Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jls.htm
2015 Vol. 5 (4) October-December, pp. 141-146/Akhavan et al.
Research Article

THE COMPARISON OF TWO ROTARY SYSTEMS EFFECT, PROTAPER AND NRT-GPR, ON THE AMOUNT OF DEBRIS EXTRUSION DURING ROOT CANAL RETREATMENT

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ABSTRACT

The aim of this study was the comparison of the effect of two rotary systems, ProTaper and NRT-GPR, on the amount of debris extrusion during root canal retreatment (In Vitro). This study was performed on the Mesiobuccal canal of 40 first mandibular molars with intact coronal and root structures. All samples were prepared and obturated with hand instruments and lateral condensation method. Samples were randomly divided into 2 experimental groups for endodontic retreatment using, NRT-GPR and ProTaper retreatment systems, successively collecting Extruded debris and irrigants in pre-weighed vials. Then vials were reweighed after drying the whole liquid in desiccator. The difference between the results of the 2 weighing procedure showed the net weight of the extruded debris from the root apex. Resulting data for each sample were analyzed using T-Test. Although the amount of extruded debris in ProTaper group was less than NRT-GPR (0.0015 and 0.0032), there was no statistical significant difference between these two groups ($p<0.1$). According to the present study, there was no significant difference between the Pro Taper retreatment and NRT-GPR groups, in the amount of extruded debris more studies are recommended to assess other clinically important aspects of these systems.

Keywords: *Debris Extrusion, Endodontic Retreatment, NRT-GPR, Protaper*

INTRODUCTION

Apical debris extrusion during manual instrumentation is one of the main reasons of pain, foreign body reaction and failure of the endodontic treatment. Debris includes irrigation agents, present microorganisms, necrotic tissues and endodontic filling materials. These products and chemical substances can penetrate periapical tissue through apical foramen during endodontic treatment. This is of concern as material extruded from the apical foramen may be related to post-operative inflammation and 'flare-up' or even failure of apical healing (Tianz *et al.*, 2005). Endodontic retreatments are indicated in failed initial endodontically treated teeth (Moiseiwitsch and Trope, 1998). Non-surgical retreatment success rate is estimated 74%-98% (Cohen and Hargreaves, 2011).

For retreatment, previous filling materials should be removed and canal must be cleaned and refilled again. For removal of previous filling material, there are several methods. Using hand instruments, heat carrying instruments, ultrasonic and solvents are among most popular methods. Rotary instruments are getting more popular in endodontic treatments day by day (Kock and Brave 2001). ProTaper® is a NiTi endodontic rotary system with two different sets for endodontic treatment and retreatments. Retreatment sets include 3 rotary files, D_1, D_2 and D_3. NRT-GPR is another rotary system and can be used in retreatments. This system has 4 different rotary files, 2 stainless steel files (S_1 and S_2). These files are used for preparation of coronal and the middle parts of the canal and extrusion of previous filling material. Other 2 files are NiTi (N_4 and N_3). These two files are used for apical preparation. During

retreatment residual filling materials, necrotic tissues, microorganisms and irrigating agents can extrude from apical foramen and penetrate periapical region.

Using NiTi rotary files is one other way to remove remaining gutta-percha in the canals. In this method clinicians divide canals into 3 parts and different sizes of NiTi files get used passively in each part (Ingle *et al.,* 2008). Most cases of root canal treatment failures depend on the presence of microorganisms or their products on periapical tissues. Whenever the main source of microorganisms (which is the infected pulp tissue) is omitted, it is expected that periapical inflammation will be eliminated as well (Cheung, 1996).

There are several studies about the effect of different techniques on apical debris extrusion. These studies evaluated different methods and amount of debris extrusion in each of them (Alomari and Dummer, 1995; Tanalp *et al.,* 2006; Hinrichs *et al.,* 1998). First Chapman in 1968 studied about extrusion of materials and infected debris from root canal during canal preparation (Chapman and Cplles, 1968). Morais *et al.,* (2013) evaluated debris extrusion in retreatment and used both rotary (ProTaper®) and hand instruments with or without solvent. The results of this study showed that there was no significant difference between different study groups. Lu *et al.,* (2015) performed same study with 2 different rotary systems and hand instruments. In this study there were significant difference amongst different groups and one of rotary systems showed better results. Therefore, there is controversy in effects of different methods in retreatments. A new study for new developed and promising systems is seemed to be needed. The aim of this study is to comprise effects of 2 different rotary systems in retreatment and measurement of debris extrusion with each system.

MATERIALS AND METHODS

Forty human first lower molars with wide mesiobuccal canals and no obstruction were collected. All samples were evaluated for caries and cracks and if existed, samples were excluded from the study. All samples were immersed in hypochlorite sodium 5.25% for 1 hour for removing attached tissue and infections. Then all samples were rinsed with normal saline and kept in normal saline for rest of the study. All samples were prepared with a proper access cavity and then endodontically treated with step-back method with K files (MANI, Utsunomiya, Japan). Working length was estimated with file size #10, it was handed though the canal and passed through apical foramen for 1mm. then took back and kept tip to tip with apical foramen. Schneider method was used for evaluation of canal curvature (Schneider, 1971). After taking radiographic images, crowns of samples were removed with disks from CEJ. Canals were prepared with K file (#10 as initial file) up to file #30 (Khademi *et al.,* 2006). In all steps of study 2 ml of sodium hypochlorite was used as irrigation agent. After preparation all samples were rinsed with EDTA 17% solution for removing smear layer. Canals were dried with paper cones and filled with gutta-percha and AH26 as sealer with lateral condensation method. After obturation, canal orifices were covered with temporary filling material. After endodontic treatment completion, radiographic images were taken for filling quality evaluation. Afterwards, samples were incubated for 2 weeks in 37°C and 100% humidity till sealer setting completed. Certain containing vials used to collect debris extruded from apical foramen. Vials were first inserted in flasks and the whole system was weighed with a balance meter device (Sartoriu, Cubis® ultra micro, GMBH, Germany) and the numbers were recorded. Its accuracy is up to 10^{-4}gr. After accumulation of all samples, the assembly was vented with a 23- gauge needle passed through the rubber stopper to equalize air pressure inside and outside the tube. Then it was sealed with rose wax. 5cc syringes with 28 gauge needle were used to irrigate canals during preparation passively, and they were penetrated to 2/3 of canal length using rubber stop as indicator (figure 1).

All samples divided into 2 study groups randomly, first group was retreated with ProTaper (Tulsa Denta SPE CIA Ties, Switzerland). This system comprises of 3 flexible instruments (D1, D2 and D3) (X Smart, DENTSPLY, UK), of which the tapers and tip diameters are equivalent to size 0.09/0.30 mm, 0.08/0.25 mm, and 0.07/0.20 mm, respectively. The lengths are 16 mm for D1, 18 mm for D2 and 22 mm for D3. They were used at 500 rpm. These instruments are specially designed for root filling removal from the coronal, middle, and apical portions of root canals. In the second group samples were retreated with NRT-

GPR with S_2 and N_4 at 500 rpm for coronal and apical regions. For both groups distilled water were used as irrigating agent. Two milliliters distilled water used for irrigating and then collected in special vials. Vials were incubated for 24 hours then stored in desiccator device for 3 weeks (figure 2). After 3 weeks all vials were weighed and recorded data was analyzed with t-test.

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Figure: 1

Figure: 2

RESULTS AND DISCUSSION

Results

All 40 samples were divided in 2 groups that each contained 20 samples. Resultsshowed in table 1 defines that debris extruded from samples treated with NRT-GPR system was slightly more than ProTaper system but the difference was not significant (P-value<0.1). Also CV of NRT-GPR files (114) were less than ProTaper files (153) that mean NRT-GPR files are more homogenous in debris removal.

Table

C.V	**X±SD**	**WeightDebris** **Study Groups**
153	0/0±0015/0023	ProTaper
114	0/0±0032/0037	NRT-GPR
	P-value<0/1	Resultst-Test

Discussion

Root canal treatment failures are common that may happen due to different reasons such as insufficient cleaning and shaping, in-treatment accidents, recurrent infections due to lack of coronal seal (Tianz *et al.*, 2005). Therefore, it can be concluded that microorganisms and their products are the main reason for failures in endodontic treatment and after removing microorganism source, periapical inflammations can be eliminated (Hinrichs *et al.*, 1998). The main goal of retreatment is to regain access to the apical foramen by complete removal of the root canal filling material, thereby facilitating sufficient cleaning and shaping of the root canal system and final proper abjuration (Kock and Brave, 2001). During retreatment irritants in the form of filling materials, necrotic pulp tissues, bacteria or irritants might be introduced into the apical region. The apically extruded materials have been clinically held responsible for post-operative inflammation and flare-up or even failure of apical healing (Morais *et al.*, 2013). Results of our study showed that two rotary systems had different amount of debris production and therefore amount of debris extruded varied in two methods, but the difference was not significant.

There are several studies available for comparison of different rotary systems in per apical debris extrusion (Morais *et al.*, 2013; Lu *et al.*, 2013; Kustarci *et al.*, 2012; Arora *et al.*, 2012; Kinue *et al.*, 2012; Huang *et al.*, 2007; Silva *et al.*, 2014; Chandra *et al.*, 2014; Lu *et al.*, 2015). Lu *et al*., (2015) studied effect of sodium hypochlorite effect in canal irrigation during retreatment and showed that it can effect debris extrusion; therefore we used distilled water for irrigation. Arora *et al*., (2012) compared two rotary and a hand instrument technique for debris extrusion. In hand instrument technique they used solvent agents but in other two, no solvent has been used. Results of their study showed one rotary technique (ProTaper®) had the least amount of debris extruded. Our study showed same results in comparison of two different rotary systems.

Silva *et al*., (2014) compared three rotary systems; ProTaper, Reciproc and WaveOne in case of their debris production. They reported that ProTaper had significantly higher debris production than other systems. This may be caused by more number of files in ProTaper (3 files in retreatment set) than other rotary systems (single file retreatment system).

Lu *et al*., (2015) compared the apical and coronal extrusions by using two reciprocating single-file systems, Reciproc and Wave One, and two full-sequence rotary BLX and ProTaper instruments. Statistically significant differences in the apical extrusion were observed among the four groups. Reciproc and

Wave One instruments produced significantly less debris than BLX and ProTaper instruments ($P < 0.05$) (Lu *et al.*, 2015).

Huang *et al.*, (2007) and Chandra *et al*., (2014) used maxillary incisors (central or lateral incisors were not distinguished) due to noticeable differences in root length and dentin thickness in these teeth that may affect in debris production, it was disadvantage in these studies, that we used particularly mesiobuccal canal of 1st mandibular molars to match the samples more accurate.

Since NRT-GPR rotary system is a new one, no scientific evidence has been found about it. Therefore, more studies are needed to have stronger evidence about the system's debris production and debris extrusion.

Further studies are required to determine whether these in vitro experimental results can be applied to clinical practice. Biological periapical tissue can exert a certain amount of pressure in vivo and is able to resist debris and irrigant extrusion. This is a shortcoming of in vitro designs because they have no periapical resistance. Therefore, we did not attempt to simulate the periapical tissue environment in this study.

In this survey, 2 rotary systems, ProTaper and NRT-GPR, were studied, and it was shown that amount of debris extrusion in NRT-GPR was slightly more than ProTaper rotary system, but statically was not significant. It may be attributed to presence of cutting edge files in ProTaper rotary system, that NRT-GPR doesn't have this feature. Accordingly, more studies should be fulfilled to choose the best, in future.

Conclusion

According to new systems introduced in endodontic treatment and retreatment, it seems more studies are needed to indicate advantages and disadvantages of each system. ProTaper® seems to have better results in elimination of debris extrusion in endodontic retreatments. But the difference is not statistically significant. Due to lack of scientific evidence, further in vivo and in vitro seems to be needed.

REFERENCES

Tianz AC, Alacam T, Zamo V, Maden M and Kayao Lu G (2005). The effect of disruption of apical constriction on periapical extrusion. *Journal of Endodontics* **31** 533-50.

Moiseiwitsch JR and Trope M (1998). Non-surgical root canal treatment with apparent indications for root endo surgery. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics* **86** 335-40.

Cohen S and Hargreaves K (2011). *Pathways of the Pulp*. 10th edition (St Louis: Mosby co) 211-32.

Kock K and Brave D (2001). More of wisdom Dental Economy; (Penn Well Publishing, U.S).

Ingle JI, Bakland LK and Boumgartner JC (2008). *Ingle's Endodantics*. 6th edition (St Ontario: BC Decker co) 1100-3.

Cheung GS (1996). Endodontic failures – chauging the approach. *International Dental Journal* **46** 131-8.

Alomari MA and Dummer PM (1995). Canal blockage and debris extrusion with eight preparation technique. *Journal of Endodontics* **21** 154-8.

Tanalp J, Kapton F, Sert S, Kayahan B and Baring G (2006). Qualitative evaluation of the amount of apically extruded debris using different rotary instrumentation system . *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics* **101** 252-9.

Hinrichs RE, Walker WA and Schindler WG (1998).Comparison of amount of apically extruded debris using handpiece driven nickel titanium instrument system. *Journal of Endodontics* **24** 102-6.

Chapman CE and Cplles JGA (1968). Preliminary report on the correlation between apical infection and instrumentation in endodpnitcs, *Journal of the British Endodontic Society*, **2** 7-11.

Schneider SW (1971). A comparision of canal preparation in and curved root canals, *Oral Surgery* **32** 271 -275.

Khademi A, Yazdizadeh M and Feizianfard M (2006). Determination of the minimum instrumentation size for penetration of irrigants to the apical third of root canal systems. *Journal of Endodontics* **32** 417-20

Morais M , Almedia B, Lopes L, Maniglia C, Almedia F, Alves R and Hangaro M (2013). Evaluation of apically entraded debris during endodontic retreatment. *Revista Brasileira de Saúde Ocupacional* **10** 56-62.

Lu V, Wang R, Zhang L, Li HL, Zheng QH, Zhou XD and Huang DM (2013). Apically extruded debris and irrigant with two Ni-Ti systems and hand files when removing root filling: a laboratory study *International Endodontic Journal* **46**(12) 1-6.

Kustarci A, Altunbas D, EnginAkpinar K (2012). Comparative study of apically extruded debris using one manual and two rotary instrumentation techniques for endodontic retreatment: *Journal of Dental Sciences* **7** 1-6.

Arora C, Bahri R and Mitten LN (2012). Comparative evaluation of debris extruded apically by using, protaper retreatment file, k3 fileand H-file with solvent in endodontic retreatment: *Saudi Endodontic Journal* **2** 136-41.

Kinue M, Leticia M, Nabcshima C and Capp R (2010). Comparision of debris eutruded apically and working time used by proTaper Universal votary and protaper retreatment system during gutta –percha removal: *Journal of Applied Oral Science* **18**(6) 542-5.

Huang X, Ling J, Wei X and Gu L (2007). Quantitive Evaluation of debris Extruded Apically by using protaper universal Tulsa Rotary system in endodontic retreatment. *Journal of Endodontics* **33** 1102-1105.

Silva EJ, Sa L, Belladonna FG, Neves AA, Aceorsi – Medonca T, Vieira VT, De-Deus G and Moreira EJ (2014). Reciprocating versus rotary systems for root filling removal: assessment of the apically extruded material. *Journal of Endodontics* **40**(12) 2077-80.

Chandra S, Rajesh Ebenezar AV, Kummar M and Sivakumar A (2014). A comparative evaluation of Gutta percha removal and extrusion of apical debris by rotary and hand files. *Journal of Clinical and Diagnostic Research* **8**(11) ZC110-ZC114.

Lu Y, Chen M, Qiaoand F and Wu L (2015). Comparison of apical and coronal extrusions using reciprocating and rotary instrumentation systems. *BioMed Central Oral Health* **15** 92-99.