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Research Paper

Efficacy of Two Rotary Ni-Ti Instruments in the Removal of Gutta-Percha for Root Canal Retreatment-an In Vitro Stereomicroscopic Study

Medical Science

KEYWORDS : Gutta-percha, Root Canal Sealer, Rotary Instruments

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ABSTRACT

30 extracted human single rooted teeth were instrumented with K3 rotary files and filled using lateral compaction of gutta-percha (GP) and AH Plus sealer. The teeth were randomly divided into three experimental groups of 10 specimens each. Removal of gutta-percha was performed with the following devices and techniques: ProTaper Universal rotary retreatment system, Mtwo retreatment files and Hedstrom files. Time to reach working length and to eliminate filling material was also recorded. The specimens were splited longitudinallyfor evaluation of the area of the remaining gutta-percha/sealer under stereomicroscope at 6X magnification. Photographs were taken for further analysis using computer image analysis program. The results were statistically analyzed using ANOVA and Bonferroni test. It was concluded that all test techniques left gutta-percha/sealer remnants within the root canal. The ProTaper Universal rotary retreatment system proved to be an efficient method of removing gutta-percha and sealer from single rooted teeth.

Introduction

The key to successful endodontic treatment is to thoroughly debride the canal system of infected or necrotic pulp tissue and microorganisms, and to completely seal the canal space, thus preventing persistence of infection or re-infection of the pulp cavity[1]. Root canal therapy, despite having high degree of success, may not lead to desired response, and failure may occur[2, 3]. When root canal therapy fails, treatment options include conventional retreatment, periradicular surgery or extraction[3,4].

The non-surgical approach is treatment of choice when access to root canal is feasible and is most conservative method[5].The clinical success rate of endodontic retreatment has been estimated to vary between 50-90%[6,7].The variability of the outcome in endodontic retreatment is related to patient's age and type of teeth treated[8], presence of alteration in natural course of root canals[7], possibility of removing coronal restoration to access pulp chamber[9] and possibility of repairing pathologic and iatrogenic defects[10]. Preoperative perforations, apical periodontitis and quality of previous filling materials are strong predictors for outcome of endodontic retreatment[10,11].

The main goal of orthograde retreatment is regaining access to apical foramen by complete removal of root canal filling material thus facilitating

sufficient cleaning and shaping of the complete root canal system and final obturation[12].One of the greatest technical difficulties faced by endodontists is the conventional root canal retreatment, as the filling materials represent a mechanical barrier that can often require considerable time and effort to remove[13]. Techniques for removal of gutta-percha include endodontic hand files combined with heat or chemical solvents, engine-driven rotary files, ultrasonic instruments, heat carrying instruments, paper points withChemicals and lasers[14, 15].Recently flexible rotary NiTi files have been introduced.

The aim of this study was to evaluate the efficiency of two rotary NiTi instruments, ProTaper (Dentsply-Maillefer, Ballaigues, Switzerland), Mtwo (Sweden & Martina, Padova, Italy) in removal of gutta-percha during root canal retreatment in comparison with hand instruments using Hedstrom files (Dentsply Maillefer, Baillaigues, Switzerland). The time to reach the working length and to eliminate filling material was also recorded and evaluated.

Materials and Methods:

Selection of teeth:

Thirty single rooted teeth with mature root apices and single canal extracted for periodontal reasons were used .Soft tissue and calculus were removed.

Initial root canal treatment:

Each tooth was decoronated at CEJ with a diamond disc to facilitate straight line access. A circumferential 'staging platform' was established near the canal orifice, ensuring a uniform working length (WL) of 15mm in each tooth.

Cleaning and shaping were performed using a crown down technique. The coronal third was flared with sizes 1–3 Gates Glidden drills (Dentsply Maillefer). Canal preparation was carried out by the sequential use of K3 rotary files (SybronEndo,Mexico) up to size 35 at working length; a step-back procedure in 1 mm increments to a file size 50 was then carried out. Upon withdrawal of each instrument, canals were irrigated alternatively with 5.25% NaOCl and 17% EDTA.

Root canal obturation:

The root canal of each tooth was dried with paper points and obturated with gutta-percha (GP) and AH Plus sealer (Dentsply, DeTrey, Konstanz, Germany) using a cold lateral compaction technique. The coronal access cavities of the specimens were sealed with temporary filling material (Cavit, DeTrey Dentsply).

Retreatment Techniques:

All the specimens were randomly divided into three experimental groups (n=3) with 10 specimens each for removal of gutta-percha by using one of the following techniques:

Group A: ProTaper Universal retreatment files
Group B: Mtwo retreatment files
Group C: Hedstrom files

All instrumentation of the ProTaper Universal retreatment files and Mtwo retreatment files was performed using Endo motor with sirona 6:1 contra-angle

(VDW Silver Munich, Germany) operated at a constant speed of 300 rpm.

Evaluation

a) Remaining gutta-percha and sealer

Teeth were grooved with diamond burs from coronal to apical third using double sided abrasive diamond disc mounted in straight handpiece. The samples were then split longitudinally into two halves using chiesel instrument. All the longitudinal sections were then photographed under stereomicroscope at 6x times magnification. The photographs of the samples were captured in JPEG images. Scores of cleanliness were evaluated by using stereomicroscope images for the coronal, middle and apical thirds of the each specimen at 6X magnification. Each canal was divided into coronal, middle and apical thirds from the 'staging platform' to the terminus of the apical preparation. The

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area of GP/sealer remnants and the canal wall were measured using image analyzer software (DigiPro4.0).

b) Operating time
The operating time which elapsed from initial GP removal with the first instrument until reaching the original working length was recorded as T1. The time required to achieve satisfactory GP removal after reaching the working length was recorded as T2. Total time for treatment was the sum of T1 and T2.

Statistical Analysis
Analysis of variance (ANOVA) was used to analyse differences in percentages of GP/ sealer remnants covered area amongst the three groups. One-way ANOVA was applied to compare the operating time amongst the three groups. Bonferroni test was performed as the post hoc multiple comparison method.

Results
a) Remnants of material
All instruments left filling material inside the root canal. The specimens retreated with the ProTaper left less filling material inside the root canals than other groups but significance difference was found between ProTaper and Mtwo and ProTaper and Hedstrom files (<0.001). **(Table 1)**

The comparison of GP/Sealer remnants at different levels among four groups using Bonferroni Method test showed that difference in different levels was found to be maximum between coronal and apical levels (6.362) while it was minimum between coronal and middle levels (2.548).

Table 1
Mean and Standard deviation of canal wall cleanliness for retreatment group

S. No.	Group	Coronal		Middle		Apical	
		Mean	SD	Mean	SD	Mean	SD
1.	A (ProTaper)	3.52	1.36	5.55	1.91	8.02	2.79
2.	B(Mtwo retreatment file)	6.13	3.06	7.71	2.20	11.49	2.77
3.	C (H-file)	9.32	2.30	13.35	3.27	18.55	2.64
"F" (ANOVA)		30.733		50.66		76.90	
"p"		<0.001		<0.001		<0.001	

a) Operating time
The mean time taken for complete procedure was found to be minimum in Group A (5.42±1.22 min) while it was found to be maximum in Group C (12.28±1.90 min). **(Table 2)** The efficacy of groups in terms of mean time taken to complete the procedure was:

Protaper R > Mtwo – R > H-file

Table 2
Mean and Standard Deviation of time taken for complete procedure in different groups

S. No.	Group	No. of samples	Mean time taken	SD	Range	
					Min	Max
1.	A (ProTaper)	20	5.42	1.22	3.55	7.45
2.	B (Mtwo retreatment-file)	20	7.80	1.03	6.18	10.59
3.	C (H-file)	20	12.28	1.90	8.49	15.10

Discussion
In present study,teeth were decoronated to ensure standardization of specimens by eliminating some variables,thereby allowing more reliable comparison between the proposed retreatment techniques. Different methodologies have been reported to evaluate the amount of filling material remaining inside canal after retreatment procedure. It can be assessed radiographically , roots can be split longitudinally and remaining gutta-percha and sealer were measured linearly or using scoring system or making the teeth transparent.

In addition computer tomography and operating microscopes have also been used for this purpose. Ideally, three-dimensional visualization of the root canal system would provide a better understanding of the distribution of the debris after retreatment[16]. Amongst them, the longitudinal splitting method is cost-effective and sensitive enough to identify small area of residual GP/sealer on the canal wall. In the present study, the roots were splitted longitudinally to allow measurement of the area of residual filling material.

In the present study Endosolv-R was selected from a variety of different solvents which are recommended for endodontic retreatment which includes eucalyptol,halothane,methylchloroform,chloroform,turpentine[14]. Although chloroform has been shown to be most effective gutta-percha solvent when compared with other solvents but its use is controversial.Additionally it is hepatotoxic and nephrotoxic and is classified as a carcinogen.

In present study better performance of ProTaper Universal retreatment instruments may be due to their specific flute design. Other features are progressive tapers of D1, D2, D3 files which make it possible to shape specific sections of a root canal with one file and variable tip diameter which allow files specific cutting action in defined area of the canal, without stressing the instrument in other section.

In the present study significant difference was found between ProTaper group and Mtwo, this is in accordance to study done by Tasdemir et al.[16] Mtwo instruments have an S-shaped cross-section, an increasing pitch length in the apical coronal direction and characterized by positive rake angle with two cutting edges, which are claimed to cut dentin effectively.Using Mtwo instruments with single length preparation left more filling material in canal during retreatment.

Conclusion
Within the parameters of this study, following conclusions may be drawn:

l None of the techniques removed all filling materials from root canal walls.

l ProTaper Universal re-treatment files left significantly less gutta-percha and sealer than Mtwo system and H files.

l Re-treatment with Protaper Universal re-treatment files systems was significantly faster than manual instrumentation in the removal of gutta-percha/ sealer.

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