

COMPARITIVE EVALUATION OF EFFICIENCY AND TIME OF GUTTA PERCHA REMOVAL USING HEDSTROM FILES, PROTAPER RETREATMENT AND RENDO FILES - AN EX VIVO STUDY

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ABSTRACT: AIMS: The purpose of this study was to evaluate the efficacy and the time taken of gutta-percha removal using protaper universal retreatment system (PTUS) and R Endo with Hedstrom files.

METHODS AND MATERIAL: 45 mandibular premolars with one single straight canals were instrumented with k files and filled using cold lateral compaction and sealer. The teeth were randomly divided into three groups of 15 specimens each. After re-preparation with Gates Glidden drills and the test instruments, the specimens were cleared. The area of remaining gutta-percha was measured using image analysis software.

STATISTICAL ANALYSIS: It was performed by means of the One-way Anova test to compare the mean values. Since there was a significance difference between mean values, Bonferroni multiple comparisons were made. Level of significance was set at $P < 0.05$.

RESULTS: The R Endo group showed significantly less obturating material than PTUS and Hedstrom files. PTUS and R Endo files required less time for gutta-percha removal.

CONCLUSION: R Endo files were found to be more effective, both R Endo and PTUS took less time.

KEYWORDS: Retreatment, Rotary, Protaper, Rendo Files.

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INTRODUCTION: Herbert Schilder quoted the term "RETREATODONTICS" and said that the future of endodontics lies in the "Retreatment of Endodontic Failures". The primary goal of retreatodontics is to establish a healthy periapical tissue. When a retreatment procedure is indicated the maximum removal of the obturating material is pivotal for achieving success.

Suggested retreatment techniques include the use of heated instruments, rotary, solvents, and ultrasonic devices to remove the obturating material and to debride canal remnants. Rotary instruments have proved to be effective and time saving in removing the filling materials.¹ Combination of the aforementioned techniques are more effective compared to any one of them.

The 3 Protaper Universal System retreatment files (PUTS) (Dentsply Maillefer Ballaigues) are designed for retreatment. The D1 PTUS has a cutting tip to facilitate initial penetration into the filling material; the D1 instrument has a length of 16mm, a tip of 0.30mm and a 0.09% taper.

The D2 instrument is used for removal of material in the middle third and has a length of 18mm, a tip of 0.25mm, and 0.08% taper. The D3 PTUS instrument for apical filling removal with a length of 22mm, a tip of 0.20mm, and a 0.07% taper is used to reach the working length.²

The R-Endo® (Micro-Mega, Besancon, France) instrumentation system, specifically dedicated to retreatment procedures, has been developed in 2003. The system is composed of four instruments: Re (size 25, 0.12 taper) to flare the first few millimeters of the canal, and three files R1, R2 and R3 dedicated to each root canal third to a size 25, with 0.08, 0.06 or 0.04 tapers respectively. An optional finishing file Rs (size 30, 0.04 taper) is available if required. The files have a triangular cross section with three equally spaced cutting edges and no radial land; the tip of the files is claimed to be inactive.³

Purpose of the study was to compare the cleanliness of root canal walls after retreatment using chloroform in combination with PTUS retreatment files, R Endo files and Hedstrom files in single rooted human teeth.

MATERIALS AND METHODS: SPECIMEN PREPARATION: Soft tissue and calculus were mechanically removed from the root surface of 45

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selected specimens. The teeth are verified radiographically as having patent and almost straight canals.

Access preparations were made on each tooth using high speed diamonds and water spray. A size 10 K-type file was placed into the canal until it was visible at the apical foramen. The working length was established 0.5mm short of this length.

1. CANAL PREPARATION: The root canals were prepared using a step-down technique. The cervical and middle thirds were flared with GGDs 1, 2 & 3 in a telescopic preparation.

Canal instrumentation was completed using K type files with the master apical file size 30. NaOCl 2.5% (Novo Dental Product, India), 2% CHX (Vishal Dentocare, India) and 17% EDTA irrigations were used during cleaning and shaping.

2. CANAL OBTURATION: The root canal of each tooth was dried with paper points (Dentsply Maillefer Ballaigues) and the instrumented canals were obturated with laterally condensed gutta-percha and AH Plus sealer. (Dentsply).

The access cavities were filled with Cavit (Dental Products of India, India) Teeth were radiographed in bucco-lingual and mesio-distally to confirm the adequacy of RC obturation. All teeth were stored in an incubator with moist gauze inside at 37°C for 2 weeks to allow complete setting of the sealer.

3. RETREATMENT TECHNIQUE: All samples were randomly divided into 3 groups having 15 specimens each. Obturation material was removed from the cervical aspect of the canals of all teeth with corresponding instruments. Then a drop of orange oil solvent (RC solve, prima dental, Mumbai, India) was introduced into each canal to soften the GP in specimen for each group. For all group amount of solvent group is 0.5 ml.

NaOCl 2.5% and 17% EDTA irrigations were used after instrumentation. Each root canal was irrigated with a total of 30ml of NaOCl and 15ml of EDTA. Each root canal is irrigated with a total of 30 ml NaOCl and 30 ml Chlorhexidine. PUTS, R Endo files were driven with a torque controlled engine at 300 rpm. Random usage sequence was used to avoid bias towards one of the three groups.

Group 1: Hedstrom files (Dentsply Maillefer Ballaigues):

Hand instrumentation was carried out with h type files with sizes 30, 35, 40 in a circumferential quarter turn push pull filing motion to remove gutta-percha and sealer from the canal walls.

Group 2: PTUS: Instruments D1, D2 and D3 were used for retreatment in the crown down technique until D3 reached the working length.

Group 3: R Endo instruments: Instruments (R1, R2, and R3) were used in a crown down technique until R3.

Finally the crowns were resected so that the working length of each tooth was 15-16 mm.

SPECIMEN EVALUATION: For all roots, 4 types of data were collected.

Radiographic Evaluation: Standard radiographs were taken and processed for each teeth. The radiographs were scanned and images stored in desktop computer. The radiographs were taken by means of parallel technique (long cone technique) standardized with 16 cm focus distance and an exposure time of 2 seconds. The radiographs were then scanned and image stored in desktop computer.

Canal Wall Cleanliness: An amount of GP / sealer on the canal walls were estimated using a image analysis software (Image J).The image was captured and analyzed using image analysis software. The evaluator was blinded to group assignment. The total area as well as area corresponding to the radiopaque filling debris were delimited and measured in unit of area (mm²) using the Image J software. No attempts were made to distinguish between residual gutta-percha and sealer.

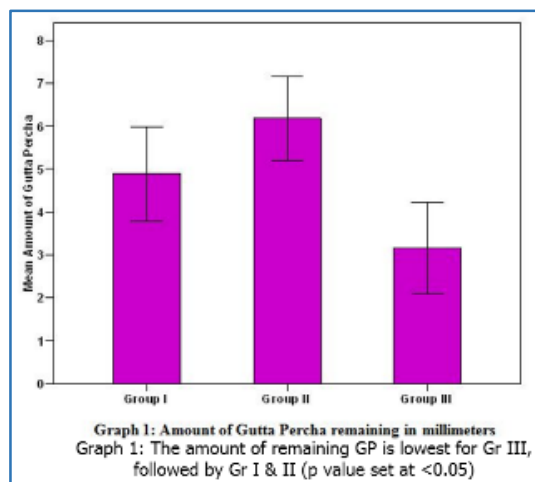
Time for Retreatment: The time elapsed from entering the canal with the first endodontic instrument until the completion of the re-instrumentation was noted.

STATISTICAL ANALYSIS: It was performed by means of the One-way Anova test to compare the mean values. Since there was significant difference between mean values, Bonferroni multiple comparisons were made. SPSS [Statistical Package for Social Science] software version 15 was used. Level of significance was set at P <0.05.

RESULTS: CANAL WALL CLEANLINESS: None of the instrument groups showed complete removal of GP. Mean of Gr III is least followed by Gr I & II; that implies, the amount of remaining GP is lowest for Gr III, followed by Gr I & II [Graph 1].Gr III has shown lesser amount of remaining GP than Gr I, and Gr II which is statistically significant. [P=0.048, 0.0005] Difference between Gr I and Gr II is statistically not significant.

One-way Anova test was applied to compare the mean amount of Gutta-Percha remaining among 3 groups as in table 1. (p value set at <0.05).

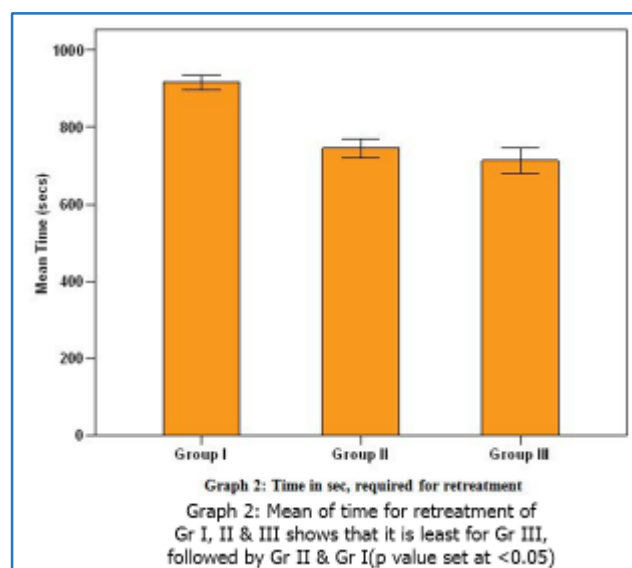
	N	Mean	Std. Deviation	Minimum	Maximum
1	15	4.88860	1.988118	2.030	8.695
2	15	6.17947	1.755277	2.874	9.181
3	15	3.16300	1.905066	0.842	5.892
Total	45				
F = 9.667 P = 0.005					
Table 1: One-Way Anova					



TIME REQUIRED FOR RETREATMENT: Mean of time for retreatment of Gr I, II & III shows that it is least for Gr III, followed by Gr II & Gr I [Graph 2]. Gr II & III has taken lesser time for retreatment than Gr I, which is statistically significant. [P=0.0005]. Though Gr III has taken lesser time for re-treatment than Gr II, it is statistically not significant.

One-way Anova test was applied to compare the mean of the time required for re-treatment, among 3 groups as in table 2. (p value set at <0.05).

	N	Mean	Std. Deviation	Minimum	Maximum
1	15	915.73	35.588	860	970
2	15	745.80	44.477	667	814
3	15	713.33	62.050	635	860
Total	45				
F = 74.945 P = 0.005					
Table 2: One-way Anova					



DISCUSSION: The management of failed root canals include nonsurgical retreatment, apical surgery or extraction. The success rate of endodontic retreatment ranges from 56-84%.⁴ Although there was no statistically

significant difference between the success rate of surgery and for conventional retreatment the preferred treatment of failing endodontic cases is non surgical retreatment.⁵ Surgical retreatment resulted in more postoperative discomfort. Variations in original root canal morphology greatly influence the changes that occur after root canal preparation and as a logical extension, after retreatment procedures.⁶ In order to minimize these variables a standardized length of root canal filling was adhered to and only teeth with straight canals in both buccolingual and mesiodistal directions were selected.

The gutta-percha dissolving solvent used in our study is orange oil. This agent was used because of the potential toxicity encountered with chloroform and xylene.⁷

The procedure of gutta-percha removal and retreatment done in our study is similar to many studies.^{1,8} In the present study, the motic stereomicroscopic imaging technique was followed under 4X magnification to get a clear and accurate picture of canal cleanliness. The amount of remaining GP was measured with image analysis software. It is considered as a simple and efficient assessment method. The amount of remaining GP was measured in millimeters.⁹

We had no broken rotary instruments, due to the use of constant speed and no torque motor in addition each set of instruments prepared only 5 root canals and the application of orange oil help to prevent iatrogenic errors like broken instruments. In the current study all retreatment techniques left remaining filling material inside the canal, this is in concordance with the previous studies.^{1,10}

In the present study, the ProTaper retreatment group has left highest remaining debris, which was observed in other studies.¹ Regarding the apical area, probably the smaller apical size of the last ProTaper re-treatment instrument (size 20) was disadvantage of the ProTaper group compared to the other groups in this study (size 40 for H file and size 25 for R endo). In contrast to the present results, it was reported that retreatment with ProTaper files showed no difference among H files, Race group and Flex Master group concerning cleanliness.¹⁰ Thus continuation of instrumentation with F2 and F3 ProTaper files would have improved the outcome in ProTaper retreatment group.^{2,9} Rendo instruments showed lowest mean area of remaining gutta-percha, this may be due to design of Rendo file having different taper and same tip diameter 0.25 giving it rigidity especially with 0.04 taper. They are machined into a round blank and their cross section is characterized by equally spaced cutting edges.

Retreatment with rotary systems (ProTaper and R Endo) was quicker and more effective than H files. The greater taper of the two rotary files compared to Hedstrom group might be the reason for quick and effective gutta-percha removal. This results are in accordance with the previous studies comparing ProTaper and Hedstrom files.^{1,9,11} Overall the time required for retreatment in the present study was longer than in other

studies. This fact may be explained by inter-operator variability, a high amount of irrigation solution used taking longer time for irrigation, as in other studies.^{1,9,11}

CONCLUSION: So rotary instruments can be used for quick removal of GP and then, hand instrumentation could be used to refine and complete the removal. This hybrid technique of combining hand and rotary instrumentation would enable the utilization of the advantages of both techniques and minimize their shortcomings. It has also been concluded by authors that the use of rotary devices in endodontic retreatment should be followed by thorough hand instrumentation to achieve optimum cleanliness of root canal walls.⁷

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