



COMPARATIVE EFFECTIVENESS OF THE PRO-TAPER UNIVERSAL RETREATMENT SYSTEM (PTR) USING FOUR DIFFERENT TECHNIQUES FOR REMOVAL OF AH PLUS SEALER – AN IN VITRO STUDY

Ashwini Hambire¹, Shreeshail Indi^{2*}, Kiran Ghatole³, Pavan Diwanji⁴, Sumapriya Sulgante⁵, Aadil Thimwala⁶

Abstract

Aim: Present study compares the effectiveness of the Pro-Taper Universal retreatment System (PTR) using four different techniques for removing the AH Plus sealer.

Methodology: Forty extracted mandibular premolar were decoronated to a standard size of 16 mm. Canals were prepared till Pro-Taper F2 size and obturation was done using Gutta percha and AH-Plus sealer. The specimens were arbitrary divided into four groups (n=10) each. Re-treatment was executed with, Group I - PTR system without solvent, Group II - PTR system with resin solvent, Group III - PTR system succeeded by Pro-Taper finishing files without resin solvent, Group IV- PTR system succeeded by Pro-Taper finishing files with resin solvent. All the teeth were sectioned and stereomicroscopic images were used for analysis with imageJ analyzer software.

Results: None of the technique completely removed the root canal filling material. The PTR system succeeded by Pro-Taper finishing files along with resin solvent showed better outcomes.

Conclusion: All the techniques were not able to remove the entire root canal filling material. The PTR system succeeded by Pro-Taper finishing files along with resin solvent showed efficient cleaning and showed lesser remnants.

Keywords: Gutta-percha, Pro-taper universal re-treatment system, Sealers

¹ MDS, Senior Lecturer. Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. ashwinighanate@gmail.com

² *MDS, Reader, Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. drshrishu@gmail.com

³ MDS, Reader Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. ghatolek@gmail.com

⁴ MDS, Reader, Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. drpawandiwanji@gmail.

⁵ MDS, Senior Lecturer Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. drsumapriya26@gmail.com

⁶ MDS, Senior Lecturer Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. dr.thimwala@gmail.com

*Corresponding author: - Dr. Shreeshail Indi

*Department of Conservative Dentistry & Endodontics, Al-Badar Dental College and Hospital, Kalaburagi – 585102, Karnataka State, India. drshrishu@gmail.com, Phone number: +91-9008765025

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Introduction

Endodontic treatment has a fairly predictable high success rate. Generally, the root canal treatment is safe and effective but at times it may not lead to desired response and occasionally fails. Insufficient cleaning, inadequate obturation, necrotic tissues, coronal leakage, bacterial biofilms, recurrent caries, and tooth fractures are the most common causes of persistent periapical disease after root canal treatment.¹ In such cases non-surgical retreatment is the conservative treatment option. It requires removal of the root canal filling thus permitting proper cleaning and re-establishing an environment for healing and re-obturation.^{2,3}

The retreatment procedures are usually challenging. For effective removal of filling material, various rotary Ni-Ti retreatment systems have been introduced. Protaper nickel-titanium system which is considered the benchmark in rotary systems had been upgraded to pro taper universal (PTU) system and pro taper rotary retreatment files (PTR).⁴

The pro taper universal retreatment (PTR) file has a unique characteristic of increasing taper. It is convex triangular cross-section with a modified guiding tip.⁵ In addition; the use of solvent as an adjunct is highly recommended which minimizes damage to the tooth structure by softening obturating material.⁶ For improving the efficacy and speed of gutta-percha and sealer removal, newer techniques should be introduced. Therefore this study was designed to compare the efficacy of four different techniques which can be used in retreatment cases.

Methodology-

Forty extracted mandibular premolars (single-rooted) were collected and stored in normal saline. Inclusion criteria included single-rooted, non-carious tooth with completely formed root. The radiographs were taken to verify the degree of curvature. Teeth with less than 10-degree curvature were selected. The root surfaces were examined to ensure the absence of any visual defects with a magnifying glass. For disinfection, the teeth were immersed in 3% sodium hypochlorite (NaOCl) for one hour.

The selected teeth were decoronated to a standard size of 16 mm and working length was accessed subtracting 1mm. Canals were prepared with Pro Taper system till F2 size having a taper of 7%. Upon withdrawal of each instrument irrigation was done with 3% NaOCl. Final irrigation was done with 3% NaOCl and 17% EDTA. Obturation was completed with Guttapercha and AH-Plus

sealer. The postoperative radiographs were taken to check the quality of the obturation.

For complete setting of the sealer, the teeth were stored at 100% humidity at 37°C for 2 weeks. The obturated teeth were randomly grouped (n=10) into four groups.

Re-treatment was performed with four techniques.

Group I: - PTR system without solvent

Group II:-PTR system with resin solvent

Group III:-PTR system followed by pro-taper finishing files without resin solvent

Group IV:-PTR system followed by pro-taper finishing files with resin solvent

In Group I, II, PTR system was used. The D1, D2 and D3 files were used in a brushing action until any further obturating material could be removed.

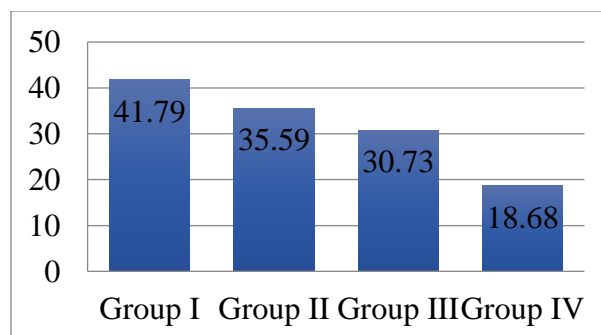
In Group III & IV pro-taper rotary finishing files F1, F2, and F3 were used till working length for root canal refinement. Before the retreatment procedure in Group II & IV, a drop (0.5 ml) of the resin solvent Endosolv- R was placed for 1 min.

All specimens were thoroughly irrigated using 2 ml NaOCl (3%) after each instrument. The teeth were then sectioned buccolingually using a diamond disk. Both halves of the teeth were assessed under a stereomicroscope at 10X. The final analysis of canal walls was completed by using the ImageJ analyzer software.

Results

Data obtained were analyzed by One Way ANOVA test and Tukey's test. A significant statistical difference was observed between the efficacies of the techniques ($P < 0.001$).

On pairwise comparison of the four groups, a significant difference was recorded among all four groups. Regarding the effect of solvent group II and group IV showed significantly ($P < 0.001$) lower value with the use of resin solvent and no significant difference between the other groups.



Graph I Showing mean percentage of total guttapercha remaining in the entire tooth among the four groups.

Discussion

Nonsurgical retreatment is the first choice for failing endodontic cases. Adequate removal of sealer and gutta-percha is mandatory to provide better access to the micro-organism which is responsible for the failure.¹ The success of retreatment relies on complete removal of the original root canal filling material. In many cases, the combination of different variety of techniques can provide efficient results and also time-saving. The nickel-titanium files are more flexible than other file system. Therefore the rotary NiTi instruments may decrease patient and operator fatigue in retreatment cases.⁵ Various studies compared PTR system with conventional manual technique and reported that pro taper universal rotary system was safe and as effective as hand instrument.^{7, 8} In the present study in all four groups PTR system were used and in group III and IV pro-taper universal finishing files were used in addition.

The convex triangular cross-section renders their internal mass larger and decreases the contact area between blade and dentin. Therefore increases the cutting and decreases torsion load.⁹ The material observed in the apical third, probably was due to the last instruments that did not get engaged in the canal walls. The additional instrumentation was purposed for refining the preparation in the apical region. The retreatment instrument has a smaller diameter than the files used in root canal treatment.

In this study AH plus sealer was used for all four groups. It is an epoxy resin-based sealer. These sealers are widely used as root canal sealers as they have presented better sealing ability and good adhesion with low solubility and disintegration.¹⁰ These sealers penetrate 10-80 micrometer in the dentinal tubules and presents good adhesion with root canal walls.⁴ Setting of epoxy resin sealers is by polymerization which results in monomer crosslinking and 3D lattice.¹² Endosolv R has been reported as a potent solvent for the AH Plus sealer.¹³ Endosolv-R may penetrate the 3D lattice formed during polymerization leading to swollen lattice and reducing its strength.¹⁰ Similarly, in this group II and IV removed filling material more efficiently in comparison to other groups. According to studies, Endosolv-R didn't show any observable affect on the bond strength of newer root canal materials to be used.¹³

Conclusion

The additional use of files improved the removal of obturating material. However, none of the techniques was able to completely remove the

obturating material. It can be concluded that the PTR system and pro-taper universal finishing files used together with resin solvent can improve the cleaning in non-surgical retreatment cases. Further clinical studies are indicated to assess the efficiency of this technique.

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