



**COMPARATIVE EVALUATION TO CHECK THE EFFICACY OF THREE DIFFERENT
RETREATMENT ROTARY FILES SYSTEMS IN THE REMOVAL OF FILLING
MATERIAL FROM THE ROOT CANAL DURING ENDODONTIC RETREATMENT—
AN INVITRO CBCT STUDY**

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ABSTRACT

Aim of the study: Effective debridement and cleansing of the root canal system, along with three-dimensional canal sealing, are essential for the potency of endodontic treatment. The removal of root canal filling materials has been accomplished with NiTi devices. The primary goals were to assess how well three rotary retreatment file systems removed gutta-percha and Bio C (Angelus), a bioceramic sealer, from root canal walls and use Cone Beam Computed Tomography to contrast the proportion of residual obturating material in the root canal walls in terms of volume following removal utilizing ProTaper, Neoendo, and Endostar RE retreatment files. **Methodology:** Sixty extracted single-rooted teeth were selected. At CEJ, they were decoronated. BioC (Angelus) Bioceramic sealer and gutta-percha were used to obturate the root canals. Based on retreatment files—the ProTaper Retreatment File, the Neoendo Retreatment File, and the Endostar RE endo Retreatment File—they were split up into 4 groups (n=15). One was a control group, and the other three were experimental groups. Solvents such as xylene were used. Cone Beam Computed Tomography was utilized for the evaluation of the remaining filling materials. **Result:** In this investigation None of the groups removed all of the root canal filler material from the walls of the canals. ProTaper retreatment files, Endostar RE endo retreatment files, and Neoendo retreatment files were found to differ significantly from one another. ($p < 0.05$) In comparison to the other groups, Group 3 (Endostar RE endo) had the most amount of gutta-percha eliminated, as seen by its significantly lower post-treatment mean rank. **Conclusion:** In root canal system the gutta-percha and Bio C sealer had not been entirely eliminated by any of the retreatment files or solvents. The Endostar RE endo retreatment file system outperformed the PTUR and Neoendo retreatment file systems among the ProTaper, Neoendo, and Endostar RE retreatment file systems.

KEYWORDS: Retreatment Gutta-percha, ProTaper universal, Neoendo, Endostar RE endo retreatment files.

INTRODUCTION

The phrase "RETREATODONTICS" was used by Herbert Schilder to suggest that "Retreatment of Endodontic Failures" holds the key to the future of endodontics. A healthy periapical tissue is the main objective of retreatodontics.^[1]

The root filling material in the root canal system can be removed using a variety of methods, such as ultrasonic instruments, lasers, Gates Glidden drills, nickel-titanium (NiTi) rotary instruments, and stainless-steel hand files.^[2,3] Chair-side clinical time has been reduced through the use of rotating devices to remove gutta-percha during the retreatment procedure.^[4,5]

D1, D2, and D3 are the components of the Dentsply Maillefer ProTaper Universal Retreatment (PTUR) files.

The D1 file is used to remove material from the coronal third, D2 for middle third and D3 for apical third of the canal.^[6,7,8]

There are three files in the pack in Neoendo retreatment file system: N1, N2, and N3. The N1 instrument is designed for the coronal one third, N2 for middle third and N3 is designed for the apical one-third.^[9,10]

In order to effectively remove outdated fillings from the canal during root canal retreatment, Endostar RE (Polident Co. Ltd.) was a recently released rotary retreatment file. Two K type files with good flexibility 4 cutting edges, And a square cross section, a "S" shaped blade including two symmetrically oriented edges, 180 degrees towards the axis of symmetry and a cutting channel at a 90-degree angle.

Additionally to having better biocompatibility, Bio-C Sealer is a non-resin cement.^[11]

Cone-beam CT (CBCT) eliminates the need for tooth damage by providing a three-dimensional image of whole root canal system.^[20]

MATERIALS AND METHODOLOGY

Methodology

Sixty excised single rooted teeth were chosen in total. To ensure that there was only single canal, a properly developed apex, and no evidence of internal resorption, calcification, or restoration, diagnostic X-rays were taken.

The teeth were decoronated to a conventional working length of 16 mm using a diamond disc. 15 K-file (Mani Dental Inc., Japan) was utilized to calculate working length. An estimated 1 mm separated the working length from the apex. Using the ProTaper gold Ni-Ti rotary system (Dentsply, Maillefer, Switzerland), the crown down technique was used to prepare the root canals, and the canals were extended to size no. F2.

3% sodium hypochlorite (Prevest DenPro) limited and 17% EDTA (PRIME (Dental Products PVT LTD) were alternately used for irrigation during the instrumentation operation. 0.9% saline was then used as a final irrigant, and The canal was dried using the paper points.

The root canals of every tooth were sealed with gutta-percha and Bio C bioceramic sealer (Angelus) with single cone obturation technique. Cavit was used to fill the coronal access cavity. For a duration of one month, all teeth were kept at 37° C to enable the sealer to complete solidify.

Each specimen was assigned a number and secured in wax arches before being scanned using a CBCT machine.

Based on the retreatment process, the specimens in each group were then randomly divided into three experimental groups (n = 15) and one control group.

- Control Group: GP and Bio C sealer-obtured canals.
- Group I: Neo endo Retreatment files are used for retreatment after canals are sealed with GP and Bio C sealer.
- Group II: PTUR retreatment files are used for retreatment after canals are sealed with GP and Bio C Sealer.
- Group III: Endostar RE Retreatment files were used to retreat canals that had been obtured using GP and Bio C Sealer.

Retreatment technique

The cervical part of each sample had 2 mm of obturating material removed using a Gates-Glidden drill size 2. Next, each canal was treated with three drops of xylene to soften the gutta-percha. Retreatment files were utilized

in conjunction with an endomotor (X smart Plus Dentsply, Maillefer, Switzerland) to remove gutta-percha.

Group 1: Xylene and Neoendo retreatment files were employed in Group I. Materials from the coronal third were extracted using N1 (16/.09). Materials from the middle third were removed using N2 (18/.08) and materials from the apical third were removed using N3 (22/.07).

Group 2: Xylene and ProTaper retreatment files.were employed in Group II. Materials from the coronal third were extracted using D1 (30/.09). Materials from the middle third were removed using D2 (25/.08), and materials f rom the apical third were removed using D3 (20/.07).

Group 3- Xylene and Endostar RE endo retreatment files were employed in group III. 30/12 (17mm), 30/08, 30/06, 30/04, 4 pcs were used for removing materials from the coronal, middle and apical third respectively.

The debris in the flutes was cleaned in order to evaluate the rotary files. According to the irrigation procedure, 2.5 ml of 3% NaOCl, 10 ml of EDTA solution, and 5 ml of NaOCl were successively irrigated into each root canal, with a final irrigation of 5 ml of saline administered in between each file change. When the last file reached the working length and the instrument was free of filler material, complete retreatment was attained.

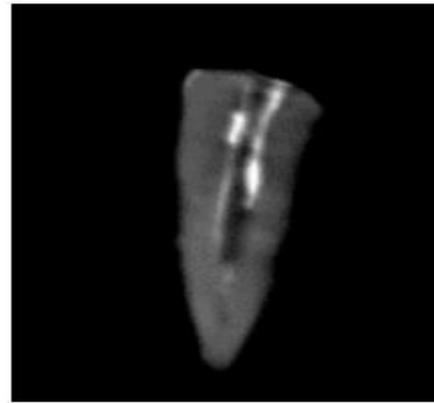
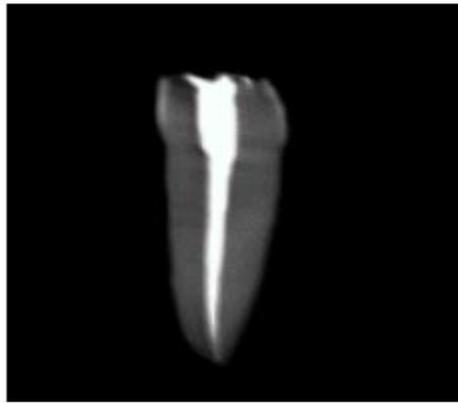
Analysis of remaining fillingmaterial using CBCT:-

Every specimen was mounted for CBCT exposure using a bar as a chin rest, set on a wax sheet, and exposed. Every specimen was mounted for CBCT exposure using a bar as a chin rest, set on a wax sheet, and exposed.

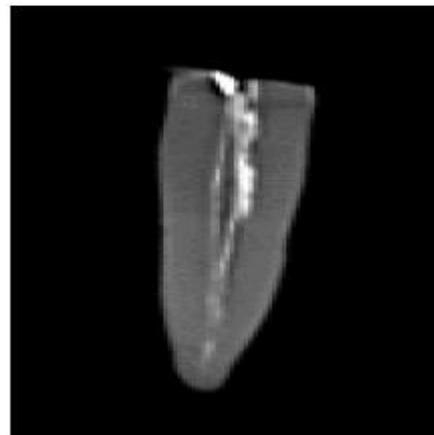
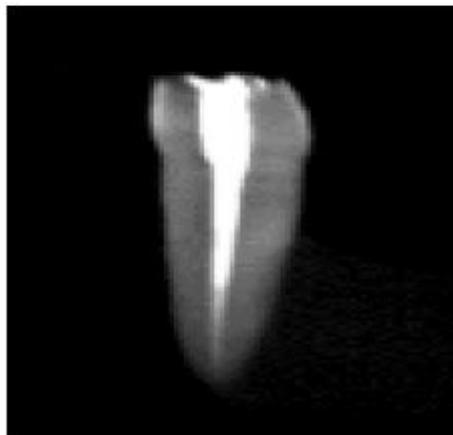
Both the canal's and the leftover filler material's volume were noted. The volume percentage of the leftover filler material was computed using the following formula.

$$\text{Volume \% of remaining filling material} = \frac{\text{volume of remaining filling material}}{\text{Total volume of material in canal before removing.}} \times 100$$

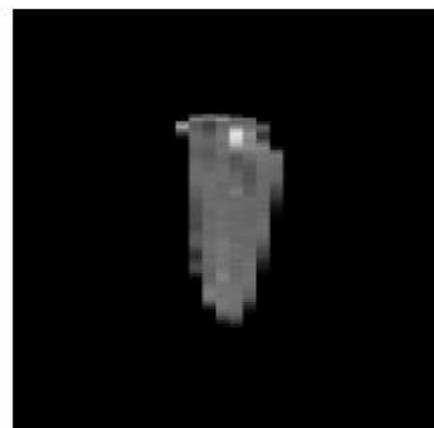
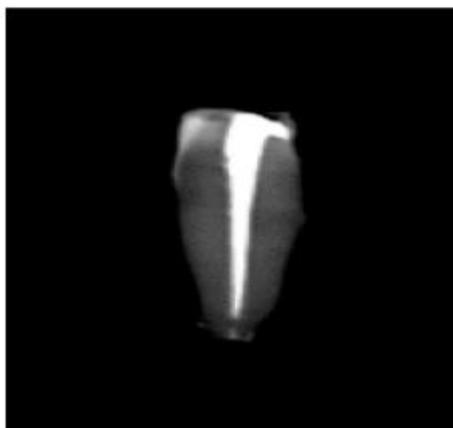
The difference in mean volume between three distinct retrieval systems was analyzed using the Kruskal Wallis test. The retrieval system pairs that differ significantly from one another were determined using the Mann Whitney u test.



CBCT image of group I before and after Retreatment



CBCT image of group II before and after Retreatment

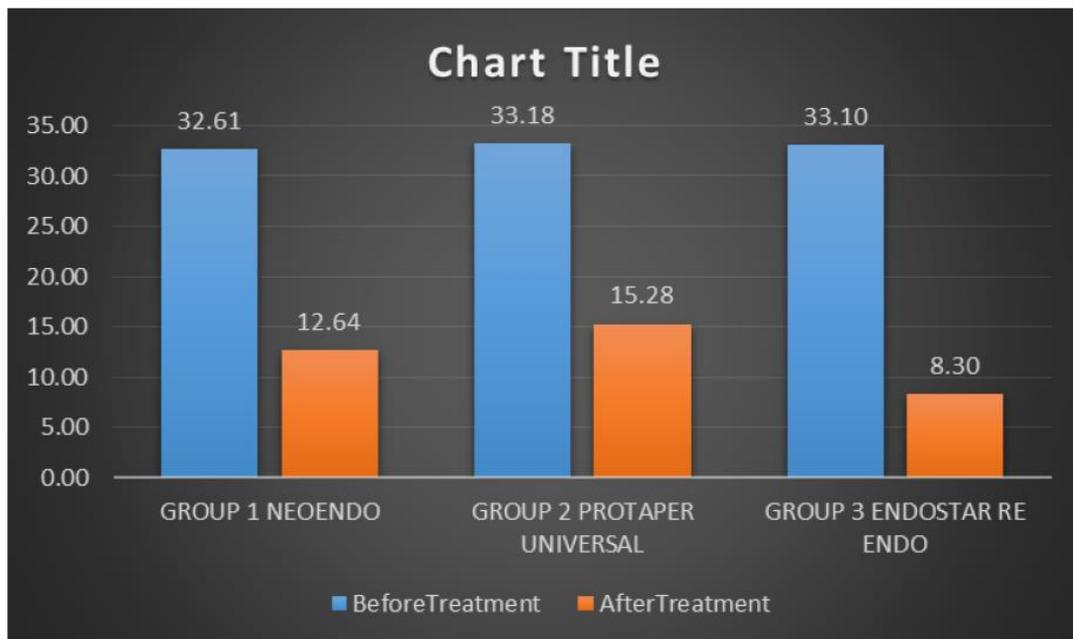


CBCT image of group III before and after Retreatment

RESULTS

Table 1: Mean volume before and after retreatment of the samples.

	Before Treatment	After Treatment
Control group	33.53	0
Group 1 neoendo	32.61	12.64
Group-2 protaper universal	33.18	15.28
Group 3 endostar reendo	33.10	8.30



Graph: Comparison of Mean volume before and after Retreatment of the samples.

Table 2: Representation of mean rank between three groups– Kruskal-Wallis Test.

Kruskal-Wallis Test		N	Mean Rank
Post-Treatment	Group 1 NEOENDO	15	24.47
	Group 2 ProTaper universal	15	36.53
	Group 3 Endostar REendo	15	8.00

Table 3: Representation of mean rank between Group 1 and Group 2 -Mann – Whitney Test.

Mann-Whitney Test		N	Mean Rank	P value
Post Treatment	Group-1 Neoendo	15	9.47	<0.001
	Group-2 ProTaper universal	15	21.53	<0.001
Post Treatment	Group-1 Neoendo	15	23.00	<0.001
	Group-3 Endostar RE endo	15	8.00	<0.001
Post Treatment	Group-2 ProTaper universal	15	23.00	<0.001
	Group-3 Endostar RE endo	15	8.00	<0.001

DISCUSSION

All defective filling materials, including gutta-percha and sealers, must be entirely removed from root canals to allow for effective root canal cleaning, shaping, and refilling in order for nonsurgical root canal retreatment to be successful.^[12]

Because of the active cutting tip's greater taper, intrinsic speed, and fluted, dynamically constructed tool, NiTi rotary retreatment files remove gutta-percha and root canal sealant more quickly and safely than other procedures. The heat generated by revolving files causes gutta-percha to become pliable and mushy.^[10]

The removal of filler material using rotary instruments and hand files did not differ significantly. The NiTi rotary files, however, outperformed the hand file in significant terms of retreatment time.^[13]

According to research, chemical adhesion and micromechanical anchoring of the material to the dentin

substrate are both involved in the bonding mechanism of bioceramic sealers to root dentin after setup.

Specifically, the byproducts of the setting reaction etch the neighboring dentin in an alkaline caustic manner, breaking the collagen fibrils' intermolecular bonds and forming a porous surface. In this zone, an ion exchange layer forms and the minerals in the sealer infiltrate the dentin; this zone is referred to as the mineral infiltration zone. Intrafibrillar apatite deposition takes place along this layer.^[14]

Determining the volume of gutta percha before and after endodontic retreatment was made possible by the use of high resolution CBCT with artifact-reducing algorithms and precise thresholding techniques in third-party software.^[15,16]

The results of the present study showed that a greater amount of root canal filling material was observed in

PTUR group in comparison to ERE and Neoendo group with significant difference.

Least amount of filling material was observed in ERE group. This could be attributed to the greater files size and taper of ERE (#30/0.06) than PTUR (#20/0.07) and the s shape cross section of ERE which give us great cutting ability.

These outcomes were completely consistent with other studies reported by Das S et al 2017 and Mustafa Ammar et al. 2023 which found that the s shape cross section design of M two which is similar to ERE, left less remaining filling material than PTUR files. Mustafa Ammar et al.2023 showed that greater amount of root canal filling material was observed in PTUR group in comparison to ERE with significant difference.^[17]

Root canal filler material was successfully removed by the Endostar-RE retreatment device. After receiving root canal therapy, it was difficult to remove the TotalFill BC sealer.

The Neoendo technology shown more success in removing root canal filling material. This is consistent with a study conducted in 2021 by Muraleedhar AV et al., which found that, in comparison to ProTaper and R-Endo retreatment files, the NeoEndo group had the least quantity of gutta percha left in the root canals after retreatment.^[19]

CONCLUSION

Even with the constraints of the in-vitro investigation, it was demonstrated that none of the retreatment files or solvents had completely removed the gutta-percha and Bio C sealer in the root canal system.

The Endostar RE endo retreatment file system outperformed the PTUR and Neoendo re treatment file systems among the protaper, Neoendo, and Endostar RE retreatment file systems.

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