



Efficiency of Different Retreatment File Systems To Remove Gutta-Percha And Sealers From The Root Canal Walls: An invitro study

Dr. Anil K.Tomer¹, Dr. Nitika Verma², Dr. Kanika³, Dr Sachin Poonia⁴, Dr. Ayushi Khandelwal⁵,
Dr. Ayan Guin⁶, Dr. Geetika Sabharwal⁷

¹Professor and Head, ²Senior Lecturer, ³⁻⁷Postgraduate Student
Department of Conservative Dentistry and Endodontics,
Divya Jyoti College of Dental Sciences and Research, Modinagar, Uttar Pradesh

***Corresponding Author:**

Dr. Kanika

Postgraduate Student, Department of Conservative Dentistry and Endodontics, Divya Jyoti College of Dental Sciences and Research, Modinagar, Uttar Pradesh

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Aim: To compare the efficiency of different retreatment instruments to remove gutta-percha and sealers from the root canal walls by evaluating the operating time and the percentage of remaining filling materials on root canal walls.

Material and method: A total of 10 extracted single rooted premolars were selected. Root canals were accessed and prepared using the crown down technique, and the biomechanical preparation was done using Protaper gold files till F2 followed by obturation.

Samples were divided into 2 groups of 5 samples each. Retreatment was carried out. For group 1 it was done using ProTaper Universal retreatment instruments and for group 2 Hyflex remover files were used to remove the filling material from the canal. The roots were split longitudinally using a diamond disk and chisel. The amount of remaining GP and sealer was evaluated. Then, the specimens were examined using a stereomicroscope at $\times 20$ magnification.

Results: The mean residual gutta-percha and sealer was 12.058% in group 1 and 11.44% in group 2. No statistically significant difference ($P > .05$) was observed among the groups. Whereas, mean time taken by group 1 was 4.44 minutes and group 2 was 5.514 minutes which showed statistical significant difference ($P < .05$) among the groups.

Conclusion: None of the instruments were able to remove the filling material completely. Gutta percha removal using Hyflex remover files were faster and more efficient compared to ProTaper Universal retreatment instruments.

Keywords: to ProTaper Universal, retreatment, Hyflex remover

Introduction

Non-surgical retreatment is an endodontic procedure whose goals are "to remove materials from the root canal space and, if present, address deficiencies or repair defects that are pathologic or iatrogenic in origin" (C.J Ruddle).¹

There are multiple reasons for the failure of root canal which include insufficient cleaning which results in persistence of bacteria leading to infection, inadequate obturation, overextension of the GP points, and improper seal or any iatrogenic errors. This resulted in the increase in research in the endodontic retreatment, which is gaining light currently by the removal of old GP.⁶ Nonsurgical

retreatment is often considered the treatment of choice in management of failed endodontic cases with a success rate of 74–98%. In the course of retreatment procedure, total elimination of root canal filling material is chiefly important so as to gain the actual cleaning and sterilization of root canals.⁴

Various techniques of retreatment have been existing with their respective drawbacks. The traditional hand files are extremely time consuming and possess an inherent risk of breakage. While Ultrasound tips mostly used for broken file removal, help in retreatment but cannot be used for the whole procedure. On the other hand rotary and reciprocating Niti files have also not shown any significant innovation since 2010.²

The aim of this study was to compare the efficiency of different retreatment instruments to remove gutta-percha and sealers from the root canal walls, during retreatment procedure by evaluating the operating time and the percentage of remaining filling materials on root canal walls using Stereomicroscope.

Material And Method

A total of 10 extracted single rooted premolars were selected. Teeth with fully formed apices, absence of calcifications and straight root canal were collected, cleaned and stored in saline with 0.1% thymol and washed under running water.

The teeth were decoronated at the cement-enamel junction by means of the diamond disk to leave a root 15–16 mm in length. A size 10 K file was introduced into the canal until it was visible at the apical foramen, and the working length was determined by reducing 1 mm from this length. Radiographs were taken. Root canals were prepared using the crown down technique, and the biomechanical preparation was done using Protaper gold files till F2. After each instrument, the canal was irrigated with 2.5 ml of 3% solution of sodium hypochlorite. Then, the final flush was performed with 5 ml of 17% EDTA for 30 s followed by 5 ml of 3% of NaOCl for 30 s and then 5 ml of distilled water. The root canal was dried with paper points and obturated with GP and AH Plus sealer using the mono cone technique. The coronal access cavity was sealed with a temporary filling material (Cavit). All teeth were stored at 100% humidity and 37°C for 3 weeks to allow the sealer to set completely.



Fig.1 Decoronated extracted single rooted premolars

Retreatment procedure

The specimens were randomly divided into two experimental groups with 10 roots each. The retreatment files were carried into the canal using endo motor. Speed and torque were set according to the manufacturer's instructions.

Group 1: ProTaper Universal retreatment instruments were used to remove the filling material. D1, D2, and D3 were used sequentially applying a crown-down technique until the working length was reached. The instruments were used with an electric motor (X-Smart; Dentsply Maillefer) at a constant speed of 500 rpm for D1, D2, and D3, with a torque of 3 Ncm.



Fig.2: ProTaper Universal retreatment file

Group 2: Hyflex remover files were used to remove the filling material from the canal. The instruments were used with an electric motor (X-Smart; Dentsply Maillefer) in continuous rotation with a speed of 500 rpm with a recommended torque of 2.5N.cm



Fig.3: Hyflex remover file

Evaluation of the results was done based on two parameters, i.e., operating time and remaining root canal filling material. Gutta-percha removal was considered completed when no filling debris was observed either on the instrument flutes or in the irrigating solution. The smoothness of canal walls was checked by tactile sensitivity using the last instrument. To eliminate inter operator variability, the same operator carried out all intracanal procedures.

Analysis of Residual Gutta Percha

The roots were split longitudinally using a diamond disk and chisel. The amount of remaining GP and sealer was evaluated. Then, the specimens were examined using a stereomicroscope at ×20 magnification. After being photographed with a digital camera, the images were evaluated using AutoCAD software. The percentage of residual filling material in the root canal walls was calculated using the following equation.

$$\text{The percentage of residual filling material} = \left(\frac{\text{Area of the remnant}}{\text{Area of the canal wall}} \right) \times 100$$

Statistical Analysis

The mean percentage area of residual filling material and time taken to remove the filling material was analyzed using 1-way ANNOVA test.

Results

All teeth examined exhibited some residual filling material within the canals. The mean residual gutta-percha and sealer was 12.058% in group 1 and 11.44% in group 2 (Table 1). No statistically significant difference (P > .05) was observed among the groups.

Whereas, mean time taken by group 1 was 4.44 minutes and group 2 was 5.514 minutes (Table 2) which showed statistical significant difference (P < .05) among the groups.

Table 1: Analysis of Variance Results for percentage of remaining filling material

F-statistic value = 3.93065
P-value = 0.08272

Groups	N	Mean	Std. Dev.	Std. Error
Group 1	5	12.058	0.2963	0.1325
Group 2	5	11.44	0.6309	0.2821

ANOVA Summary					
Source	Degrees of Freedom DF	Sum of Squares SS	Mean Square MS	F-Stat	P-Value
Between Groups	1	0.9548	0.9548	3.9306	0.0827
Within Groups	8	1.9433	0.2429		
Total:	9	2.8981			

Table 2: Analysis of Variance Results time taken for the retreatment

F-statistic value = 6.9615

P-value = 0.02978

Groups	N	Mean	Std. Dev.	Std. Error
Group 1	5	5.514	0.752	0.3363
Group 2	5	4.44	0.5128	0.2293

Discussion

Endodontic retreatment is always the first choice to save the tooth when infected again after the root canal treatment even though it is time-consuming. The use of conventional files to remove a well-condensed obturating material has relatively been a tiresome and laborious procedure for the operator and might also lead to endodontic accidents. Advances in the endodontic field led to the use of NiTi rotary instruments, which are not only effective in root canal shaping but also proved to be efficient and require less time in removing GP/sealer during endodontic retreatment. In the current study 2 rotary retreatment files were compared for their efficacy of removing root canal filling material.

ProTaper D series, containing three flexible instruments, are designed for root filling material removal from different thirds of the canal. They should each work at special torque and speed according to the manufacturer in electric motor controllers. *Gu et al.* suggested that better performance of ProTaper D series in straight canals was due to the progressive taper and length of these files. The better performance of ProTaper Universal retreatment instruments may be attributable to their design. The design features could alter the retreatment instruments to chop not only, GP however additionally the superficial layer of dentine throughout root filling removal. Moreover, the precise flute design and rotary motion of the ProTaper Universal retreatment instruments tend to pull GP 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 could plasticize GP. The plasticized GP would thus present less resistance and be easier to get rid off.³

Hyflex remover is a single file system. The heat treatment renders it with excessive flexibility and cyclic fatigue resistance which allows it to respect the original anatomy and achieve a working length of 3mm thus, keeping the apical part safe. It is available in N°30, with a variable triplex helix cross section with an open flute which is symmetrical in the first 3mm and asymmetrical towards the shaft. It exhibits a 7 degrees taper limited to first 10mm followed by a 0 degree taper towards the shaft enhancing efficient debris removal while preserving peri radicular dentine. Its non-active tip of 30/100mm allows its usage in curved canals with active edges offering decreased risk of ledges while respecting the anatomy with an improved cutting efficiency. Its uniquely designed using 1mm wire which makes it smaller than that of the majority of re- shaping or retreatment instruments thus being minimally invasive and yet renders it with improved flexibility allowing protection of the peri-cervical part by preserving the dentin and respecting the natural anatomy of the canals.²

The success of endodontic retreatment directly hinges on the maximum removal of filling material in that poorly instrumented and obturated root canal systems can lead to the harbouring of necrotic tissues and microorganisms responsible for endodontic treatment failure. Jadhav et al in his study concluded that rotary instrumentation took less time and cleaned canal walls better than hand instrumentation, likewise H-files showed the maximum amount of remaining guttapercha within the root canals and took more time than R-endo & ProTaper.⁵

In the present study, the amount of residual filling material was assessed by sectioning the roots longitudinally into separate halves. The results of the present study revealed that none of the canals

submitted to filling removal were completely devoid of residual guttapercha and sealer. This finding is consistent with those of *Bramante et al⁹* and *Xu et al¹⁰*, who reported the virtual impossibility of removing 100% of the residual gutta-percha and sealer from root canal walls, irrespective of the technique used for filling material removal.

The study also revealed that Hyflex remover was quicker in completing the retreatment as compared to protaper universal retreatment file the reason for this can be the number of instruments present in the file system as Hyflex remover is a single file system and protaper retreatment file are a set of 3 instruments. However further studies are required to assess the efficiency of these instruments in a clinical scenario.

Conclusion

With in the limitation of the study it can be concluded that none of the file system was able to remove the root canal filling material completely as regardless of the retreatment system used, residual obturation material were evident on the root canal surface. Hyflex remover took less time for the removal of root canal filling material as compared to protaper universal retreatment file.

Bibliography

1. Alakabani TF, Faus-Ll acer V, Faus-Matoses V. Evaluation of the time required to perform three retreatment techniques with dental microscope and ultrasonic activation for removing filling material from the oval root canal. *J Clin Exp Dent*. 2018;10(8):e810-4.
2. Dr. Niladri Maiti, Prof. Dr. Babacar Tour e, Prof. Dr. Rachida Amezian. Hyflex Remover: The Top-Drawer Endodontic Retreatment Tool. *Turkish Online Journal of Qualitative Inquiry (TOJQI)* Volume 12, Issue 5, July, 2021: 4003-4008
3. Marfisi K, Mercade M, Plotino G, Duran-Sindreu F, Bueno R, Roig M. Efficacy of three different rotary files to remove gutta-percha and Resilon from root canals. *International Endodontic Journal*, 43, 1022–1028, 2010.
4. Agrawal P, Ramanna PK, Arora S, et al. Evaluation of Efficacy of Different Instrumentation for Removal of Gutta-percha and Sealers in Endodontic Retreatment: An In Vitro Study. *J Contemp Dent Pract* 2019;20(11):1269–1273.
5. Aniket Jadhav, Anupam Sharma, Nitin Shah, Rajendra Daule. An in-vitro study to evaluate the efficacy of hand and rotary instruments; with and without RC solvent in root canal retreatment Aniket Jadhav¹, Anupam Sharma, Nitin Shah, Rajendra Daule. *Indian Journal of Conservative and Endodontics*, April-June,2017;2(2):45-49.
6. Raj PKT, Mudrakola DP, Baby D, Govindankutty RK, Davis D, Sasikumar TP, Ealla KKR. Evaluation of Effectiveness of Two Different Endodontic Retreatment Systems in Removal of Gutta-percha: An in vitro Study. *J Contemp Dent Pract* 2018;19(6):726-731.
7. Bhagavaldas MC, Diwan A, Kusumvalli S, Pasha S, Devale M, Chava DC. Efficacy of two rotary retreatment systems in removing Gutta-percha and sealer during endodontic retreatment with or without solvent: A comparative in vitro study. *J Conserv Dent* 2017;20:12-6.
8. Muraleedhar AV, Satish SV, Patil AM, et al. Comparative evaluation of efficacy of three different rotary retreatment systems with manual instrumentation in removing gutta-percha from root canals - an in vitro study. *J Evolution Med Dent Sci* 2021;10(14):1025-9.
9. Bramante CM, Fidelis NS, Assumpc,~ao TS, et al. Heat release, time required, and cleaning ability of MTwo R and ProTaper universal retreatment systems in the removal of filling material. *J Endod* 2010;36:1870–3.
10. Xu LL, Zhang L, Zhou XD, et al. Residual filling material in dentinal tubules after gutta-percha removal observed with scanning electron microscopy. *J Endod* 2012;38:293–6.
11. Patil A, Mali S, Hegde D, Jaiswal H, Saoji H, Edake DN. Efficacy of Rotary and Hand Instrument in removing Gutta-percha and Sealer from Root Canals of Endodontically Treated Teeth. *J Contemp Dent Pract* 2018;19(8):964-968