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Comparative Evaluation Of Effectiveness Of Protaper Universal Rotary Retreatment System And Mtwo Retreatment System For Gutta-percha Removal With Or Without Solvent-an In Vitro Study

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Abstract
Aim of this study was to evaluate the efficacy ofnickel- titanium rotary instrument systems with or without a solvent versus stainless steel hand files for gutta-percha removal.
Methodology: Ninety extracted human maxillary anteriors stored in 10% formalin were used in this study. They were prepared by using a hybrid technique, debrided and irrigated with NaOCl, ethylenediaminetetra acetic acid and normal saline, and obturation was done with lateral compaction technique. All teeth were stored for 30 days at 370 C at 100% humidity.Teeth were randomly divided into 6 groups (n-15). Group I-H file with Endosolv R,Group II-H file without Endosolv R,Group III- ProTaper Universal Retreatment files with Endosolv R,Group IV- ProTaper Universal Retreatment files without Endosolv R,Group V- Mtwo Retreatment files with Endosolv R, and in,Group VI- Mtwo Retreatment files without Endosolv R were used. Retreatment was considered complete for all groups when no filling material was observed on the instruments. The teeth were grooved bucco-lingually with a diamond disc and sectioned longitudinally with a chisel and mallet. Each half was observed under a stereomicroscope at 7X magnification and amount of Gutta percha/sealer on the canals walls were estimated
Results: The results showed that ProTaper retreatment system with the use of solvent was more efficient inmaterial removal compared to Mtworetreatment system. Most remnants were found in the apical third of the canals.
Conclusion:ProTaper Universal Retreatment files with solvent were found to be an efficient rotary system for endodontic retreatment.

Key Words
Endodontic retreatment, ProTaper retreatment files and Mtwo retreatment files.

Introduction

There has been a significant growth in endodontic treatment in recent years. This increase in clinical activity can be attributed to better trained dentists and specialists alike. Over a period of time, patients have become more confident in selecting endodontic treatment because of the changing perception that pain can be managed, techniques have improved and long-term success is achievable. With all the potential for endodontic success, the fact remains clinicians are confronted with post-treatment disease[1].

Endodontic therapy is a conservative treatment modality yielding high long term tooth survival rate. In the past undesirable outcomes of endodontic therapy were described as failures. Friedman suggested using term post-treatment disease to those cases that would previously referred to as treatment failures[2].

Management of such post-treatment pathosis includes orthograde retreatment, apical surgery, or intentional re-implantation. Often, orthograde retreatment is the preferred choice of treatment because it is the least invasive approach[3]. The success rate for orthograde retreatment is reported to range from approximately 65% to more than 80%[4].

In 1986, late Dr Herbert Schilder quoted the term "RETREATODONTICS" and said that the future of endodontics lies in the "Retreatment of Endodontic Failures" [5].

The goals of nonsurgical retreatment are to remove materials from the root canal space and if present, address deficiencies or repair defects that are pathologic or iatrogenic in origin. Nonsurgical endodontic retreatment procedures have enormous potential for success if the guidelines for case selection are respected and the most relevant technologies, best materials and precise techniques are utilized[6].

Several techniques can be used to remove the gutta percha, including the use of stainless steel hand files, nickel titanium rotary instruments, heat-bearing instruments, and ultrasonics. In addition, use of a solvents such as chloroform, eucalyptol, xylol, halothane and certain commercially available products as Endosolv E and Endosolv R have been used to facilitate the removal of gutta-percha by softening it. Various NiTi rotary instruments systems such as ProTaper Universal rotary retreatment system and Mtwo retreatment systems have been introduced to facilitate removal of root canal filling material; nevertheless, there is no agreement about which system should be the preferred one. Although various studies have shown that it is almost impossible to completely remove the existing root canal filling but novel techniques seek improved results through NiTi rotary instruments and the use of operating microscope[7].

Materials and Methods

90 extracted maxillary anteriors, collected from the department of Oral and Maxillofacial Surgery, Seema Dental

College and Hospital, Rishikesh were used in this study. Selection of teeth was done under following criteria. Inclusion criteria-teeth with single canals, intact teeth with fully formed apex, non carious teeth. Exclusion criteria - carious teeth, teeth with visible cracks or fractures, primary teeth, teeth with any developmental anomalies, teeth with internal or external resorption.

Methodology

Crowns were decoronated with the help of a diamond disk mounted on a DFS mandrel in straight hand piece at 30,000 rpm. Each root had a length of 16mm (measured with a vernier caliper). Patency of the canals was checked and the glide path established. Estimation of the provisional working length was made by placing size 15 K-file (Dentsply Maillefer) into the root canal until it was observed at the apex. The final working length was ascertained after subtracting 1 mm from this length. The canals were prepared using Crown down technique. The cervical third was flared with Gates Glidden drills (3 and 2). The remaining canal instrumentation was completed using K files up to size 35 K type file apically and 50 K type cervically. Throughout the entire sequence of operations, irrigation was performed with an endodontic irrigating needle and syringe by using 2 ml of 3% sodium hypochlorite. Recapitulation was performed with the K-file. After completion of instrumentation, all specimens received a flush of sodium hypochlorite (5 ml, Pyrex, 3%), followed by 1 ml of 17% ethylenediamine tetra acetic acid (EDTA) [Ammdent] for 1 minute. All specimens were finally irrigated with normal saline. The canals were dried with paper points and obturation was done with gutta-percha and AH Plus sealer (Dentsply Maillefer).After removal of 1 mm of gutta-percha from the root canal, openings were sealed using Cavit G (ESPE, 3M, St. Paul, MN). All teeth were stored at 100% humidity and 37 0C for 30 days to allow the sealer to set completely.

Retreatment techniques

The size 2 and 3 Gates-Glidden (GG) drills were used to remove the coronal 3 mm of all root canal obturating materials. The obturated root canals from all groups were subjected to retreatment by using three different file systems with or without solvent (n=15) as follows:

Group 1st and 2nd: # 15, 20, 25, 30, 35 Hedström files (Dentsply Maillefer), were used until they reached the working length in a circumferential push-pull filing motion to remove all the filling materials (Gutta percha and sealer) and clean the canal walls. Endosolv R (Septodont) was used as per the manufacturer's instructions in the 1st group. (Put a drop of Endosolv into the chamber and dip the point of the instrument in Endosolv before each application). For the 2nd group the experimental procedure remained the same except for the non usage of solvent Endosolv R.

Group 3rd and 4th: Root canal obturation was removed with ProTaper retreatment files in an endodontic motor (X-Smart, Dentsply, Maillefer, Switzerland), with a constant speed of 500 rpm for D1, and 400 rpm for D2, according to the manufacturer's instructions. Root canal retreatment was completed with ProTaper rotary files based on the following sequence: D1 (#20, 0.09 taper) and D2 (#25, 0.08 taper), with torque of 3 Ncm, and files were used with crown-down technique until the working length was reached. In the 3rdgroup, Endosolv R was used as per the manufacturer's instructions. For 4th group,the experimental procedure remained the same except for the non usage of solvent Endosolv R.

Group 5th and 6th: The root canal obturation was removed to the working length using Mtwo R25/.05 and Mtwo R15/0.05 retreatment instruments in a brushing action. Then Mtwo rotary files were used in a circumferential motion at the working length. In the 5th group, Endosolv R was used as per manufacturer's instructions. For 6thgroup, the experimental procedure remained the same except for the non usage of solvent Endosolv.

During the chemomechanical preparation, canals were irrigated along with the change of each instrument using 2 ml of 3% NaOCl. After that, a final rinse with saline solution was done. On withdrawal, the files were cleansed of any obturating material before being reintroduced in the root canal. Each file was discarded after being used in five teeth. Retreatment was considered complete for all groups when no obturating material was observed on the instruments.

Evaluation of remaining filling materials

Retreatment was completed when the last file reached the working length, and no obturating material was seen on the instrument after removal.

The teeth were grooved bucco-lingually with a diamond disk and sectioned longitudinally using a chisel and mallet. Both root halves were marked at the coronal 3rd, middle 3rd and apical 3rd (with marker) and photographed with a camera (canon) attached to an operating microscope with 7X magnification.

To evaluate the remaining obturating material, the images taken were transferred to software (Auto Cad, 2010)[10] which was utilized to measure the areas of remaining obturating material and then the data was statistically analysed.

Results

The results showed that mean debris in different groups with Endosolv was minimum in ProTaper, followed by H file and then M-two, While different results were seen in without Endosolv groups-where maximum mean debris was seen in M-two followed by H file and then ProTaper.Conflicting results were found in a study done by Bahareh et al (2011), where M-two retreatment without solvent showed less filling material than ProTaper, both with and without solvent.

Analysis of variance depicted no statistically significant difference among groups ($p<0.001$). While the Tukey HSD test revealed that minimum between H-file and M-two, than H-file and ProTaper and maximum was observed between M-two and ProTaper, and None of the differences were significant statistically. **Table 1 - 2.**

Table 1 : Mean Residual Debris Values And Sd For Different Groups

SN	With Endosolv			Without Endosolv		Significance of difference (Independentsamples "t" test)		
	Materials	Mean	SD	Mean	SD	"t"		"p"
1	H-file	3.068	7.124	2.488		3.029	0.502	0.617
2	M-two	3.880	13.429	15.099		21.455	2.973	0.004
3	ProTaper	1.288	1.718	1.833		2.132	1.337	0.185

Table 2 : Group Comparison Of Residual Debris With Or Without Use Of Endosolv

SN	With Endosolv			Without Endosolv	
	Materials	Meandifference	"p"	Mean difference	"p"
1	H-files vs M-two	-0.812	0.901	-12.611	< 0.001
2	H-files vs ProTaper	1.780	0.606	0.655	0.967
3	M-twovs ProTaper	2.592	0.348	13.266	< 0.001

Discussion

Success in endodontic treatment is based on proper diagnosis, treatment planning and knowledge of the anatomy and morphology of the root canal system. The triad of debridement, sterilization and three dimensional obturation of the root canal system contributes to success.[2], [8].

Root canal retreatment is one of the most difficult and time-consuming endodontic procedures. Removal of the filling material is fundamental for reshaping of the root canal system and for achievement of the desired goals in canal therapy. Several studies have been conducted to develop and investigate new instruments that provide a clean, debris-free, disinfected root canal system[9].

Root filling materials act as a mechanical barrier against reaching the apex of the root during endodontic re-treatment, and any remnants of this material could hide the bacteria that may be responsible for failure of re-treatment. Complete removal of these residues may increase the success of endodontic re-treatment[10].

Several reports have proposed techniques for removing gutta-percha and sealer from root canals[11]. These reports generally compared the safety and efficiency of shaping rotary Ni-Ti instruments to that of stainless steel hand files. According to Hu¨lsmann & Bluhm, use of rotary devices, heat or solvents in endodontic retreatment procedures should be followed by thorough hand instrumentation to achieve optimal cleanliness of the root canal walls[12].

K fir A et al, evaluated radiographically and microscopically the efficacy of various techniques for removing root filling material. They reported that radiographic evaluation failed to adequately and reliably detect the extent of filling material remaining on the canal walls, which was later observed by microscopic evaluation[13].

In the present study, maxillary anteriors were selected, as they have straight and wide root canals that were easier to prepare and standardize for evaluation of effectiveness and efficacy of H files, ProTaper retreatment files (D1, and D2) and Mtwo retreatment files (R1,and R2) in removing gutta-percha and sealer from the canals.

For over 100 years, gutta-percha has been the most commonly used obturating material for root canal. Gutta-percha can be easily sterilized, is easy to manipulate, impervious to tissue fluids and is biocompatible.

However, one of the disadvantages of gutta percha as a root canal obturating material is that it lacks sealing ability if used alone. Therefore it must be coated with a root canal sealer to provide an effective seal. Consequently, a sealing agent is required. In the current study, AH Plus was used as a sealer. AH Plus is anepoxy-amine resin basedroot canal sealer. It is characterized by superior mechanical properties, high radiopacity, minimal polymerization shrinkage, low solubility and high degree of stability on storage.

In order to facilitate the removal of filling materials from the root canals, numerous techniques have been proposed, including hand files, ultrasonic files, engine driven instruments, rotary files etc.

In the current study ProTaper retreatment files were chosen as they are one of the latest mechanized instruments available. They save time and show lesser tendency of straightening, zipping, ledging or perforation, with torque of 3 Ncm. These files are used with crown-down technique until the working length is reached. The better performance of ProTaper Universal retreatment files may be attributable not only to their design but also due to their cutting action. They cut not only GP but also a superficial layer of dentine during root filling removal. Similar results were found in a study done by T. Tasdemir et al, where ProTaper, H file, M-two and R-endo were used[14].

The other system used in the present study was the Mtwo instruments, which were elected as they have an S-shaped cross-section, an increasing pitch length in the apical-coronal direction and non-cutting safety tip. Therefore, these instruments are characterized by a positive rake angle with two cutting edges, which are claimed to cut dentine effectively. The initial reports concluded that Mtwo was successful in root canal retreatment, as they have sharp blades. It is possible to cut through the canal and reach the apical end-point whilst bypassing gutta-percha. Conflicting results were found in a study done by Bahareh et al[15], where M-two retreatment without solvent showed less filling material than ProTaper, both with and without solvent.

Adjunctive solvents like Chloroform effectively dissolve gutta-percha and allow quicker access to the working length, and help to maintain the original route by facilitating instrumentation inside the obturation mass. Furthermore, the use of solvents eliminates the need for excessive force during negotiation of gutta-percha obturated canals and thus preventing canal transportation. Hence, the H-files, ProTaper retreatment files (D1, and D2) and Mtwo (R1and R2) in conjunction with solvent (Endosolv) were used in the current study to remove the gutta-percha which waslaterally condensedinto the canals withAH Plus sealer.

In the present study, direct visual scoring by using Stereo microscope was adopted for the evaluation of the residual filling material because this enhances the inspection of the root canal walls. It also allows evaluation of both the halves of the canal wall along their entire length, even if the volume of debris cannot be determined precisely.

The results of the present investigation revealed that none of the experimental technique guarantees complete removal of the filling material. The results showed that mean debris in different groups with Endosolv was minimum in Protaper retreatment files (3rdgroup) followed by H files (1stgroup) and then M-two retreatment files (5thgroup) which were same as study done by T. Tasdemir et al[7] and the mean debris in different groups without Endosolv was also minimum in ProTaper retreatment files (4th group) followed by H files (2ndgroup) and then M-two (6th group). Conflicting results were found in study done by Bahareh et al[15], where M-two retreatment without solvent showed less filling material than ProTaper.

When comparing the two Ni-Ti instruments in groups- 3rd, 4th, 5th and 6th, it can be explained by the fact that the Protaper retreatment system which work on crown-down approach eliminates the filling material from the coronal third more effectively and this may be a reason why instrumentation was more effective in apical and middle thirds while M-two retreatment files tend to immediately reach the working length. When comparing hand and NiTi rotary systems, the results of present study revealed that hand files were better in coronal 3rd than M-two and inferior to Protaper. In 2001, Betti and Bramante claimed that hand files were more efficient in the coronal third. However, Masiero and Barletta (2005) reported that K3 Endo System was more efficient than hand files in

apical third[12].

Ni-Ti instruments were more rapid than hand files .The gutta-percha plasticized by mechanical instrumentation offers a lower resistance to the action of the subsequent instrumentation For this reason, it was probably easier to reach the working length with Ni-Ti instruments rather than hand files[16].

With the introduction of new instruments for retreatment, the procedure can be completed more easily, quickly, and predictably, but effective cleaning of the entire root canal is still challenging. Further studies are needed to assess the efficacy, maintenance of original canal morphology and safety of NiTi rotary instruments during retreatment and complicated root canal anatomy.

Conclusion

None of the techniques were efficient in removing all the obturating material from the canals. Under the experimental conditions, ProTaper retreatment files left significantly lesser gutta- percha and sealer in the root canals than the other systems and The use of Endosolv helped to reduce working time and to enhance root canal cleanliness. There were statistically significant differences between ProTaper retreatment system, H files and Mtwo instruments used with or without Endosolv. The ProTaper systems with Endosolv proved to be more efficient than H files, Mtwo instruments as well as the other traditional techniques used for retreatment.

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