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APICALLY EXTRUDED DEBRIS AFTER RETREATMENT PROCEDURE WITH TWISTED FILE ADAPTIVE, PROTAPER GOLD AND PROTAPER NEXT

Dr. Sukhbir Kour*, Dr. Trishagni Chaudhury and Dr. Pradeep P. R.

Dept. of Conservative Dentistry and Endodontics M.R Ambedkar Dental College & Hospital Bangalore.

Corresponding Author: Dr. Sukhbir Kour
Dept. of Conservative Dentistry and Endodontics M.R Ambedkar Dental College & Hospital Bangalore.
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ABSTRACT

Aim: The aim of this study was to compare the amount of apically extruded debris with three endodontic rotary nickel-titanium instruments i.e Twisted File Adaptive System, ProTaper Gold and ProTaper Next, **Materials and Methods:** Freshly extracted non-carious 60 single rooted mandibular premolars were selected, prepared and filled with gutta-percha and AH Plus sealer (Dentsply, Germany) using the lateral compaction technique. The teeth were randomly divided into 3 groups of 20 for removal of the root filling material with TFA, PTG, and PTN files. The apically extruded debris was collected in pre weighted Eppendorf tubes. The time for gutta-percha removal was recorded. Data were statistically analyzed using Kruskal-Wallis and 1- way analysis of variance tests. **Result:** The amount of debris extruded was PTG> TFA > PTN, respectively. Compared with the TFA group, the amount of debris extruded in the PTG group was statistically significantly higher (P<.001). There was no statistically significant difference among the TFA, PTN and PTG groups regarding the time for retreatment. (P >.05).

KEYWORDS: Apically Extruded Debris, Nickle- Titanium Rotary Instruments, Protaper Gold, Protaper Next, Twisted File Adaptive.

INTRODUCTION

In cases in which root canal treatment is unsuccessful, nonsurgical retreatment is the first treatment option.[1] During retreatment, root canal filling materials, necrotic pulpal tissues, irrigation solutions, and microorganisms can extrude into the periradicular tissues, and the extruded material referred to as the 'worm of necrotic debris' has been related to periapical inflammation and postoperative flare ups.[2]

The immunological studies of postoperative flare ups demonstrated that antigens originating from root canal preparation resulted in the formation of an antigen antibody complex when forced beyond the apical foramen, which could lead to a severe inflammatory response.

To remove the filling material in the root canal, various methods, such as nickel titanium (NiTi) files, ultrasonic systems, laser systems and chemical solvents are used.[3] These methods caused various levels of debris extrusion from the apex[4]

Studies examining an apical extrusion of debris have stated that procedures using the push pull motion tend to produce more debris than those involving some sort of rotational movement. This has led to the hypothesis that engine driven instruments produce less debris than hand filing techniques, as they have a tendency to pull debris in the flutes of the instrument.[5]

Retreatment is much more difficult and time-consuming than the initial root canal treatment. The use of NiTi files makes the retreatment procedure easier.

The ProTaper Next (PTN; Dentsply Maillefer, Ballaigues, Switzerland) file system, has a square cross section that moves continuously asymmetrically during rotation and is made of M-Wire alloy. There have only been a few studies on the application of this system in retreatment procedures.[6] Another file system, the Twisted File Adaptive (TFA; SybronEndo, Orange, CA), has its own endodontic motor (Elements Motor, SybronEndo) and combines the advantages of rotation and reciprocation motions. Unless there is stress on the file, the file rotates 600 clockwise, stops, and then continues the rotation motion. In the case of an increase in stress on the file, the Elements Motor modifies the motion of the file up to 370° clockwise and 50° counterclockwise.[7]

Thus, the aim of the present study was to compare the amount of debris extruded from the apex during retreatment procedures with TFA, PTN and PTG files and the duration of these retreatment procedures.

The null hypothesis was that there would be no difference among the amounts of debris extruded from the apex using the TFA, PTN and PTG files and the duration of the retreatment procedures.

MATERIAL AND METHODS

Sample Selection

This study was done in Dept of Conservative dentistry and Endodontics M.R Ambedkar dental college Banagolre in the year 2017-2018. After obtaining ethics committee approval, 60 single rooted mandibular premolars, which had been extracted because of periodontal reasons, were included in the present study. Radiographs of the teeth confirmed that the apexes of all the teeth were completely mature; there was no resorption, calcification, or previous root canal filling in the canal. All the soft and hard tissue remnants on the teeth were mechanically removed.

Root Canal Preparation

The endodontic access cavities of all the teeth were prepared under water cooling. The working length was set to be 1 mm shorter than the length where #10 K-file (Dentsply Maillefer) reached the level of the minor apical foramen. Root canal preparation was performed via the crown-down technique using a K-file manual file to produce an apical diameter of 45.02. After instrumentation with each of the canal files, the canals were irrigated with 2 mL 5.25% sodium hypochlorite (NaOCl). In the final irrigation, 2 mL 5.25% NaOCl, 2 mL 17% EDTA for 2 minutes, and 5 mL distilled water were used.

Root Canal Obturation

Root canal obturation was performed with a 45.02 master apical cone (Dentsply Maillefer) and AH Plus sealer (Dentsply DeTrey, Konstanz, Germany) using cold lateral condensation techniques. The teeth were kept at 37°C and 100% humidity for 14 days for setting of the sealer by closing the canal openings with a temporary filling material (Cavit G; 3M ESPE).

Retreatment Procedure: Then, the teeth were randomly divided into 3 groups (n = 20). A single operator performed all the retreatment procedures.

Group 1: TFA

The TFA ML2 (35.06) and ML1 (25.08) files were used with the crown-down technique. The TFA ML2 (35.06) file was used to remove the gutta-percha and root canal sealer from the coronal one third of the canal, and the ML1 (25.08) file was used throughout the working length. According to the manufacturer's instructions, the files were operated using the ''TF Adaptive'' program.

Group 2: PTN

The PTN X3 (30.07) and X2 (25.06) NiTi files were used with the crown-down technique. The PTN X3 file was used to remove the gutta-percha and root canal sealer from one third of the coronal part of the working length, and the PTN X2 file was used in the entire working length of the canal. A total of 20 mL distilled water was used during the retreatment procedure. Protaper Next file system was used with X-SMART ™ (Dentsply) endomotor system.

Group 3: PTG

Protaper Gold file system was used with X-SMART ™ (Dentsply) Endomotor. F3 (25,0.09) and size F2(25,0.08) were used with crown –down technique. The F3(25,0.09) File was used to remove the gutta –percha and root canal sealer from the coronal one third of the canal and the F2(25,0.08) file was used throughout the working length.

In all the groups, the duration of the retreatment procedures was recorded using a digital chronometer. The time taken for file replacements and canal irrigations was not included in the duration for retreatment. Twenty milliliters of distilled water was used during the retreatment procedure.

Debris collection

Empty Glass vials without stoppers were weighed with an electronic balance. The stoppers of the eppendorf tubes were separated, and a hole was drilled in the tops. Each tooth was inserted into the stopper of an eppendorf tube till the CEJ. A stopper of the vial was drilled, and each eppendorf tube that was perforated at the tip was attached to the stopper of the vial. A 27-G needle was placed alongside the stoppers to equalize the internal and external pressures. During the instrumentation procedure, the teeth were isolated with a rubber dam to preclude the operator from seeing the root and to prevent irrigation solution extrusion through the hole. After change of each instrument 5ml of 2.5% NaOCl was used as an irrigating solution with a 30G side vented irrigating needle. The apically extruded debris was collected in pre weighed glass vials. The surface of the root was washed with 1 ml of saline into the vial to collect the debris adhering to the root surface. The vials were then stored in an incubator at 50ºC for 10 days before weighing the glass vials with the dry debris. The net weight of the extruded debris was determined by subtracting the initial weight from the final weight.

Statistical Analysis

After preparing the obtained debris data for analyses, the Shapiro Wilk test showed that the data were not distributed normally. The Levene variance homogeneity test showed that the variances were not distributed homogenously. Therefore, the Kruskal Wallis test was used for intergroup comparisons of the amount of debris. After preparing the obtained time data for analyses, the Shapiro Wilk test revealed that the data were distributed normally. The Levene variance homogeneity test showed that the variances were distributed homogenously. Therefore, the intergroup comparisons of the duration of the retreatment procedures were executed using the 1-way analysis of variance test. In all the statistical analyses, SPSS 21 (IBM SPSS Inc, Chicago, IL)

software was used. The statistical significance level was set at 5%.

RESULTS

The Twisted File Adaptive and ProTaper Next systems extruded significantly less debris than the ProTaper Gold (P<.001) although no significant differences were obtained between the Twisted File Adaptive and ProTaper Next systems (P > .05).

Table1: Medians (Minimum–Maximum) of Apically Extruded Debris (g) and Total Time (seconds) required for retreatment.

Groups	N	Median	Minimum	Maximum	Time
Twisted file adaptive	20	0.00019[a]	0.00011	0.00048	36.35± 13.90[a]
Protaper Next	20	0.00017[bc]	0.00017	0.00044	30.50± 12.03[a]
Protaper Gold	20	0.00030[ca]	0.00017	0.00064	38.44±16.93[a]
P value		<0.5			>.05

Different superscript letters indicate a significant difference between groups

DISSCUSSON

The leading reason for failure after retreatment is debris extruded from the apex during the retreatment procedure.[8] Shovelton DS had reported that bacteria are also extruded along with debris through the apical foramen. The number of bacteria extruded apically has a direct correlation with the weight of the debris which is a quantitative factor and the type and virulence of the bacteria is related to the severity of the periapical inflammation (qualitative factor).[9] Previous studies reported that all preparation techniques led to debris extrusion from the apex.[10]

Thus, the present study compared the amount of debris extruded from the apex during retreatment procedures using PTN, PTG, and TFA file systems, which have different designs and working principles. According to the results of the present study, the PTG group extruded significantly more debris than the TFA and PTN group. Thus, the null hypothesis of the present study was rejected.

In the present study, the method developed by Beurklein et al[11] to measure the amount of debris extruded from the apex during the retreatment procedures was used. Considering that NaOCl may become crystallized and affect these measurements, only distilled water was used during the retreatment procedures.

In the present study crown down pressure less technique has been used according to Ruiz –Hubard *et al*. this technique produce less extrusion of debris compared to step back technique.[12] According to Martin H, *et al*. engine driven instruments produce less debris than hand filing technique as they have a tendency to pull debris into the flutes of the instruments. The difference in the root canal preparation using hand and rotary Protaper files is because of the time of contact between the file and the root canal wall.[13] The engine driven Protaper file contacts the apical area for a lesser period of time and also the rotational speed and torque is fixed, whereas, the Hand Protaper file remains in contact with the apical area for an extended period of time and the rotational movement of the file is an operator controlled which is a variable factor, extruding more amount of debris.[14]

In this study the ProTaper Universal system led to a statistically significantly higher level of apical extrusion during root canal retreatment. However, in accordance with the results of the present study, there was no statistically significant difference between the PTN and TFA groups. In the present in vitro study, the ProTaper Gold extruded a greater amount of apical debris than the ProTaper Next and Twisted File Adaptive systems. The common design feature of the ProTaper Next and ProTaper Gold systems is the presence of progressive and regressive percentage tapers on a single file. However, the ProTaper Gold F2 instrument has a 0.08 taper at the apical 3 mm, whereas the ProTaper Next X2 instrument has a 0.06 taper at the apical 3 mm. The larger taper at the tip of the ProTaper Gold instrument might explain the increased amount of debris extrusion with this system. Moreover, the cross-sectional geometric design of the ProTaper Next system is different from that of the ProTaper Gold system. ProTaper Next instruments have an off-centered, rectangular design, generating traveling waves of motion along the active part of the file. The superior performance of the ProTaper Next system might be caused by the new swaggering motion, which serves to minimize the engagement between dentin and the file and enhances auguring debris out of the canal.[15] In a study that compares the apical extrusion levels of the PTN, TFA, and WaveOne systems, the PTN system resulted in the highest level of extrusion, but there was no statistically significant difference between the PTN and TFA groups.[16] In the present study, the low amount of apically extruded debris in the PTN group might be caused by the file number used to remove the root canal filling materials because removing the root canal filling material in the coronal third with an X3 file might relieve the movement of the second X2 file. As a result of the relieving of the NiTi file, the apical force that occurs during retreatment might be decreased; thus, the apically extruded debris might be decreased too.

The Twisted File Adaptive (SybronEndo, Orange, CA) is a file that uses a combination of continuous rotation and reciprocating motion during biomechanical preparation. The file uses continuous rotation when it is exposed to

minimal or no applied load and uses reciprocal motion when it engages dentin and a load is applied **Error! Bookmark not defined.**. Manufacturers have claimed that this adaptive technology and twisted file design using R-phase treatment increase debris removal and flexibility and allow the file to adjust to intra-canal torsional forces depending on the amount of pressure placed on the file. The reduction of both torsional and bending stress of in twisted adaptive file system is the main advantage of reciprocating movement. Another possible advantage of reciprocation is a better maintenance of the original canal trajectory, mainly related to lower instrumentation stress and, consequently, its elastic return.

According to the results of the present study, there was no statistically significant among group differences in the duration of the retreatment procedures. Dincer et al[17] reported a statistically significant difference in the duration of retreatment procedures between the PTR and RCP groups; the duration of the retreatment procedure in the Mtwo R group was shorter than that of the other groups. These contrary findings may be explained by operator-related variables and methods for calculating the total retreatment time.

REFRENCES

1. Seltzer S, Naidorf IJ. Flare-ups in endodontics: I. Etiological factors. J Endod, 1985; 11: 472–8.
2. McKendry DJ. "Comparison of balanced forces, endosonic and stepback filing instrumentation techniques: Quantification of extruded apical debris". *Journal of Endodontics, 1990;* 16: 24- 27.
3. Pirani C, Pelliccioni GA, Marchionni S, et al. Effectiveness of three different retreatment techniques in canals filled with compacted gutta-percha or Thermafil: a scanning electron microscope study. J Endod, 2009; 35: 1433–40.
4. Betti L, Bramante C, Quantec SC. rotary instruments versus hand files for guttapercha removal in root canal retreatment. Int Endod J., 2001; 34: 514–9.
5. Capar Ismail Davut., *et al*. "An in vitro comparison of apically extruded debris and instrumentation times with ProTaper Universal, ProTaper Next, Twisted File Adaptive, and HyFlex instruments". *Journal of Endodontics, 2014;* 40.10: 1638- 1641.
6. Nevares G, Diana S, Freire LG, et al. Efficacy of ProTaper NEXT compared with Reciproc in removing obturation material from severely curved root canals: a micro–computed tomography study. J Endod, 2016; 42: 803–8.
7. Gambarini G, Testarelli L, De Luca M, et al. The influence of three different instrumentation techniques on the incidence of postoperative pain after endodontic treatment. Ann Stomatol (Roma), 2013; 4: 15.
8. Al-Haddad A, Ab Aziz ZC. Apically extruded debris during removal of Realseal using two re-treatment rotary systems. Aust J Basic Appl Sci., 2011; 5: 114–9.
9. RuizHubard EE., *et al*. "A quantitative assessment of canal debris forced periapically during root canal instrumentation using two different techniques". *Journal of Endodontics, 1987;* 13: 554558.
10. Reddy SA, Hicks ML. Apical extrusion of debris using two hand and two rotary instrumentation techniques. J Endod, 1998; 24: 180–3.
11. Burklein S, Benten S, Sch€afer E. Quantitative evaluation of apically extruded debris with different single-file systems: Reciproc, F360 and OneShape versus Mtwo. Int Endod J., 2014; 47: 405–9.
12. RuizHubard EE., *et al*. "A quantitative assessment of canal debris forced periapically during root canal instrumentation using two different techniques". *Journal of Endodontics*, 1987; 13: 554558.
13. Martin H., et al. "The effect of endosonic and hand manipulation on amount root canal material extruded". Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 1982; 53: 611613.
14. Arias A., et al. "Torque and force induced by ProTaper universal and ProTaper next during shaping of large and small root canals in extracted teeth". Journal of Endodontics, 2014; 40.7: 973-976.
15. Ruddle CJ, Machtou P, West JD. The shaping movement 5th generation technology. Dent Today, Apr, 2013; 32(4): 94.
16. Ustun Y, C¸anakc¸i B, Dinc¸er A, et al. Evaluation of apically extruded debris associated with several Ni Ti systems. Int Endod J., 2015; 48: 701–4.
17. Dincer A, Er O, Canakci B. Evaluation of apically extruded debris during root canal retreatment with several NiTi systems. Int Endod J., 2015; 48: 1194–8.