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Original Research

Comparison of efficacy of D-RaCe files, ProTaper Retreatment files, Mtwo retreatment files and Manual H-files in removing filling material from the root canals both in terms of remaining filling material, and the time required

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ABSTRACT:
Background: Success is the expected outcome after root canal treatment (RCT), regardless of the clinical conditions. The aim of this in-vitro study is to compare the efficacy of D-RaCe files, ProTaper Retreatment files, Mtwo retreatment files and Manual H-files in removing filling material from the root canals both in terms of remaining filling material, and the time required. **Materials & methods:** The present study was conducted for comparing the efficacy of D-RaCe files, ProTaper Retreatment files, Mtwo retreatment files and Manual H-files in removing filling material from the root canals both in terms of remaining filling material, and the time required. A total of 40 freshly extracted mandibular premolars were included in the study. The samples were randomly divided into four experimental groups each containing 10 samples; depending upon the instruments used to remove the root canal filling: Group A: D-RaCe files, Group B: ProTaper Retreatment files, Group C: M two Retreatment files and Group D: Hedstrom files with Solvent. In this study the following parameter was evaluated: Remaining Root Canal Filling Material. All the results were analysed by SPSS software. **Results:** Mean remaining root canal filling material among specimens of group A, group B, group C and group D was 8.9%, 8.1%, 12.7% and 16.2 % respectively. While comparing the results, significant results were obtained. **Conclusion:** The use of D-RaCe files & ProTaper Retreatment files proved to be efficient methods for removing gutta-percha during endodontic retreatment.
Key words: Retreatment, root canal

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INTRODUCTION

Success is the expected outcome after root canal treatment (RCT), regardless of the clinical conditions. However, predicting success usually requires adopting a referential or criteria, and presupposes that the patient is healthy.[1, 2]

The dentist's skills are crucial to interpret correctly the radiographic features and establish a diagnostic hypothesis.Successful RCT prevents pain, apical periodontitis (AP) and tooth loss, but it is a real challenge because several clinical conditions can contribute, alone or in combination, for a poor prognosis, namely root canal perforation, overfilling, endodontic and periodontal lesion, root fracture, periapical biofilm, traumatic dental injury, fracture of instrument, AP, root resorption, etc.[3, 4]

Radiographic evaluation of root canal obturation depends on these factors. The radiographic appearance of an appropriate root canal obturation is characterized by a uniformly tapered canal from the coronal to apical ends, a dense root canal obturation without voids, and presence of filling materials 0.5–2 mm below the radiographic apex. In root canal obturation, each 1-mm loss of working length in teeth with apical periodontitis increases the failure rate by

14%. Underfilling and overfilling of a root canal obturation will also compromise the success rate of RCT. In addition, other iatrogenic errors such as instrument fracture, ledge formation, and apical perforations can cause failure of nonsurgical RCT.[5, 6]
The standard of coronal restoration has an effect on the peri-apical status of the root filled teeth. The outcome of a poor root canal filling can be favourable, if the quality of coronal restoration is good. On the other hand a tooth with poor coronal restoration, but having a well cleaned, prepared and well obturated root canal system may fail shortly. The endodontic re-treatment demand is increased, because the observations of numerous cross-sectional studies showed that an increased percentage of root filled teeth have evidence of apical periodontitis radiographically.[7, 8]
Before endodontic retreatment can be performed on an obturated tooth with a failed root canal treatment, the root canal filling material needs to be effectively and completely removed from the canal. Several techniques have been proposed to remove filling materials from root canal system, including the use of endodontic hand files, Nickel Titanium rotary instruments, Gates Glidden burs, heated instrument, ultrasonic instruments, laser, and use of adjunctive solvents. Conventionally, the removal of gutta percha using hand files with or without solvent can be a tedious, time-consuming process especially when the root filling material is well compacted.[9]The aim of this in-vitro study is to compare the efficacy of D-RaCe files, ProTaper Retreatment files, Mtwo retreatment files and Manual H-files in removing filling material from the root canals both in terms of remaining filling material, and the time required.

MATERIALS & METHODS

The present study was conducted for comparing the efficacy of D-RaCe files, ProTaper Retreatment files, Mtwo retreatment files and Manual H-files in removing filling material from the root canals both in terms of remaining filling material, and the time required. A total of 40 freshly extracted mandibular premolars were included in the study. Forty mandibular premolars with closed apices, single canals, and no visible signs of root fractures, cracks, or external resorption were selected for analysis. The crowns of the teeth were removed to a length of 15 mm from the apex using a diamond disc, which aimed to minimize variables in access preparation and to create a uniform surface for a stable reference point. Apical patency was assessed by inserting a no. 10 K-file into the canal until the tip was visible beyond the apical foramen. The working length was determined by subtracting 1 mm from the total root length. Cleaning and shaping procedures were conducted using K-files, with apical enlargement up to size 40, followed by a step-back technique to size 70 K-file. During the cleaning and shaping process, EDTA gel served as a lubricant, while 5% sodium hypochlorite was utilized as an irrigant. Following instrumentation, a 17% EDTA solution was introduced into the canal for 1 minute to eliminate the smear layer, which was subsequently rinsed with 5% sodium hypochlorite. The final rinse was conducted with normal saline. After the biomechanical preparation, the canals were dried using absorbent paper points and obturated with gutta-percha and AH Plus sealer through the cold lateral compaction technique. The samples were randomly divided into four experimental groups each containing 10 samples; depending upon the instruments used to remove the root canal filling:
Group A: D-RaCe files
Group B: ProTaper Retreatment files
Group C: M two Retreatment files
Group D: Hedstrom files with Solvent
During instrumentation, the blades were inspected and cleaned with gauze; and irrigation was done with 5% NaOCl solution. Filling material removal was considered complete when the final file easily reached the working length; the root canal walls were smooth and no further filling material was observed in the flutes of the file or in the irrigation solution. After complete removal of filling material, canal was irrigated with 17% EDTA for 1 min, followed by 5% NaOCl & final rinse with normal saline. In this study the following parameter was evaluated: Remaining Root Canal Filling Material. All the results were analysed by SPSS software. Chi-square test and student t test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

Mean remaining root canal filling material among specimens of group A, group B, group C and group D was 8.9%, 8.1%, 12.7% and 16.2 % respectively. While comparing the results, significant results were obtained.

Table 1: (Group A- D-RaCe Files)

Sample No.	Total canal area (in mm^2)	Area of remaining root canal filling material (in mm^2)	Remaining root canal filling material (in %)
Mean	25.7	2.1	8.9

Table 2: (Group B- ProTaper Retreatment Files)

Sample No.	Total canal area (in mm^2)	Area of remaining root canal filling material (in mm^2)	Remaining root canal filling material (in %)
Mean	27.8	2.9	8.1

Table 3: (Group C- Mtwo Retreatment Files)

Sample No.	Total canal area (in mm^2)	Area of remaining root canal filling material (in mm^2)	Remaining root canal filling material (in %)
Mean	27.9	3.8	12.7

Table 4: (Group D- Hedstrom Files with Solvent)

Sample No.	Total canal area (in mm^2)	Area of remaining root canal filling material (in mm^2)	Remaining root canal filling material (in %)
Mean	26.7	4.1	16.2

DISCUSSION

The successful endodontic treatment depends upon thorough debridement of infected or necrotic pulp tissue and microorganisms, and complete obturation of the canal space, thus preventing the persistence of infection and re-infection of the pulp space. If a root-filled tooth is functional, clinically symptomless and has no evidence of disease radiographically, then treatment can be considered a success.Failure may occur due to several causes including- iatrogenic procedural errors such as poor access cavity design, untreated canals, canals that are poorly cleaned and obturated, complications of instrumentation (ledges, perforations, or separated instruments) and overextension of root filling materials or due to factors such as coronal leakage, persistent infection and radicular cysts. The clinical success rate of endodontic retreatment has been estimated to vary between 50-90%, depending on the effective elimination of necrotic tissue, bacteria, and infected obturation material such as gutta-percha and cements from root canal. Although numerous materials including pastes, cements, semisolid materials and solid materials have been used for obturation of root canals; gutta-percha combined with sealer is the most commonly used material. Many techniques have been described for removal of gutta-percha. These include endodontic hand files combined with heat or chemical solvents (chloroform, methylchloroform, carbon disulfide, carbon tetrachloride, benzene, xylene, eucalyptol oil, halothane, and rectified white turpentine), Gates-Glidden drills, engine-driven rotary files, ultrasonic instruments, heat carrying instruments, paper points with chemicals and lasers.[10-12] The aim of this in-vitro study is to compare the efficacy of D-RaCe files, ProTaper Retreatment files, Mtwo retreatment files and Manual H-files in removing filling material from the root canals both in terms of remaining filling material, and the time required.

Mean remaining root canal filling material among specimens of group A, group B, group C and group D was 8.9%, 8.1%, 12.7% and 16.2 % respectively. While comparing the results, significant results were obtained. Kesim B et al compared the efficacy of manual and mechanical instrumentation techniques, including ProTaper Universal retreatment system, Mtwo retreatment system, Reciproc system, and Hedström files, regarding removal of overextended root canal filling material. Eighty extracted human mandibular premolar teeth were prepared at the apical foramen level using Revo-S rotary files and subsequently obturated. The root canal filling material was deliberately extruded from the apex. Samples were transferred to glass vials that simulated the periapical area. Eighty samples of overfilled teeth were randomly assigned to four equal groups (n = 20) for removal of the root filling material with ProTaper Universal retreatment files (Group 1), Mtwo retreatment files (Group 2), Reciproc system (Group 3), and hand files (Group 4). Removal of the root canal filling material and additional preparation were performed by individual instruments from each different system up to a #40 size. The external apical surface of the teeth and the surrounding glass vials were checked using a dental operation microscope with ×12.5 magnification. Samples were divided into two groups based on whether removal of the overextended root canal filling material was successful or not. The success rate for removal of overextended gutta-percha was greater for the Mtwo (30%) and hand files (30%) compared with the ProTaper (20%) and Reciproc (10%). However, no significant statistical differences existed among the experimental groups ($P > 0.05$). This study demonstrated that all tested systems had similar efficacy in removing overextended root canal filling material.[10]Kaşıkçı Bilgi Icompared the amount of apically extruded debris and of remaining filling material during the removal of root canal filling material using three rotary NiTi retreatment instruments or Hedström files. Ninety-six severely curved human molars of both jaws were selected. The root canals were prepared to size X2 (tip size 25, .06 taper) using the ProTaper Next system (Dentsply Sirona, Ballaigues, Switzerland), filled with gutta-percha and AH Plus sealer (Dentsply De Trey, Konstanz, Germany) and then randomly divided into four experimental groups (n = 24 each) with two subgroups of maxillary and mandibular teeth each. An experimental model was used as a phantom head to simulate the upper and lower jaws. The root filling materials were removed with one of the following files using a crown-down preparation technique: I. Hedström files (H-files) (VDW, Munich, Germany), II. R-Endo (Micro-Mega, Besançon, France), III. Reciproc (VDW) and IV. ProTaper Universal Retreatment system (PTU-R) (Dentsply Maillefer). Apically extruded material was collected in vials, which were weighed with a microbalance (10-5 g) before and after the retreatment. The area of residual filling material in the coronal, middle and apical root

level was assessed using digital analysis. Reciproc was associated with significantly less extruded debris than the H-files (P = 0.009). No significant differences were detected amongst the four retreatment techniques concerning residual filling material (P = 0.082). The amount of extruded debris and areas of remaining filling material were not correlated (P = 0.901). Location of teeth in the maxilla or mandible had no impact on the amount of extruded debris within each instrument group (P = 0.609). However, when teeth were evaluated in general irrespective of the instruments, significantly more debris was extruded in the mandibular location (P < 0.001). All retreatment systems were associated with apical extrusion of debris, but H-files extruded significantly more material than Reciproc.[11]

CONCLUSION

The use of D-RaCe files & ProTaper Retreatment files proved to be efficient methods for removing gutta-percha during endodontic retreatment.

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