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# ORIGINAL RESEARCH

# Comparison of the effectiveness of different techniques for supportive removal of root canal filling material

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## Abstract

**Background:** To compare the effectiveness of different techniques for removal of root canal filling material.

**Materials & Methods:** A total of 100 canine teeth were enrolled in the study, featuring canals with a flat oval shape. A control group received traditional needle irrigation (CI). Statistical analysis encompassed the Kruskal–Wallis test, followed by post hoc Dunn's tests. The result was analysed using SPSS software.

**Results:** A notable distinction was observed concerning the overall remaining gutta-percha and sealer content among the various groups (P<0.001). The average size of the gutta-percha and sealer residue in the XP group (0.78) was significantly smaller compared to the remaining groups (P<0.001).

**Conclusion:** The quantity of gutta-percha and sealer present in the XP group was less than that observed in the EA, IS, and CI groups.

**Keywords:** root canal, irrisafe, endoactivator.

## Introduction

Failures are the pillars of success. Endodontic failures are no exception and hence would need retreatment. The main goal of retreatment is cleaning and shaping of the root canal with removal of old root filling material, and this can be achieved by either hand instruments or rotary instruments. Endodontic retreatment can be done either by nonsurgical retreatment (orthograde) or by apical surgery (retrograde). [1] The main goal of orthograde retreatment is regaining access to the apical foramen by complete removal of root canal filling material, thus facilitating sufficient cleaning and shaping of the complete root canal system and then final obturation. [2]During nonsurgical retreatment, all existing root canal filling materials should be removed because they might contain microorganisms that can interfere with the effective distribution of irrigants and prevent adaptation of new root canal filling materials. Nickel-titanium (NiTi) rotary instruments have been shown to be more resistant to fracture for the removal of root canal filling materials and faster than using hand instruments.[3,4]NiTi rotary instruments also reduce operator-related complications. [5] Complete removal of gutta-percha from root canal walls, re-establishing working length, promoting disinfection and re-obturating the root canal are the main goals of non-surgical retreatment to re-establish healthy periapical tissues and obtain predictable success. [6]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 can be a tedious, time consuming process especially when the root filling material is well compacted. [7]Recently, a novel NiTi rotary system has been launched called XP-endo Finisher (FKG Dentaire). According to the manufacturer, it is made of a proprietary MaxWire alloy, which gives the instrument unparalleled flexibility and ability to remove debris from the root canal system complexity. The XP-endo Finisher has an ISO 25 in diameter and zero taper (25/.00) at 20°C and below (martensitic phase). [8] The manufacturer claims that the reach of the instrument could be expanded to 6 mm in diameter or 100-fold of an equivalent sized file at 35°C and above (austenitic phase). [8]Various systems had been applied for the removal of root

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canal filling material from canals which includes stainless steel hand files, Ni–Ti files, ultrasonic files, and lasers. Usage of conventional files has been found to be a quite tedious and time-consuming procedure for the operator to remove a well-condensed obturating material and might also cause endodontic mishaps. Ni–Ti files possess superelasticity which allows more centered canal preparations with less transportation of the canal and a decreased incidence of canal aberrations. Furthermore, the increased taper preparation facilitates adequate irrigation. These files have a greater cutting efficiency once engaged in a crown-down approach and a continuous reaming motion. Consequently, rounder root canal preparations, with less straightening and a smaller amount of apical extrusion, are achievable. In spite of their increased flexibility, separation is still a concern with Ni–Ti files. Studies done by Tasdemir et al. and Bramante et al. demonstrated that ProTaper, ProTaper Universal retreatment files and Mtwo Ni–Ti rotary instrumentation system are faster and more efficient in removal of obturation material than hand files. [9,10] Hence, this study was conducted to compare the effectiveness of different techniques for removal of root canal filling material.

**Materials & Methods**

A total of 100 canine teeth were enrolled in the study, featuring canals with a flat oval shape. These teeth underwent instrumentation up and were filled using the warm vertical compaction technique. Removal of gutta-percha and sealer was executed. The teeth were divided into 4 groups of 25 teeth each, and different activation methods were employed: XP-endo Finisher (XP), EndoActivator (EA), and IrrıSafe (IS). A control group received traditional needle irrigation (CI). Statistical analysis encompassed the Kruskal–Wallis test, followed by post hoc Dunn's tests. The result was analysed using SPSS software.

**Results**

A notable distinction was observed concerning the overall remaining gutta-percha and sealer content among the various groups (P<0.001). The average size of the gutta-percha and sealer residue in the XP group (0.78) was significantly smaller compared to the remaining groups (P<0.001). Conversely, the mean size of gutta-percha and sealer residue in the CI group (1.86) was significantly larger than that in the other groups (P<0.001).Within the middle third, the quantity of remaining gutta-percha and sealer was comparatively reduced in the XP and IS groups in comparison to the remaining groups (P>0.05). Conversely, in the coronal third, the quantity of residual gutta-percha and sealer in the XP group demonstrated a marked decrease in contrast to the other groups (P<0.001).

**Table 1: mean deviations of residual gutta percha and sealer on walls of the canals**

| Group | Apical | Middle | Coronal | P – value |
|---|---|---|---|---|
| **XP-endo finisher** | **0.78** | **0.78** | **0.77** | **>0.05** |
| **Endo Activator** | **0.96** | **1.18** | **1.15** | **<0.05** |
| **Irissafe** | **0.85** | **1.04** | **1.21** | **<0.05** |
| **Conventional irrigation** | **2.10** | **1.67** | **1.99** | **<0.001** |
| **P value** | **<0.001** | **<0.001** | **<0.001** | |

**Discussion**

The major factor for endodontic failure is the persistence of microbial infection in the root canal system and/or in the periradicular area. Nonsurgical management of the previously obturated canals is the initial treatment of choice for the management of such endodontic failures. [11] The goal of nonsurgical endodontic retreatment is to remove as much gutta-percha and sealer as possible. This procedure will uncover the remnants of necrotic tissue and bacteria which might have caused the periapical inflammation and pain. This will, in turn, enable chemomechanical re-instrumentation and disinfection of the root canal system with antiseptic or antibacterial solutions and thus destroy the bacteria and clean the infected root canal. [12] Hence, this study was conducted to compare the effectiveness of different techniques for removal of root canal filling material. In the present study, a notable distinction was observed concerning the overall remaining gutta-percha and sealer content among the various groups (P<0.001). The average size of the gutta-percha and sealer residue in the XP group (0.78) was significantly smaller compared to the remaining groups (P<0.001). Conversely, the mean size of gutta-percha and sealer residue in the CI group (1.86) was significantly larger than that in the other groups (P<0.001). A study by Ozyurek T et al, There was significantly less gutta-percha and sealer remnant in the XP group than in the other groups (P<0.05). The CI group contained significantly more gutta-percha and sealer remnant than the other groups (P<0.05). The apical third of the CI group

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

had significantly more residual gutta-percha and sealer when compared to that of the other groups (P<0.05). Within the limitations of the study, the amount of gutta-percha and sealer in the XP group was lower than that in the EA, IS, and CI groups.[13] In the present study, within the middle third, the quantity of remaining gutta-percha and sealer was comparatively reduced in the XP and IS groups in comparison to the remaining groups (P>0.05). Conversely, in the coronal third, the quantity of residual gutta-percha and sealer in the XP group demonstrated a marked decrease in contrast to the other groups (P<0.001). Another study by Kasam S et al, The ultrasonic retreatment tip had less percentage of residual guttapercha/sealer, shorter mean operating time and little apical extrusion with a significant difference (p<0.05) between the other groups.All techniques retained guttapercha/sealer remnants within the root canal. The ultrasonic retreatment tip proved to be an efficient method of removing obturated material. It was fastest with least apical debris extrusion.[14] Ozlek E et al, there were no significant differences between the groups in the percentage of root canal filling material removal. However, a statistically significant difference was found between the groups in the time required to reach the apex and remove the entire filling material. The time required to remove the root canal filling material was higher in the EdgeFile® X3 group.NiTi files manufactured for root canal preparation can be used effectively and safely to remove root canal filling materials. EdgeFile XR produced for retreatment can be used as an alternative to ProTaper Universal Retreatment files.[15]Different methods have been reported to evaluate the amount of root canal filling material remnant inside the canals during the retreatment procedure. Remaining root filling material can be assessed using radiography and can be measured linearly using a scoring system by splitting teeth longitudinally and making teeth transparent or using computer digitized images of canals using operating microscopes. Radiography is commonly used method to evaluate the residual obturation material in root canals. However, radiographical assessment produces two-dimensional representation of a three-dimensional structure and may be subjected to magnification and distortion as mentioned by Unal et al. [16] Hence, radiographs do not reveal all the residual filling material in the canal. Hence, to prevent the above shortcomings in this study, stereomicroscopic imaging technique under ×16 magnification was used to get a clear picture of the residual obturating material as suggested by Schirrmeister et al. [17]Various methods, such as micro-tomography, longitudinal sectioning and radiological assessment, have been used to evaluate root canal residual gutta-percha and sealer. Micro-tomography could provide 3D information and accurate quantification data (volume) of the remaining filling materials.[18,19] In the present study, the longitudinal sectioning method was preferred because it enables a direct examination of the samples. Thus, it is easier to determine root canal obturation materials using the sectioning method than using radiographic techniques; also, it is less costly. [20]The radiological method provides 2D images of the 3D structure; magnification and distortions are likely to occur in the image, potentially increasing the possibility of inaccurate results. [21]

## Conclusion

The quantity of gutta-percha and sealer present in the XP group was less than that observed in the EA, IS, and CI groups.

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