

Original Research

Comparative evaluation to check the efficiency of three different retreatment rotary file systems to remove filling material from the root canal: An in vitro study

Dr. Navjot Singh Mann¹, Dr. Ashu Jhamb², Dr. Ivneet Kaur³, Dr. Navneet Kaur Mann⁴, Dr. Manu Rana⁵, Dr. Divya Batra⁶

¹Professor and Head, Dept of Conservative Dentistry and Endodontics, National Dental College and Hospital, Derabassi

²Professor, Dept of Conservative Dentistry and Endodontics, National Dental College and Hospital, Derabassi.

³Post graduate student, Dept of Conservative Dentistry and Endodontics, National Dental College and Hospital, Derabassi

⁴Professor, Dept of Conservative Dentistry and Endodontics, National Dental College and Hospital, Derabassi

^{5, 6}Reader, Dept of Conservative Dentistry and Endodontics, Derabassi, National Dental College and hospital.

ABSTRACT:

Aim: Aim of the study is to check the efficiency of three different retreatment rotary file systems to remove filling material from the root canal. **Materials and Methods:** In this study 30 extracted human single rooted teeth were taken. The samples were instrumented using Protaper gold and then obturated with gutta percha using seal apex sealer. The samples were then randomly divided into 3 groups depending upon the retreatment rotary file systems used for removal of the filling material, Group 1- Neoendo retreatment files, (Orikam, India); Group 2 - Protaper Universal Retreatment system, (Dentsply Malliefer, Ballaigues, Switzerland); Group 3 - Hyflex Remover, (Coltene/Whaldent Altstatten Switzerland). Samples were then checked using CBCT for the amount of filling material left in the root canal after using the respective retreatment systems. **Results:** On evaluation though none of the sample showed complete removal of gutta-percha but Protaper Universal Retreatment system showed better result than Hyflex Remover file and Neoendo retreatment files. The remaining filling materials in the canals treated with Protaper Universal Retreatment system were less than Hyflex Remover file and Neoendo retreatment files. **Conclusion:** It can be concluded that Protaper Universal Retreatment system is better but rigid, Hyflex Remover file is good along with flexibility and Neoendo retreatment files are okay but very aggressive to work with.

Keywords: CBCT, Hyflex Remover, Neoendo retreatment, Protaper Retreatment, Retreatment

Received: 5 Feb, 2023

Accepted: 28 March, 2023

Corresponding Author: Dr. Navjot Singh Mann, Professor and Head, Dept of Conservative Dentistry and Endodontics, National Dental College and Hospital, Derabassi

This article may be cited as: Mann NS, Jhamb A, Kaur I, Mann NK, Rana M, Batra D. Comparative evaluation to check the efficiency of three different retreatment rotary file systems to remove filling material from the root canal: An in vitro study. Int J Res Health Allied Sci 2023; 9(3):46- 49

INTRODUCTION

Post -treatment endodontic disease might occur due to persistence of bacteria in the root canal system as a consequence of insufficient cleaning, untreated canals, inadequate filling or coronal/apical leakage [1]. But, failures are the pillars of success.

Therefore, to reduce the number of microorganisms, the obturating material (gutta-percha and root canal sealer) must be removed as much as possible from the root canal system [2].

Nonsurgical procedures require the complete removal of filling materials from the endodontic space to obtain 3-dimensional cleaning, shaping, and obturation of the root canal system [3]. This can be achieved by either hand instruments or rotary instruments.

Several techniques can be used to remove the root filling material from the root canal system, including the use of stainless steel hand files [4, 5], Gates Glidden drills, nickel-titanium (NiTi) rotary instruments, ultrasonic instruments [6-9], heat-bearing instruments

[10], lasers [11] and use of adjunctive solvents. The removal of gutta-percha using rotary instruments in the retreatment process has decreased the chair-side clinical time [12].

Neoendo retreatment files are designed to remove filling material from canals. It is a pack of three files; N1, N2 and N3. N1 and N2 come in 16mm and 18mm and N3 comes in 22mm and 25mm. The N1 instrument has a length of 16 mm, a tip of 0.30 mm, and a 9% taper and is to be used in coronal one-third. The N2 has a length of 18 mm, a tip of 0.25 mm, and an 8% taper. It is to be used in the middle one-third. The N3 has a length of 22 mm; a tip of 0.20 mm, and a 7% taper and is to be used at the apical one-third.

The ProTaper Universal System retreatment files (PTUS) are designed to facilitate the removal of filling material. There are a total of three retreatment files. Each file has different lengths, tapers, and apical tip diameters. The D1 PTUS instrument has an active tip to facilitate initial penetration into the filling material; the D1 instrument has a length of 16 mm, a tip of 0.30 mm, and 9% taper. The D2 PTUS instrument for removal of filling material at the level of the middle third of the root has a length of 18 mm, a tip of 0.25 mm, and an 8% taper. The D3 PTUS instrument for apical filling removal with a length of 22 mm, a tip of 0.20 mm, and a 7% taper is used to reach the working length.

The Hyflex Remover file is recommended to remove obturation materials from the root canal during a nonsurgical endodontic retreatment. Only one file is required to remove the root canal filling material. It comes with a non-cutting tip of 0.30 mm, and a 7% taper limited to the first 10 mm and followed by a 0% taper towards the shaft in order to preserve periradicular dentine. It is available in 19mm and 23mm.

The present study was designed to evaluate and compare the effectiveness of hyflex remover file with neoendo retreatment files and protaper universal system retreatment files.

MATERIALS AND METHODS

Thirty single rooted human teeth were used for this study. They were free of caries, cracks, anatomic variations, immature apex, and restoration. Teeth were stored for 1 week in formalin and then in normal saline until use. The soft-tissue covering the root surface was then removed with curettes.

Access opening was done. A 15 number stainless steel K file was inserted into the root canal until the tip of the instrument was visible at the end and the working length was determined. The root canals were shaped using protaper gold files (Dentsply Maillefer, Ballaigues, Switzerland).

During shaping procedure, the root canals were irrigated with a 5.25% sodium hypochlorite (NaOCl) and 17% ethylenediaminetetraacetic acid (EDTA). The root canals were then dried with paper points.

The samples were then obturated using sealapex sealer. Then they were temporized and stored at 37°C in 100% humidity for 1 week to allow complete sealing of the sealer. After that the samples were randomly divided into three groups depending upon the retreatment rotary file systems used for removal of the filling material; Group 1: Neoendo retreatment files, (Orikam, India); Group 2: Protaper Universal Retreatment system, (Dentsply Maillefer, Ballaigues, Switzerland); Group 3: Hyflex Remover, (Coltene/Whaldent Altstatten Switzerland).

For group I, the Neoendo files (Orikam, India) were used according to the manufacturer's instructions starting with the first file of 30/9% for coronal third, followed by 25/8% for middle third and lastly 20/7% for apical third till the files came out clean of the filling material.

For group 2, the ProTaper Universal retreatment files (Dentsply Maillefer Ballaigues, Switzerland) were used as per manufacturer's instruction. D1 (30/9%) instrument was used for coronal third, D2 (25/8%) for middle, while D3 (20/7%) for apical third till the files came out clean of the filling material.

For group 3, the Hyflex Remover file, (Coltene/Whaldent Altstatten Switzerland) was used as per manufacturer's instruction. Since it is a single file system, the file was used up till the working length till it came out clean of the filling material.

Samples were scanned after removal of root canal filling material in each group using CBCT equipment and analysed for the amount of residual filling material. The area of the root canal and residual filling material was recorded using the following equation.

$$\text{Area \% of remaining filling material} = \frac{\text{Area of remaining filling material} \times 100}{\text{Area of canal wall}}$$

The obtained data were analyzed statistically using the one-way analysis of variance (ANOVA) (P = 0.05) and post hoc multiple comparison analysis.

RESULTS

The mean ± standard deviation, respectively, was as following: Neoendo retreatment files, 14.61±1.26; Protaper Universal Retreatment system, 11.04±1.37; Hyflex Remover files, 11.80±2.12.

There was statistically significant difference when Neoendo retreatment files were used for removal of filling material in comparison with ProTaper Universal retreatment files and Hyflex Remover files.

However there was not much statistical difference between ProTaper Universal retreatment files (Dentsply Maillefer Ballaigues, Switzerland) and Hyflex Remover file, (Coltene/Whaldent Altstatten Switzerland) [Table 1].

Table 1: Comparison of remaining gutta-percha material expressed as mean±standard deviation

Group	n	Mean±SD	P
Neoendo retreatment files	10	14.61±1.26	<0.05**

Protaper Universal Retreatment system	10	11.04±1.37	>0.05*
Hyflex Remover	10	11.80±2.12	>0.05*

*P>0.05 derived from ANOVA considered non-significant,

**P<0.05 derived from ANOVA considered significant.

DISCUSSION

In 1998, the American Association of Endodontists Glossary of Contemporary Terminology for Endodontics defined retreatment as a procedure to remove filling material from the pulp cavity and also to clean and shape the root canal system again [13].

Microorganisms may persist or recolonize after obturation in the root canal system secondary to coronal or apical leakage thereby leading to endodontic failure [14]. So, when the primary endodontic management fails, root canal retreatment is often required.

The success of nonsurgical root canal retreatment depends on the complete removal of the infected filling material such as gutta-percha and sealers from root canals to allow effective cleaning, shaping and refilling of the root canal [15]. To simplify the standardization of the specimens, single-rooted teeth were used and were prepared using the same file system that is, Protaper gold files. After the shaping procedure, the samples were obturated using Sealapex sealer.

There are various methods to remove the root canal filling material from the canals in the literature. This includes conventional hand files, Gates Glidden drills, ultrasonics, heat, laser, GPX drill, GG drill, and Endotec device contemporary nickel-titanium (NiTi) rotary files [16].

Use of purely mechanical means for removal of root canal content can induce iatrogenic errors such as perforation, ledge, canal straightening, or alteration of canal anatomy. Removing filled content from canal with conventional H files is a laborious and time-consuming process. Rotary NiTi instrumentation may decrease operator and patient fatigue, thus completing the entire process with relative ease in less time [16].

The purpose of this study was to evaluate the efficacy of removal of filling material from the root canals using Neoendo files, ProTaper Universal retreatment files and Hyflex Remover file.

After removal of root canal filling material following manufacturer's instructions, CBCT was used to scan the samples.

CBCT was used as a non-invasive method which allows visualization of morphological features in detail [17]. This method is simple, efficient and sensitive enough to identify small areas of residual filling materials on the canal walls. CBCT scanning allows

three-dimensional evaluation of the root canal system and does not require destruction of the teeth.

The CBCT evaluation found significant differences between Neoendo retreatment files and Protaper Universal Retreatment system along with Hyflex Remover file in the removal of filling material. However, there was nonsignificant difference between Protaper Universal Retreatment system and Hyflex Remover file.

The mean volume of remaining filling materials in the canals were less with Protaper Universal Retreatment system and Hyflex Remover file compared to Neoendo retreatment files. This means Protaper Universal Retreatment system and Hyflex Remover file removed filling materials more efficiently compared with Neoendo retreatment files.

However, Hyflex remover file, being a single file system and having controlled memory was easy to use than Protaper Universal Retreatment system which was stiffer because of the difference in metallurgy of both the files.

The better concert of Protaper Universal Retreatment system instruments may be attributed to the three progressive tapers and length design of D1, D2 and D3 files [18].

CONCLUSION

Within the limitation of this study, it can be concluded that Protaper Universal Retreatment system is better but rigid, Hyflex Remover file is good along with flexibility and Neoendo retreatment files are okay but very aggressive to work with.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Siqueira JF, Jr. Aetiology of root canal treatment failure: why well-treated teeth can fail. *Int Endod J.* 2001;34(1):1-10.
2. Siotia J, Acharya SR, Gupta SK. Efficacy of ProTaper retreatment system in root canals obturated with gutta-percha using two different sealers and GuttaFlow. *Int J Dent* 2011; 2011:676128.
3. Stabholz A, Friedman S. Endodontic retreatment: case selection and technique—part2: treatment planning for retreatment. *J Endod* 1988;14:607-14.
4. Imura N, Kato AS, Hata GI, Uemura M, Toda T, Weine F. A comparison of the relative efficacies of four hand and rotary instrumentation techniques during endodontic retreatment. *Int Endod J.* 2000;33(4):361-6.
5. Schirmeister JF, Hermanns P, Meyer KM, Goetz F, Hellwig E. Detectability of residual Epiphany and gutta-percha after root canal retreatment using a dental operating microscope and radiographs—an ex vivo study. *Int Endod J.* 2006;39(7):558-65.
6. Schirmeister JF, Wrbas KT, Meyer KM, Altenburger MJ, Hellwig E. Efficacy of different rotary instruments

- for gutta-percha removal in root canal retreatment. *J Endod.* 2006; 32(5):469-72.
7. Dadresanfar B, Iranmanesh M, Mohebbi P, Mehrvarzfar P, Vatanpour M. Efficacy of Two Rotary NiTi Instruments in Removal of Resilon/Epiphany Obturants. *Iran Endod J.* 2012;7(4):183-8.
 8. Khalilak Z, Vatanpour M, Dadresanfar B, Moshkelgosha P, Nourbakhsh H. In Vitro Comparison of Gutta-Percha Removal with H-File and ProTaper with or without Chloroform. *Iran Endod J.* 2013;8(1):6-9.
 9. Akhavan H, Azdadi YK, Azimi S, Dadresanfar B, Ahmadi A. Comparing the Efficacy of Mtwo and D-RaCe Retreatment Systems in Removing Residual Gutta-Percha and Sealer in the Root Canal. *Iran Endod J.* 2012;7(3):122-6.
 10. Friedman S, Mor C. The success of endodontic therapy--healing and functionality. *J Calif Dent Assoc.* 2004;32(6):493-503.
 11. Viducic D, Jukic S, Karlovic Z, Bozic Z, Miletic I, Anic I. Removal of gutta-percha from root canals using an Nd:YAG laser. *Int Endod J.* 2003;36(10):670-3.
 12. Schirrmeister JF, Wrbas KT, Schneider FH, Altenburger MJ, Hellwig E. Effectiveness of a hand file and three nickel-titanium rotary instruments for removing gutta-percha in curved root canals during retreatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006;101(4):542-7.
 13. American Association of Endodontists. Glossary of Endodontic Terms. 7th ed. Chicago: American Association of Endodontists; 2003
 14. Mollo A, Botti G, Goldoni NP, Randellini E, Paragliola R, Chazine M, et al. Efficacy of two Ni-Ti systems and hand files for removing gutta-percha from root canals. *Int Endod J* 2012;45:1-6.
 15. Friedman S, Stabholz A, Tamse A. Endodontic retreatment--case selection and technique. 3. Retreatment techniques. *J Endod.* 1990;16(11):543-9.
 16. Fenoul G, Meless GD, Perez F. The efficacy of R-Endo rotary NiTi and stainless-steel hand instruments to remove gutta-percha and Resilon. *Int Endod J* 2010;43:135-41.
 17. Bergmans L, Van Cleynenbreugel J, Wevers M, Lambrechts P. A methodology for quantitative evaluation of root canal instrumentation using microcomputed tomography. *Int Endod J.* 2001;34(5):390-8.
 18. Gu LS, Ling JQ, Wei X, Huang XY. Efficacy of ProTaper Universal rotary retreatment system for gutta-percha removal from root canals. *Int Endod J.* 2008;41(4):288-95.