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EFFICACY OF DIFFERENT METHODS FOR REMOVING ROOT CANAL FILLING MATERIAL IN RETREATMENT – AN IN VITRO STUDY

Endodontics

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ABSTRACT

Patients undergoing endodontic retreatment comprises a significant percentage of patients, in spite of significant improvement in novel materials and techniques. Several techniques have been proposed to remove filling materials from root canal system. Aim of the study was to evaluate and highlight efficient method for removing root canal material.

KEYWORDS

Endodontic therapy, Re-treatment, PROTAPER rotary instrument, Extrusion, Optical stereo microscope

INTRODUCTION

Retreatment requires complete removal of the root canal filling material, followed by further complete cleaning, shaping, and re-obturation, many of these cases can be managed successfully and the tooth saved by careful endodontic retreatment[1,2,3]. Although varied materials are prescribed for obturation of root canals, gum together with a sealer is most often used. Various methods are used to remove the filling material: thermal, mechanical, chemical and a combination of the three[4]. Strategies for using gutta percha and its solvents are well researched. Several techniques have been proposed to remove filling materials from root canal system, including the use of endodontic hand files, Nickel Titanium rotary instruments, Gates Glidden burs, heated instrument, ultrasonic instruments, laser, and use of adjunctive solvents. Conventionally, the removal of gutta percha using hand files with or without solvent are often tedious, time overwhelming method particularly when the root filling material is well compacted[5]. Retreatment is a tedious and time consuming process leading to many procedural errors. Selecting the case for retreatment is a meticulous process where the pros and cons of tooth prognosis have to be weighed, So duration of time plays an important role in selecting the case .

The aim of the study was to Evaluate Efficacy Of Different Methods For Removing Root Canal Filling Material In Retreatment .

MATERIALS AND METHOD

The present study was carried out in the Department of Conservative Dentistry and Endodontics at Department of Conservative Dentistry and Endodontics, School of Dental Sciences, Sharda University , Greater Noida.

Selection criteria : 30 straight single rooted extracted premolars were included with round canal and curvature less than 10° with completely developed apices (Figure 1(a), Figure 1 (b)).

- **Specimen preparation :** Soft tissue and calculus was mechanically removed. Cusps were removed and access to the pulp was established with a cylindrical diamond bur (Figure 2). Root canal orifice identified & canal patency was determined. Working length was established 1mm shorter. (Figure 3)

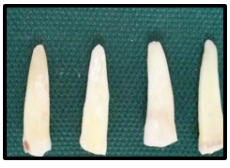


Figure 1 (a)

Figure 1 (b)

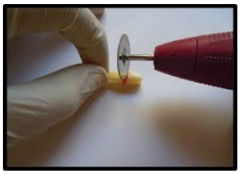


Figure 2

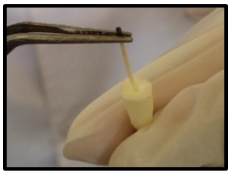


Figure 3

- **Canal Preparation :** Shaping was done with PROTAPER rotary instrument (torque - 2.4 with 500 rpm) in a crown down manner with size 40 & 0.40 taper.Irrigation was done with 2.5 ml of 5.25%NaOCL. Final flush was done with 5 ml of 17% EDTA solution for 30 seconds . Further rinse with 5 ml of saline solution was carried out .Canal was dried with sterile paper points. All samples were divided into six groups with 5 specimen each.
- **Experimental Group Of The Investigation**

Group	Filling Material	Retreatment Technique
1	SINGLE CONE	Gates Glidden(GG)+ HEDSTROM
2	SINGLE CONE	PROTAPER RETREATMENT FILES +HEDSTROM
3	SINGLE CONE	PROTAPER RETREATMENT FILES
4	LATERAL CONDENSATION	Gates Glidden (GG)+HEDSTROM
5	LATERAL CONDENSATION	PROTAPER RETREATMENT FILES +HEDSTROM
6	LATERAL CONDENSATION	PROTAPER RETREATMENT FILES

SINGLE CONE OBTURATION : Group 1,2 & 3 were obturates with Master Gutta percha cone 4% corresponding to the last file size 40 (Figure 4). Tug back was checked and the tip was trimmed . Master cone coated with AH plus sealer & positioned into the canal (Figure 5).

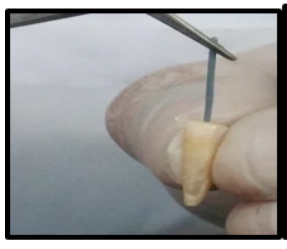


Figure 4

Figure 5

LATERAL OBTURATION :

- Group 4, 5 & 6 were obturated with Master gutta percha cone 2% corresponding to the last file size 40. Tug back was checked and the tip was trimmed . Master cone coated with AH plus sealer & positioned into the canal. Medium fine accessory gutta percha cones - laterally condensed (until they could not be introduced more than 5 mm into the canal).
- Temporary restoration was given and stored in a humidor at 37°C for two weeks.

Retreatment Technique :

Group 1, and 4 -*GATES GLIDDEN* - was used to remove approx 5 mm of filling material from the coronal part. Solvent was used along with *H-type files* size 20, 25, 30, 35, 40 in a circumferential quarter turn push pull motion. (Figure 6)

Group 3 & 6 - *Protaper retreatment files* - instrumented in a crown down sequence

- Pro taper D1- coronal third of the root canal
- Pro taper D2- for middle third
- Pro taper D3- for apical third , till the working length. (brushing action with lateral pressing movements)

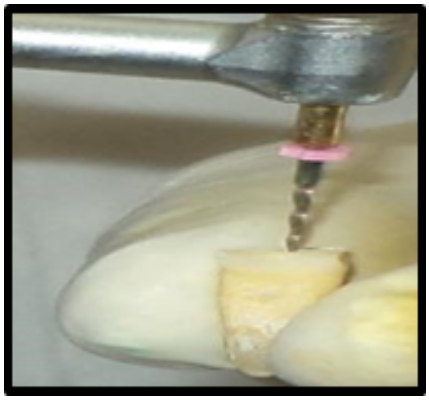


Figure 6

Group 2 & 5 - *PROTAPER RETREATMENT FILES + HEDSTROM* - Solvent was introduced into the coronal portions of the canals. H File was used to penetrate the remaining root filling and increase the surface area of the gutta-percha to enhance its dissolution. This was followed by use of Protaper as in group 3, and 6.

Retrieval was complete when last file reached the working length. Ultimately irrigation was done with 2 ml of 5.25% NAOCL followed by Irrigation with 5 ml of 17% EDTA solution and final rinse with 5ml of saline solution was made.Time and duration was recorded for satisfactory filling material removal.

Extrusion :

- Debris of root canal filling material through the apical foramen was observed visually using loupes with 3x magnification and scored according to the following system .

0= no extrusion of filling material
1=detectable extrusion of filling material

Canal wall cleanliness :

- Evaluation was done using optical stereo microscope. Root was splitted longitudinally & each half examined.
- Grading system used to establish different score for coronal, middle & apical portions of the root canal of each section.
- The following criteria were used:-
- 0= none to slight(0 – 25%) of residual debris
- 1=presence (25 -50%) of residual debris
- 2=moderate(50- 75%)
- 3=entire or almost the entire surface(75- 100%)

Optical stereo microscope photographs:

Figure 7 (a)

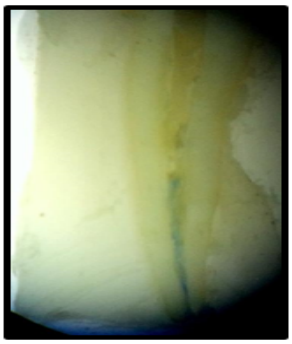


Figure 7 (b)

Figure 7 ©

Statistical Analysis:

The data obtained was analyzed by using descriptive statistics, ANOVA (Analysis of Variance)-one way, ANOVA (Analysis of Variance)-two way and Scheffe's post hoc test through SPSS for windows (v 16.0).

RESULTS

Results were consistent with others who reported that mechanical instrumentation was significantly more rapid than hand files. Mean time taken for retreatment is less for mechanical instrumentation than hand which did not depend on the kind of filling material. Apical extrusion was significantly less for protaper retreatment files + hedstrom than pro taper followed by GG and hedstrom. By mean OSM analysis, it was observed that during material removal, canal in all the groups tend to accumulate more debris apically regardless of the protocol or material used. The results suggest that a combine use of rotary and hand instruments achieves the desired optimal results.

The use of hand instrument followed by NiTi rotary files to remove filling material quickly should be followed to obtain better canal wall cleanliness especially in the apical third further by limited increasing the size of apical preparation.

Table 1:

Time Necessary for Retreatment (seconds)		p-value	
		Single cone technique	**Lateral condensation technique**
Gg+ Hedstrom	Protaper Retreatment Files+ Hedstrom	0.002*	0.009*
Gg+ hedstrom	Protaper Retreatment Files	0.010*	0.017*
Protaper Retreatment Files+hedstrom	Protaper Retreatment Files	0.022*	0.029*

Table 2:

Apical Extruded Material		p-value	
		Single cone technique	**Lateral condensation technique**
Gg+ Hedstrom	Protaper Retreatment Files+ Hedstrom	0.012*	0.019*
Gg+ hedstrom	Protaper Retreatment Files	0.021*	0.028*
Protaper Retreatment Files+hedstrom	Protaper Retreatment Files	0.028*	0.035*

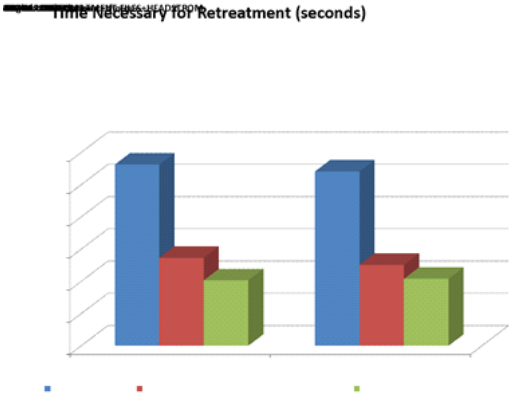
Table 3:

canal wall cleanliness		p-value		
		Coronal	Middle	Apical
GG+HEDSTROM	PROTAPER RETREATMENT FILES+HEDSTROM	0.019*	0.023*	0.021*
GG+HEDSTROM	PROTAPER RETREATMENT FILES	0.027*	0.031*	0.029*
PROTAPER RETREATMENT FILES+HEDSTROM	PROTAPER RETREATMENT FILES	0.032*	0.036*	0.034*

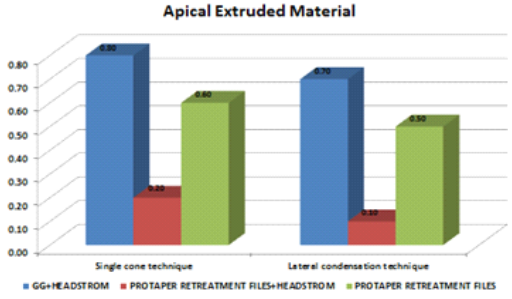
Table 4:

canal wall cleanliness		p-value		
		Coronal	Middle	Apical
GG+HEDSTROM	PROTAPER RETREATMENT FILES+HEDSTROM	0.009*	0.013*	0.011*

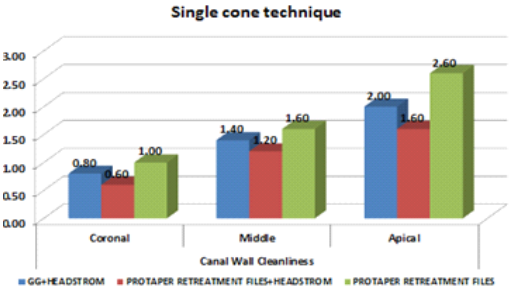
GG+HEDSTROM	PROTAPER RETREATMENT FILES	0.017*	0.021*	0.019*
PROTAPER RETREATMENT FILES+HEDSTROM	PROTAPER RETREATMENT FILES	0.029*	0.033*	0.031*



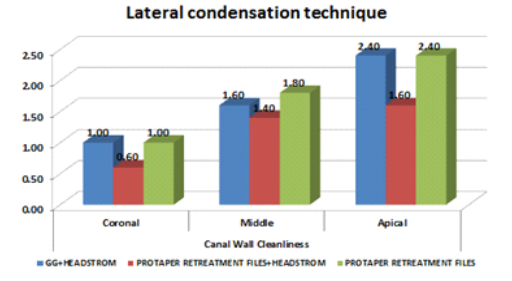
Graph 1



Graph 2



Graph 3



Graph 4

DISCUSSION

Obturated root canals is an initial treatment of choice for the management endodontic failures. Many technique and instruments have been advocated for removal of gutta percha for hand and rotary which includes different variety of instruments designs.

An epidemiological study was done by Kvist T et al., to know the success of non surgical retreatment and surgical retreatment. There was no statistically significant difference between the success rate of surgical and for non surgical retreatment; the preferred treatment for failed endodontic cases is non surgical retreatment as surgical retreatment resulted in more postoperative discomfort, trauma to the normal oral tissues, post surgical complications [6]

In the present study no instrument failure ,perforations, blockages or ledging were registered. Results were consistent with others who reported that mechanical instrumentation was significantly more rapid than hand files.

Active cutting tips and cutting blades positively influenced both the time required for retreatment and safety of the instrument. Protaper showed good results in the apical thirds could be explained by the fact that the obturation is done with 40.02 master cone and D3 has 0.07 taper which is greater than the master apical file size. Therefore along the gutta-percha root filling material, the adjacent dentin wall also has been removed. This leads to the complete removal of root filling material. Rotary NiTi retreatment instrument used in the present study produced less apical debris extrusion than hand files; this could be because of triangular cross section of protaper retreatment files that reduces the contact between the instrument and also the dentin walls. During the retreatment procedure, debris positioned between the apical blades and conveyed apically in the rotating instrument in auger like fashion, which helps to decrease the amount of the debris [7]

Gates Glidden drill (1-3 size) was used in the present study to remove coronal 2mm of the canals. This step facilitates access to the more apical portions of canals and it provides a receptacle for the placement of the chemical solvent. The deep penetration with Gates Glidden drill would have removed the entire root filling material and even an extensive amount of surrounding root dentin which weaken the tooth and make it susceptible for future root fracture. Xylene was used as a solvent to remove gutta-percha filling from the root canal. According to Filho TM et al., xylene has better capacity of dissolution of gutta-percha [8,9]

In the present study safe sided H files left the maximum amount of gutta-percha in the canals, produced more apical debris extrusion and took more time to remove filling material from the canals. This could be because of the cutting surface; cutting blades and the contact cutting surface were less. Hand instruments are stiffer than NiTi rotary instruments, cannot be directed effectively towards the root canal walls and don't produce frictional heat leaving more amount in the root canals. The non cutting side on one side of the H file will lead to more debris accumulation. The push pull filing action of the safe sided H files acts as a piston, posing a risk of pumping the debris through the apical foramen [7]

CONCLUSION

- The results suggest that a combine use of rotary and hand instruments achieves the desire optimal results.
- The use of hand instrument followed by NiTi rotary files to remove filling material quickly should be followed to obtain better canal wall cleanliness especially in the apical third further by limited increasing the size of apical preparation.

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