D3 (20/07) of ProTaper universal retreatment system, which is designed to reach the working length, does not permit a complete cleaning action.

In group I, maximum amount of debris was remaining in the canal when compared with other groups [Table 1]. This was in contrast with the previous studies,^[1,9] who compared the rotary with hand files during retreatment. In their study hand files showed better results; this could be because of the use of solvents along with them.

Table 2: Scores of retreatment time (min) in all groups

Group	Minimum (min)	Maximum (min)	Mean	Standard deviation
I	10.13	16.23	12.96	2.12
II	4.32	9.53	6.31	1.60
III	9.05	12.05	9.82	1.09

In this study specimens were grooved longitudinally and split into halves with a chisel. Care was taken not to touch the root canal wall during splitting of the tooth and thus prevented GP remnants from displacement during this process. The amount of residual GP was evaluated quantitatively by using a stereomicroscope. Nonetheless, a radiographic examination provides a two-dimensional image which was proved to be less effective than that provided by a cleavage method.^[10]

With regard to retreatment time, group II [Table 2] took significantly less time than groups I and III because of the frictional heat produced by the rotary instruments which might have plasticized the GP^[7] and help in its better removal.

With the introduction of new instruments for retreatment, the procedure can be completed more easily, quickly, and predictably, but effective cleaning of the entire root canal is still challenging.

Conclusion

Under the experimental conditions of the present study, all techniques proved helpful for removal of endodontic filling material. The ProTaper Universal rotary retreatment system showed better removal of GP and also proved to be faster in terms of retreatment time than the other experimental groups. Further studies may be required to confirm the effect of various retreatment techniques on root canal cleaning successfully.

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