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To compare the efficacy of different file systems to remove filling material during root canal retreatment utilizing stereomicroscope: An *in vitro* study

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Abstract

Aim: To evaluate the efficacy of M two, Protaper D Files, and R endo retreatment files to remove filling from root canal using stereomicroscope.

Materials and Methods: Thirty extracted human single rooted teeth, having a single canal were selected. The teeth were cleaned and shaped using a crown-down technique to a size 40 and filled with gutta-percha and a zinc oxide-eugenol-based sealer using a lateral compaction technique. Teeth was assigned into three group according to the system used for removing the root filling material Group 1- M Two Files, Group-II - Protaper D files and Group III - R Endo files. The amount of remaining filling material after the retreatment procedure was assessed utilizing a stereomicroscope.

Result: Statistical analysis revealed that Group 2 (Protaper D Files) showed highest efficiency in removing guttapercha.

Keywords: M-two files, Protaper D files, R-Endo files, re-treatment

Introduction

The success of nonsurgical root canal retreatment highly depends on removal of previous root filling material, bacteria and necrotic tissue [1]. Root canal therapy, despite having high degree of success, may not lead to desired response and failure may occur. When root canal therapy fails then, treatment options include conventional retreatment periradicular surgery, or extraction [2] Clinically, failure of endodontic treatment is determined on the basis of radiographic findings and clinical signs or symptoms of the treated teeth [3]. The most commonly used root canal filling material is gutta-percha in combination with a root canal sealer, as the use of gutta-percha without a sealer fails to produce a hermetic seal. Therefore, re-treatment of previously filled canals demands that the guttapercha and the sealer must be removed from the canal walls and anatomical ramifications to ensure complete cleaning of the root canal system during the chemo-mechanical preparation and application of antibacterial dressings [4]. Various instruments have been used for gutta-percha (GP) removal, including endodontic hand files, engine-driven rotary files, ultrasonic tips and files, and heat carrying instruments. Chemicals are sometime used as solvent.

Nickel-titanium (NiTi) rotary instruments have been used successfully in root canal cleaning and shaping [5] Products such as M Two R Files (VDW Antreas, Munich, Germany), Protaper D Files (Dentsply Tulsa Dental, Tulsa, OK, USA), and R Endo files (Mico Mega) have been proposed for removal of root filling material and have been shown to be more efficient and safer than traditional hand files. The purpose of the present laboratory study was to evaluate the efficacy of MTwo R Files, Pro Taper D Files and R Endo in removing GP from root canals.

Materials and Method

Thirty extracted mandibular premolars having single canal were used for the study. Biomechanical preparation was done using rotary protaper files upto F3 and teeth were obturated using mono cone technique. Teeth were then allotted into three groups with 10 teeth in each group. Group 1: MTwo R Files, Group 2: - Protaper D File, Group 3: R-Endo Files.

Reinstrumentation of the canals with ProTaper D files, Mtwo retreatment files and R-Endo retreatment files in respective groups was performed using X-smart endodontic motor. After the Guttapercha removal, all the teeth were sectioned longitudinally and scanned under stereo microscope (Figure 1-3).



Fig 1: Group 1 (M Two R Files)



Fig 2: Group 2 (Protaper D Files)



Fig 3: Group 3 (R Endo Files)

Statistical Analysis

Descriptive statistics, including the mean, standard deviation, standard error were calculated for each of the groups tested.

The results obtained were then evaluated using Post Hoc Tukeys Test (Tables 3), to analyze differences in removing the gutta percha within groups. The Friedman one-way ANOVA was carried to compare the different techniques for removing the root filling material. Significance for all statistical tests was predetermined at $P < 0.05$.

Result

All instruments left some amount of filling material inside the root canal. However, specimens retreated with the Pro Taper D Files left less filling material inside the root canals than other groups tested. Table 1 shows the mean and standard deviation of all the three groups.

Table 2 shows Statistically significant difference between all the three groups ($P = 0.002$) using one way ANOVA.

Table 3 shows significant difference in mean between M two and Protaper D (0.001), M two and R Endo ($P = 0.001$), Protaper D and R Endo ($P = 0.003$) using POST HOC analysis.

Results showed that Protaper D files are superior than R endo files & M two R files in removing gutta percha

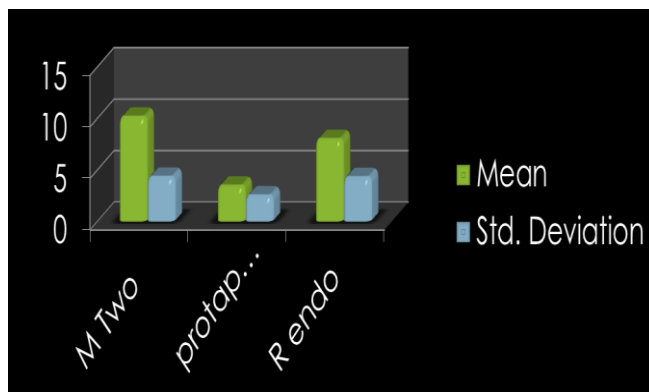
Table 1: Mean and Standard Deviation Values

Group	Mean	Std. Deviation
M-Two R Files	10.1840	4.35486
Protaper D Files	3.4970	2.55208
R Endo Files	8.0220	4.32535

Table 2: Freidman One Way Anova One Way Anova

	Square of sum	df	Mean Square	F	Sig
Between the groups	232.886	2	116.443	7.903	.002

$P = 0.05$



Graph 1: Graphical Statistical Analysis

Table 3: Post Hoc Tukeys Analysis

Group I	Group II	P Values
M-Two	Protaper D	0.001
M-Two	R Endo	0.001
Protaper D	R Endo	0.003

Discussion

Complete removal of pre-existing filling material from canals is a prerequisite for successful nonsurgical root canal retreatment. This procedure can uncover residual necrotic tissues or bacteria that may be responsible for persistent periapical inflammation, and allow further cleaning and refilling of the root canal system [6]. The crucial factor for achieving successful retreatment is thorough reshaping and cleaning of the canals to eliminate bacteria [7]. A success rate of 74-98% is reported for the nonsurgical retreatment

procedure^[8]. The increasing patient demands for saving teeth and the 10% possibility of root canal failure signifies the importance of the retreatment procedure. Removing filling material from inadequately prepared or filled root canal systems is necessary because this material causes a mechanical barrier that hinders contact of irrigating solutions and intracanal dressings to the root canal walls^[9]. Removal of filling material also uncovers remaining necrotic tissue or bacteria that might be responsible for periapical inflammation and thus post treatment disease^[10]. Apical extrusion of debris also appears to occur with all instrumentation techniques which may cause acute exacerbations of chronic inflammatory conditions. Therefore, practical methods for removing this material from the root canal has been investigated^[11]. NiTi rotary instruments have been proposed for removing guttapercha from root canals^[12].

The current study focused on the efficacy of Pro Taper D Files, Mtwo R Files and R Endo Files in removing guttapercha from root canals. No solvent was used in addition to facilitate removal of guttapercha.

The Mtwo rotary systems has specifically designed files with cutting tips for retreatment^[13]. In the Mtwo file, the distance between cutting edges (pitch) is increased from the tip of the instrument to the handle. The depth of the space designed for dentine removal is increased behind the blades, which provides the largest space for dentine removal and leads to more efficient gutta-percha and sealer removal. The Mtwo file has H file-like motion (up and down). Its capacity for material removal is good due to its structure^[14]. These files have an S-shaped cross-section, an increasing pitch length in the apical-coronal direction and a cutting tip. Therefore, these instruments are characterized by a positive rake angle with two cutting edges. Unlike other NiTi instruments, the Mtwo rotary instruments do not require a crown-down instrumentation sequence. Using the Mtwo instruments with the single length preparation leave more filling material in the canal during retreatment^[15].

R Endo consist of set of four files. Re (size 25, 0.12 taper) instrument is used to remove the first 2-3 mm of the filling, R1 (size 25, 0.08 taper) and R2 (size 25, 0.06 taper) are used to one-third and two-thirds of the estimated working length respectively and finally R3 (size 25, 0.04 taper) which is used at the working length for the complete removal of filling material from the canal^[16].

The better performance of ProTaper D Files may be attributable to their design. D1, D2 and D3 have three progressive tapers and lengths which makes it possible to shape specific sections of a root canal with one file and variable tip diameter. The curvature of these specimens allowed better performance of the D series instruments (D1, D2, D3) with tapers equal to (9%, 8% and 7% respectively). They are more likely to contact the root canal walls and remove filling remnants. These features may enable the retreatments to cut not only GP but also the superficial layer of dentine during root filling removal. Moreover, the specific flute design and rotary motion of the Pro Taper Universal retreatment instruments tend to pull guttapercha into the file flutes and direct it towards the orifice. Furthermore, it is possible that the rotary movements of engine-driven files produce a certain degree of frictional heat which might plasticize guttapercha. The plasticized guttapercha would thus present less resistance and be easier to remove^[17].

Various methodologies have been reported to evaluate the amount of filling material remaining inside the canal after retreatment procedure. It can be assessed radiographically,

roots can be split longitudinally and remaining gutta-percha and sealer were measured linearly or using scoring system or making the teeth transparent. In addition computer tomography and operating microscopes have also been used for this purpose. Ideally, three-dimensional visualization of the root canal system would provide a better understanding of the distribution of the debris after retreatment^[18]. However, observer performance may vary as the root canal cleanliness evaluations subjective and semi-quantitative. In the present study, a stereomicroscope was used to visualize the remaining filling material as it is cost effective and sensitive enough to identify small area of residual GP/sealer on the canal wall^[5]. The roots were visualized using magnifying loops at 3X magnification for stereomicroscopic analysis.

The results of our study demonstrated that ProTaper D Files were more efficient in removing the gutta-percha. However, in the current study, all groups had some amount of remaining debris. This is in accordance to previous studies by C. M. Takahashi *et al.* and Zohreh Khalilak *et al.* in which completely clean canal walls were not produced by any of the techniques investigated^[19,20].

Conclusion

Within the parameters of this study, none of the file system completely removed the Gutta-percha from the root canals. However, Protaper D files are most efficient, followed by R endo files. Whereas M Two files were least effective in removing the Guttapercha from the root canal system. So, further studies are required for long - term conclusion of the efficacy of these retreatment file systems.

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