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# Endodontic Retreatment: Methods for Removing Root Canal Filling Material

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## Abstract

Orthograde endodontic retreatment is a common procedure in dental practice. Its primary indication is often a persistent underlying endodontic infection within a canal obturation. The success of endodontic retreatment relies on optimal canal unsealing, allowing endodontic instruments and disinfectant irrigation solutions to effectively manage the endodontic infection. Various methods for removing root canal filling material are available, and the choice depends on the type and density of the existing canal obturation.

**Keywords**: endodontic retreatment, manual unsealing, Mechanized unsealing

## Introduction and Background

The fundamental and primary objective of initial endodontic therapy would be to maintain periapical health. Compatible with the functions of the tooth on the arch (aesthetic, masticatory, etc.). This involves adhering to the principles of initial endodontic treatment. (proper shaping, disinfection, three-dimensional canal filling)[1].

The advent of endodontic instrumentation, along with a better understanding of endodontic biology has led to initial endodontic treatment achieving high success rates : 80% à 95%[2].

Despite this, failure is still possible[3], manifesting as a periapical disease, hence the need for therapeutic management. In this case, orthograde endodontic retreatment would be the first therapeutic choice to discuss with others (endodontic microsurgery, extraction).

Endodontic retreatment will aim to correct the defects of the initial treatment[4], which caused the onset or persistence of an endocanal infection.

Once access to the root canals is obtained, a complete and effective removal of the entire root filling is necessary. Indeed, canal filling removal must allow not

only access to the apical third but must also incorporate the complete elimination of all endodontic material, this last one could carry microorganisms or constitute an obstacle to the disinfection of a contaminated canal part[5]. Several techniques are employed to remove filling materials from root canal system, depending on the nature and density of the canal filling. The objective of this article is to highlight the main systems and techniques for gutta-percha/sealer removal.

**Manual Retreatment[6]**

A Hedström file (H) may be inserted along the gutta-percha root filling. The diameter of the H file is selected to engage the root filling while remaining free, without coming into contact with the canal walls. The H file is turned a quarter turn in the clockwise direction to ensure better engagement within the root filling. Once engaged, the file is withdrawn, and it should remove the detached root filling in a single piece. It may be necessary to repeat the procedure successively until all the root filling in gutta-percha is removed. Although K-files may also be used, Hedström files are particularly effective due to their design. Manual retreatment is best suited for porous root fillings or floating gutta-percha cones. It may be less effective when dealing with dense and well-condensed root fillings.

**Mechanized Root Canal Retreatment with or without Solvent[4]**

With the advent of nickel-titanium endodontic instrumentation, several systems designed for root canal obturation removal have emerged on the market, which can be used with or without solvent. They allowed a significant time saving; however, their use will be reserved for cases where the initial canal preparation was performed with a NiTi system. Indeed, if this is not the case, the reduced taper of the root canal will block the tip of the NiTi instrument, which has an increased taper, and the instrument may fracture due to torsion.

Figure 1: Endodontic retreatment endodontic procedure in tooth 46. Root canal filling removal was accomplished using a manual technique, due to the low taper of the existing canal filling. A notable reduction in the periapical lesion is observed, particularly at the level of the mesial roots.

- Protaper® Universal Retreatment System: This system includes three root canal retreatment instruments (D1, D2, and D3). These instruments have increasing lengths with a decreasing variable taper. The D1 instrument is the only one with an active tip, allowing it to engage with the filling material. The D1 instrument is used in the coronal third, D2 in the middle third, and D3 in the apical third (at a speed of 500 to 750 rpm).

Figure 2: Endodontic retreatment of tooth 21. Root canal obturation removal was performed using the R-Endo® system. Healing of the periapical lesion is observed.

- R-Endo® System (COLTENE MicroMega): This system consists of a manual instrument (Rm) and four engine-driven nickel-titanium retreatment files (Re, R1, R2, and R3). An additional instrument (Rs) is available for apical shaping after retreatment.
- D-Race® (FKG)[7]: The FKG company has introduced a simplified NiTi system: The D-Race system consists of two NiTi files, DR1 and DR2. DR1 has an active tip that allows it to penetrate the filling material (at an optimal speed of 1000 rpm). Once access to the canal is achieved, DR2 is used to the working length at an optimal speed of 600 rpm. DR2 is single-use due to its high mechanical stress.
- Mtwo® R (VDW®) Retreatment System (8,9): Mtwo® R is a NiTi retreatment system with an S-shaped cross-section and an active tip, designed so that a single instrument can perform the entire root canal retreatment (R25 /.05 for large to medium-sized canals; R15 /.05 for narrow canals). Once access to the root canal has been achieved (using Gates drills or an Opener instrument), the chosen Mtwo® R instrument, selected based on the canal diameter, is placed in the canal without excessive pressure and activated at a speed of 280 rpm (0.3 to 1.2 Ncm). Typically, the frictional heat and the active tip of the instrument soften the gutta-percha, allowing the instrument to progress apically without the need for additional pressure.
- Endo ReStart® (Komet) (10,11): Endo ReStart® is a single-use NiTi rotary system with a simplified sequence consisting of only two instruments, specifically designed for root canal retreatment. It comprises an Opener file, a short instrument (15mm) with an active part of 5mm. As its name suggests, it is used for initial penetration during root canal retreatment. Root canal retreatment will then be completed using the Endo ReStart® file
- Remover® (COLTENE MicroMega) (12): The Remover® is part of the range of single-instrument endodontics, designed from a C-wire alloy that has undergone a thermomechanical treatment to enhance its flexibility and resistance to cyclic fatigue. Once access to the canal is achieved, a device such as an Opener (HyFlex® EDM, COLTENE; or One Flare®, COLTENE MicroMega) is used within 2 to 3 mm inside the canal to create a hole in the canal filling, in order to guide the engagement of the Remover® instrument within the canal. The Remover® instrument is positioned into the opening or hole created by the Opener instrument and is then pushed apically until resistance is felt. The instrument is then retracted while applying pressure on the selective canal wall (the so-called safety wall). Generally, all the canal content will be removed by 3 to 4 vertical back-and-forth movements.

The removal of root canal filling materials is carried out under abundant irrigation, with or without solvent. Aside from these NiTi systems specifically designed for root canal retreatment, canal shaping systems can also be used with a modification in the operative sequence (in reversed sequence) (5).

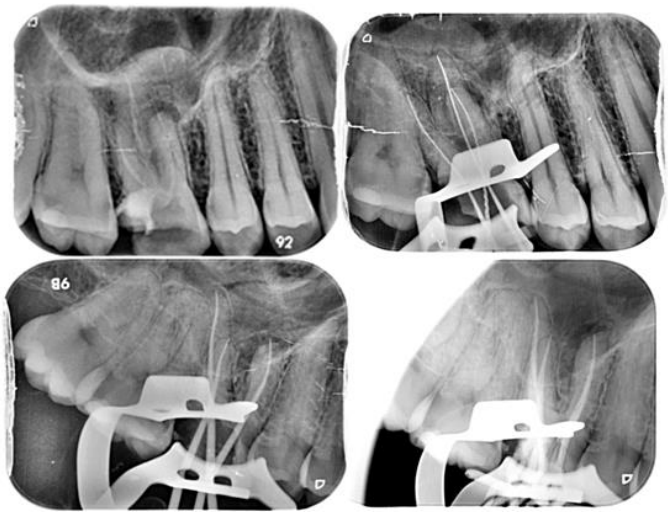

Figure 3: Endodontic retreatment of tooth 16. Root canal filling removal was performed using a manual technique, followed by canal shaping with the ProTaper® system.

**Ultrasonic technique[6]**

This technique is particularly effective in cases of poorly condensed or porous canal fillings, or a floating gutta-percha cone in the canal. A small-sized ultrasonic file is inserted into the canal filled with irrigation solution, without contact with the canal walls. The turbulence generated by the ultrasound disaggregates the porous canal filling, and the debris is removed through irrigation.

**Solvents**

They were introduced to soften the canal filling and facilitate its removal. There are many on the market and specific for each type of material (13). Chloroform would be the solvent of choice for gutta-percha, despite its toxicity often highlighted in the scientific literature[6].

The use of solvents should not be routine but prioritized in cases of an impermeable canal filling. Regardless of the solvent type used, it is important to ensure sufficient contact time with the filling material and to renew the solvent once it is saturated.

Tableau 1: solvents used for during endodontic retreatments[14]

| Nature of the root canal filling material | Solvents | Features |
|---|---|---|
| Gutta percha | Chloroform | ✓ Used since 1874, it can also be used to dissolve (soften if necessary) products such as: Résilon®, Propylor®. |
| | Eucalyptol | ✓ Aromatic eucalyptus oil<br>✓ Used since 1850 to dissolve gutta-percha |
| Eugenate based paste | Eugenol | ✓ Antiseptic and analgesic. It would be effective as a solvent for Cortisomol®. |
| | Trichloroethylene, tetrachloroethylene | ✓ Very effective for dissolving gutta-percha and eugenol<br>✓ High toxicity, their handling should be done with caution |

| | | |
|---|---|---|
| | Orange oil, lemon oil | ✓ A solvent action slower than other solvents<br>✓ They are irritating, allergenic, and cytotoxic; their use will be done with caution |
| Resin based paste | Formamide (Endosolv-R®), dimethylformamide | ✓ High toxicity<br>✓ However, they prove to be effective for removal resin-based cements |

**Conclusion**

In the event of failure of the initial endodontic treatment, retreatment is indicated to correct the shortcomings of the previous procedure. This is only possible through complete root canal obturation removal, allowing the clinician to access the entire endodontic system for disinfection and resealing.

There is no consensus on the technique or instrumentation to be used for root canal obturation removal[5]; the clinical approach is case-dependent, based on the type of canal filling material.

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