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## **An in-vitro comparative evaluation for detection of residual gutta-percha after root canal retreatment with four different files using stereo microscope**

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**Abstract**--Background: Removal of gutta-percha using hand files with or without solvent is tedious and time consuming process especially when the root filling material is well compacted. Therefore, the use of NiTi rotary instruments in the root canal retreatment might decrease patient and operator fatigue and various studies have reported their efficacy, cleaning ability and safety. Several NiTi rotary instruments also were been used to remove gutta-percha. Here in this study four file systems were used to assess the efficacy of each file system in retreatment procedures. Materials & methods: The study samples comprised of 80 extracted anteriors having single root canals with fully formed apices were collected. The crowns were de-coronated with a diamond disc to leave a 16-mm root. A size 10 K-file was introduced into the canal until it was visible at the apical foramen. The working length was determined by subtracting 1mm from this measurement. During shaping, each canal was irrigated with 3% sodium hypochlorite then smear layer was removed with 17% EDTA and 1 ml of 3% sodium hypochlorite. After one month the teeth were divided into following groups with 20 specimens each as follows. Group I -protaper retreatment file (dentsply maillefer), group II- mtwo retreatment files (vdw sweden and martina), group III-k<sup>3</sup>xf rotary files (sybron dental specialties). The amount of Gutta-percha on the canal walls was estimated using stereomicroscope under 4X magnification. (Olympus, SZX, 16 Japan). The images were captured and analyzed using image analysis software (Version 6.2). Results: All the retreatment techniques used were resulted in some amount of residual filling material in root canal space after retreatment. So, it is impossible to the clean canals completely. One way ANOVA and TUKEY POST HOC test showed statistically significant difference between the groups ( $p < 0.05$ ). ProTaper showed statistically significant difference between the hand files, Mtwo files and K<sup>3</sup> XF files. Conclusion: All retreatment files proved helpful for removal of endodontic filling material and left remnants of filling material inside the root canal. There was a statistically significant difference between four rotary systems. However Protaper retreatment file has proven to be efficient file among hand, Mtwo and K<sup>3</sup>XF files.

**Keywords**---Rotary, Retreatment

## **Introduction**

With proper care, even teeth that have had root canal treatment can last a life time, but sometimes, due to the reasons given below a tooth that has been treated does not heal properly and can become painful or diseased in months or even years after the treatment. In such conditions retreatment procedures should be performed.<sup>1-3</sup>

These treatments are to be performed with more advanced scientific and technical methods. Due to introduction of these scientific and technical methods the recurrence rate is reduced to much extent, otherwise millions of teeth would have

been lost. It is universally accepted that a natural tooth with good prognosis is a superior choice to loss and replacement. Unfortunately, all the treatments would not result in optimum long-term healing or success. Even though we give good treatment, sometimes, there will be recurrence of the disease, so one must try to reduce the recurrence of the disease to much extent as far as possible.<sup>4-6</sup>

The success rate for retreatment is ranging from 74% - 98%, but the retreatment success rate varies due to different factors like patient age and the types of teeth treated, the presence of alterations in the natural course of the root canals like curved canals, "c" shaped canals, improper removal of the coronal restorations while accessing the pulp chamber, the techniques used to remove the existing filling materials and the possibility of repairing pathologic or iatrogenic defects.<sup>7</sup> Overfilling should be prevented as often as possible since undesirable postoperative complications such as flare-ups can develop usually when a large amount of filling material extrudes through the apical foramen, concomitant infection develops and as a result, endodontic failures occur.<sup>8</sup>

There are good numbers of studies showing that endodontic treatment failures are greater in teeth that are associated with pretreatment periradicular rarefactions than in teeth without pretreatment rarefaction. When the non-surgical root canal retreatment is indicated, its main objective is to completely remove the endodontic filling material from the root canal system and to regain access to the apical foramen. This procedure completely removes the residual necrotic tissues or bacteria and allows further effective cleaning, shaping and filling of the root canal.<sup>6-8</sup>

Several techniques like stainless steel endodontic Hand files, Nickel-Titanium (NiTi) rotary instruments, Gates glidden drills, Heat bearing instruments, Ultrasonics and Laser etc have been proposed to remove gutta-percha. Use of solvents is recommended to facilitate the removal of gutta-percha by softening it.<sup>5</sup> Removal of gutta-percha using hand files with or without solvent is tedious and time consuming process especially when the root filling material is well compacted<sup>8</sup>. Therefore, the use of NiTi rotary instruments in the root canal retreatment might decrease patient and operator fatigue<sup>10</sup> and various studies have reported their efficacy, cleaning ability and safety. Several NiTi rotary instruments also were been used to remove gutta-percha.<sup>9, 10</sup> Here in this study four file systems were used to assess the efficacy of each file system in retreatment procedures.

## **Method**

The present in-vitro study was conducted in the Department of Conservative Dentistry and Endodontics, Sree Sai Dental College and Research Institute, srikakulam.

The study samples comprised of 80 extracted anteriors having single root canals with fully formed apices were collected from Department of Oral and Maxillofacial Surgery, Sree Sai Dental college and Research institute, Srikakulam,

The criteria for the selection of teeth were:

*Inclusion criteria:*

- 1) Teeth extracted for periodontal reasons.
- 2) Maxillary centrals and laterals having single root canals.

*Exclusion criteria:*

- 1) Carious tooth.
- 2) Teeth with open apex.
- 3) Curved canals.

The crowns were de-coronated with a diamond disc to leave a 16-mm root. A size 10 K-file was introduced into the canal until it was visible at the apical foramen. The working length was determined by subtracting 1mm from this measurement.

The root canals were prepared in a conventional technique by using Gates glidden drills size 1 ( to 10 mm ), 2 ( to 7 mm ), 3 ( to 5 mm ) to enlarge the cervical and the middle thirds and further conventional bio mechanical preparation was followed with the sequential use of the K files of sizes 15, 20, 25, 30, 40, 45, 50 at the working length.

During shaping, each canal was irrigated with 3% sodium hypochlorite then smear layer was removed with 17% EDTA and 1 ml of 3% sodium hypochlorite. The residual irrigants were removed with final rinse with 9 ml of saline. The root canals were dried with size 50 paper points. The roots were filled with lateral condensation technique and AH PLUS sealer (Dentsply) was used. The quality and apical extent of the root fillings was confirmed radiographically. The access cavities were then sealed with cavity (3MESPE) and the teeth were stored at 37°C in 100 % humidity for one month, to allow complete setting of the sealer.

Retreatment Techniques:

After one month the teeth were divided into following groups with 20 specimens each as follows.

Group i -protaper retreatment file (dentsply maillefer)

In this group ProTaper retreatment file D1( Size 30 , 0.09 taper ) was used for removal of Gutta percha in coronal third, D2 ( size 25 , 0.08 taper ) and D3 ( Size 20 , 0.07 taper ) were used for removal of Gutta percha from the middle and apical third. All rotary files were used according to the manufactures instructions.

Group ii- mtwo retreatment files (vdw sweden and martina)

Mtwo Retreatment file Mtwo R2 (size25, 0.05taper) was used to the working length. Progression of the rotary file was performed by applying slight apical pressure and frequently removing the files to inspect the blades and clean the debris from the flutes .Finally, conventional Mtwo rotary instrument (size 30, 0.05 taper) was used till working length. All rotary files were used according to the manufactures instructions.

### Group iii-k<sup>3</sup>xf rotary files (sybron dental specialities)

These are the files that are not only used for retreatment, but also used in normal cleaning and shaping. These are 5 files in number. According to the manufactures instructions these are used. These instruments are good in cutting. The main advantages of K<sup>3</sup>XF files are they are having positive rake angle and good radial line. It is having all the features of K<sup>3</sup> files and flexibility is an additional asset to K<sup>3</sup>XF files. The movement of the rake angle helps in efficient cutting of the instrument. They all are of size 25, 0.12 taper, size 25, 0.10 taper, size 25, 0.08 taper, size 25,0.06 taper, size 25,0.04 taper.

After instrumentation, the specimens were decalcified in 5 % nitric acid for 72 hours and then were washed for 4 hours and dehydrated in increasing concentrations of alcohol (80 % for 12 hours, 90 % for 1 hour and 99 % for 3 hours). The roots were then cleared using methyl salicylate.

The amount of Gutta-percha on the canal walls was estimated using stereomicroscope under 4X magnification. (Olympus, SZX, 16 Japan). The images were captured and analyzed using image analysis software (Version 6.2).

### Results

All the retreatment techniques used were resulted in some amount of residual filling material in root canal space after retreatment. So It is impossible to the clean canals completely. One way ANOVA and TUKEY POST HOC test showed statistically significant difference between the groups ( $p < 0.05$ ). ProTaper showed statistically significant difference between the hand files, Mtwo files and K<sup>3</sup> XF files.

Table 1  
Mean, maximum, minimum and standard deviation of remaining obturating material between three groups.

Group	Minimum	Maximum	Mean	SD
Hand files	0.00	85.16	31.65	22.22
Pro taper	0.00	27.23	12.03	7.23
K <sup>3</sup> xf files	0.40	76.47	26.62	16.08
Mtwo files	0.00	57.52	22.53	17.62

Table 2  
Comparison between groups by using ANOVA& TUKEY POST HOC test

Group	Mean	SD	P-value	Inference
Hand files	31.65	22.22	<0.01	HS
Pro taper	12.03	7.23		
K <sup>3</sup> xf files	26.62	16.08		
Mtwo files	22.53	17.62		

Table 3  
Comparison between the four groups

Group		P-value	Inference
Hand files	Pro taper	<0.01	HS
	k <sup>3</sup> xf files	0.53	NS
	Mtwo files	<0.01	HS
Pro taper	k <sup>3</sup> xf files	<0.01	HS
	Mtwo files	<0.01	HS
K <sup>3</sup> xf files	Mtwo files	0.69	NS

## Discussion

This study was done to determine the relative efficacies between Hand files, ProTaper retreatment files, Mtwo files and K<sup>3</sup>XF files in removal of gutta-percha during retreatment. The root canals were prepared in a conventional technique by using Gates glidden drills size 1( to 10 mm ) , 2 ( to 7 mm ) , 3 ( to 5 mm ) to enlarge the cervical and the middle thirds and further conventional bio mechanical preparation was followed with the sequential use of the K files of sizes 15, 20, 25, 30, 35, 40, 45, 50 at the working length. During shaping, each canal was irrigated with 3% sodium hypochlorite, then smear layer was removed with 17% EDTA and 1 ml of 3% sodium hypochlorite. The residual irrigants were removed with final rinse with 9 ml of saline. The root canals were dried with size 50 paper points.

In this investigation specimens were decalcified in 5 % nitric acid for 72 hours and then will be washed for 4 hours and dehydrated in increasing concentrations of alcohol (80 % for 12 hours, 90 % for 1 hour and 99 % for 3 hours). The roots were then cleared using methyl salicylate.<sup>10, 11</sup> Further, samples were photographed with a stereomicroscope. The results of present studies show that all the retreatment techniques left some amount of filling material inside the root canal. There was statistically significant difference ( $p < 0.05$ ) between the groups. The results of the study were similar to the previous studies done by different authors.<sup>6, 7, 11, 12</sup>

The result of the present study supports L.-S. Gu, J.-Q Ling et al Efficacy of ProTaper Universal rotary retreatment system for gutta-percha removal from root canal. In this laboratory study all test techniques left GP/sealer remnants within the root canal. The ProTaper Universal rotary retreatment system proved to be an efficient method of removing GP and sealer from maxillary anterior teeth.<sup>7</sup>

The present study reveals that there is a statistically significant difference between ProTaper and hand instruments and the results are supporting the study done by an in vitro study done by Giuliani V et al. in 2008 evaluated the efficacy of the ProTaper Universal rotary retreatment files, ProFile rotary instruments and hand instruments (K-file) in the removal of gutta-percha during retreatment and they found that ProTaper Universal rotary retreatment files left cleaner root canal walls than the K-file hand instruments and ProFile 0.06 rotary instruments, although none of the devices used guaranteed complete removal of the filling materials. The reason could probably be attributed to the instrument design. Here in this study there is a statistically significant difference between hand instruments and ProTaper instrument group.<sup>6</sup>

In contrary to the present study Takahashi et al in 2009 evaluated effectiveness of ProTaper Universal rotary retreatment system and stainless steel hand instruments (K-file) with or without a solvent in removal of gutta-percha and concluded that both the instruments proved helpful for the removal of endodontic filling material and they were similar in material remaining after retreatment. There was no significant difference between the two instruments in regard to the amount of gutta-percha remnants.<sup>5</sup>

Marcos De Azevedo Rios et al conducted a study on Efficacy of 2 Reciprocating Systems Compared with a Rotary Retreatment System for Gutta-percha Removal has concluded that wave one and Reciproc are as effective as ProTaper in removal of gutta-percha. There was no statistically significant difference between these systems.<sup>13</sup>

According to the present study ProTaper retreatment file was proven to be efficient files systems than other retreatment file techniques, The better performance of ProTaper retreatment instruments may be attributable to their design. Instruments D1, D2 and D3 have three progressive tapers and lengths; hence they cut not only the gutta-percha but also the superficial layer of dentine. The active working tip of D1 instrument facilitates initial penetration into the filling material and the penetration of the subsequent instruments. Moreover, the specific flute design and rotary motion of these files tend to pull the gutta-percha into the file flutes and direct it towards the orifice. ProTaper instruments have negative cutting angles<sup>6</sup> and a convex diameter, cross sectional design<sup>14</sup> which will result in a combination of softening the gutta-percha by rotation and cutting the guttapercha, Furthermore, it is possible that rotary movements of engine-driven files produce a certain degree of frictional heat which might plasticizes gutta-percha,<sup>12</sup> the plasticized gutta-percha is less resistant and easier to be penetrated and removed.<sup>5,12,14</sup> On use, it was observed that ProTaper instruments frequently removed large amounts of gutta-percha in spirals around the instruments.<sup>14</sup>

Both ProTaper Universal retreatment files and Mtwo are efficient to remove root filling material than using a manual technique. Our results are consistent with others who reported that mechanical instrumentation was significantly more rapid than hand files. It can be hypothesized that the active tip and the cutting blades of both NiTi rotary files that were used in the present study positively influenced both the time required for retreatment and the safety of the instruments.<sup>15</sup>

Mtwo retreatment files also faired better following ProTaper retreatment files the reason for the efficiency is the S- shaped cross section and shorter pitch which enhances the advancement of the file into the material. It is having the increasing pitch and the active tip renders the instrument to penetrate guttapercha, as the internal mass of the Mtwo is less than the ProTaper.

ProTaper universal retreatment instrument showed significant difference. There is statistically no significant difference between Mtwo retreatment files and K<sup>3</sup>xf rotary files.

### **Conclusion**

All retreatment files proved helpful for removal of endodontic filling material and left remnants of filling material inside the root canal. There was a statistically significant difference between four rotary systems. However Protaper retreatment file has proven to be efficient file among hand, Mtwo and K<sup>3</sup>XF files.

### **References**

- 1 Kenneth M. Hargreaves, Stephen Cohen. Cohen's pathways of the pulp, 10th Edition. Non-surgical Retreatment. Page no. 890-952.
- 2 J.F. Siqueria Jr. Etiology of root canal treatment failure: why well-treated teeth can fail. *Int Endod J* 2001; 34:1-10.
- 3 Lin LM, Skribner JE, Gaengler P. Factors associated with endodontic treatment failures. *J Endod* 1992; 18: 625-7.
- 4 Friedman S, Stabholz A, Tamse A. Endodontic retreatment: case se-lection and technique. Part 3: retreatment techniques. *J Endod* 1990; 16: 543-9.
- 5 Takahashi C, Cunha R, DeMartin A, Fontana C, Silveira C, Silveira Bueno C. In Vitro Evaluation of the Effectiveness of ProTaper Universal Rotary Retreatment System for Gutta-Percha Removal with or without a Solvent. *J Endod* 2009; 35(11):1580-3.
- 6 Giuliani V, Cocchetti R, Pagavino G. Efficacy of ProTaper Universal Retreatment Files in Removing Filling Materials during Root Canal Retreatment. *J Endod* 2008; 34(11):1381-4.
- 7 Gu L-S, Ling J-Q, Wei X, Huang X-Y. Efficacy of ProTaper Universal rotary retreatment system for gutta-percha removal from root canals. *Int Endod J* 2008; 41(4):288-95.
- 8 De Oliveira DP, Barbizam JV, Trope M, Teixeira FB. Comparison between gutta-percha and resilon removal using two different techniques in endodontic retreat-ment. *J Endod* 2006; 32:362-4.
- 9 Saad AY, Al-Hadlaq SM, Al-Katheeri NH. Efficacy of two rotary instruments in the removal of Gutta-percha during Root Canal Retreatment. *J Endod* 2007; 33:38-41.



- 10 Tasdemir T, Er K, Yildirim T, Celik D. Efficacy of three rotary NiTi instruments in removing gutta-percha from root canals. *Int Endod J* 2007; 41:191-6.
- 11 Gu LS, Ling JQ, Wei X, Huang XY. Efficacy of ProTaper Universal rotary retreatment 8 for gutta-percha removal from root canals. *Int Endod J* 2008; 41:288-95.
- 12 L. V. Betti & C. M. Bramante Quantec SC rotary instruments versus hand files for gutta-percha removal in root canal retreatment *International Endodontic Journal*, 2001, 34, 514–519.
- 13 Marcos de Azevedo Rios, Alexandre Mascarenhas Villela, Rodrig Sanches Cunha, Efficacy of 2 Reciprocating Systems Compared with Rotary Retreatment System for Gutta-percha Removal (*J Endod* 2014;40:543–546).
- 14 Hulsmann M, Bluhm.V. Efficacy, cleaning ability and safety of different rotary NiTi instruments in root canal retreatment. *Int Endod J* 2004;37:468-76.
- 15 Francesco Somma, Giuseppe Cammarota. The Effectiveness of Manual and Mechanical Instrumentation for the Retreatment of Three Different Root Canal Filling Materials. *J Endo* 2008, 34(4),
- 16 Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. *International Journal of Health Sciences*, 6(1), i-v. <https://doi.org/10.53730/ijhs.v6n1.5949>