Root Canal Retreatment: 2. Practical Solutions

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Abstract: **Root canal retreatment is often the preferred method of treating a tooth in which root canal treatment has failed. Part two of this two-part article discusses the rationale for root canal retreatment and practical techniques and equipment that are available to practitioners.**

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Clinical Relevance: **Root canal retreatment may prevent extraction in a root-filled tooth with persisting apical periodontitis.**

When carrying out root canal retreatment the practitioner encounters the problems associated with routine root canal treatment (infected root canal system, fine canals, fins, tight curves and other complex anatomy) combined with iatrogenic difficulties (existing root-filling materials, broken instruments, ledges and perforations). Retreatment is therefore generally more demanding.[1]

Root canal retreatment may be considered if a root-filled tooth becomes symptomatic, or a new coronal restoration is planned on a tooth with a technically deficient root canal filling, or because of the presence of non-resolving periapical radiolucencies. Retreatment has been shown to be particularly effective when the existing root treatment is deficient technically or there have been procedural errors.[2]

Some of the problems that will be faced during retreatment include:

- Removal of posts;
- Removal of paste and cement root filling materials;
- Removal of silver points;
- Dealing with fractured instruments;
- Bypassing ledges;
- Sealing perforations;
- Identification of uninstrumented canals.

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ILLUMINATION AND MAGNIFICATION

Good illumination and magnification are paramount for predictable root canal retreatment as the demands on the practitioner are considerably greater than during routine root canal treatment. Loupes offer magnification in the range x2.5 to x4, which is ideal for endodontics and routine dentistry. Magnification can best be achieved by using loupes with an additional headlamp, or a surgical microscope. The advantage of such a system over using the standard operating light is that the light source is much brighter and is directed in the line of sight. It becomes much easier to determine the morphology of the pulp chamber and to correct an access cavity that has deviated from the correct axis (Figures 1, 2).

POST REMOVAL

Screw Posts

A post with a screw head, such as *Dentatus* (Tricare Bradford, UK) or *Radix anchor* (Maillefer, Ballaigues, Switzerland), can usually be removed by cutting away any adherent core material and using the manufacturer's wrench to unscrew it. Placing an ultrasonic scaler tip on the post will loosen it, and it may even start to unscrew. Posts that are fractured beneath the pulp floor can be loosened with ultrasound and removed with the Masserann trephine. Special long-necked

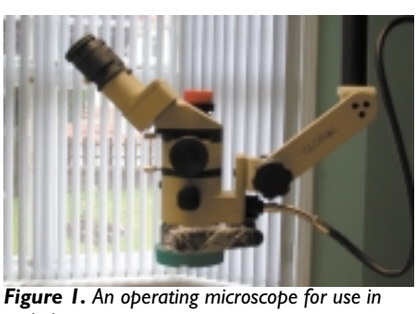

***Figure 1.** An operating microscope for use in endodontics.*

Figure 2. *Loupes used with a headlamp give excellent illumination in the direction of sight, and good magnification.*

Figure 3*. The Masserann trephine, cuts in an anticlockwise direction.*

Figure 4*. The tip of the Masserann extractor.*

trough around posts fractured at the level of the root face, but extreme caution should be taken to avoid perforation.

Masserann instruments

These instruments (Micromega, Besancon, France) are designed for the removal of objects from the root canal. There is a range of trephine drills and a Masserann extractor, which can be locked onto the head of a file to remove it (Figure 3).

The trephine is used to create a space around an object. The extractor tube is inserted over the fractured instrument, which is then locked by screwing in a rod. The file will come out of the canal as the extractor is removed from the tooth (Figure 4).

The hole required to fit the Masserann extractor is relatively large and significant amounts of dentine may need to be removed. It therefore should only be used in the coronal third of the canal, where access is relatively straight, to avoid perforation. The trephines are fragile and can be easily blunted. The cutting tips should be checked before use and can be sharpened with a fine carborundum disc.

Larger objects (e.g. posts) can be removed using the Masserann trephines, which are rotated by hand or in a handpiece, cutting in an anticlockwise direction. Once the cement lute has been removed from around the object, the next smallest trephine is used to grip it for removal.

Cast Posts

An ultrasonic scaler tip or Piezon ultrasonic tips can be used for vibrating a post to break up the cement lute surrounding it. A notch can be cut in the post for placement of an ultrasonic tip, which is oscillated against the post in a vertical direction.

Post Pullers

These are effective by having one part that grips the post, while the other pushes against the root face. Post pullers require good access and care must be taken not to place torsional forces on the root, which could otherwise fracture.

REMOVING PASTES AND CEMENTS FROM THE PULP CHAMBER

Paste and cement root-filling materials include calcium hydroxide-based pastes and zinc oxide-eugenol cements. During the removal of pastes, extrusion of material into the periapical tissues, or damage to the root canal walls, must be prevented.

Figure 5. *An endosonic insert will remove paste root-filling material. The ultrasonic delivery of irrigant is very efficient and can be used to clean the prepared canals.*

Figure 6. *Ultrasonic tips such as the CT1 used in a piezoelectric handpiece are very versatile in retreatment cases.*

Non-setting materials can be effectively removed from the pulp chamber using an ultrasonic scaler tip or an excavator. The irrigant around the tip of an ultrasonic scaler produces acoustic microstreaming and cavitation which will rapidly dislodge paste material and wash it away.

Removing Pastes from the Root Canals

If the root canal had been underprepared, the coronal flaring stage of retreatment will remove significant amounts of filling material early in the preparation sequence. Coronal flaring is normally carried out at the start of modern preparation techniques, with a combination of files and Gates-Glidden burs, or nickel-titanium rotary instruments.

Paste materials in the apical parts of the canal system can be removed using endosonics. Acoustic microstreaming in a

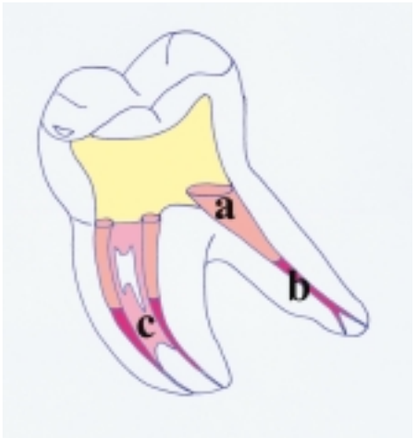

***Figure 7**. Gutta-percha removal. Filling material in the coronal aspect (a) can be removed with Gates-Glidden burs. Files are used to remove the remaining material from the root canals (b), whilst solvents are required in the inaccessible areas such as fins and lateral canals (c).*

high volume of irrigant will help remove paste from the canal (Figure 5).

Polymer-based Cements

Polymer-based cements are extremely difficult to remove from the root canal system even for the specialist who has particular ultrasonic tips.

Material can be removed in a controlled manner under good illumination and magnification using a piezoelectric ultrasonic handpiece with CT or CPR tips (Maillefer, Ballaigues, Switzerland). Ultrasonic vibration breaks up cements and should be used with irrigant.

Removing material from the root canal with a round bur has been superseded by ultrasonics to avoid the high risk of perforation (Figure 6).

Gutta-Percha Removal

The Single Cone

Single cone gutta-percha root fillings can usually be removed using Hedstroem files, Stieglitz forceps or endosonics.

The largest Hedstroem file that will fit alongside the cone is gently screwed into the space alongside the gutta-percha until resistance is met. At this point, the instrument is withdrawn from the canal, along with the gutta-percha cone. Endosonics may loosen cement around a single cone, aiding removal. Cones can be gripped with Stieglitz forceps for removal.

Condensed Gutta-percha

Condensed gutta-percha can be removed using Gates-Glidden burs (Figures 7 and 8), nickel-titanium rotary instruments, Hedstroem files, solvents and heat.

Gates-Glidden burs are extremely efficient for removing gutta-percha from the coronal part of the root canal and can be used to remove as much gutta-percha as possible before using a solvent. These burs are rotated in a slow handpiece generating frictional heat that will aid gutta-percha removal. Rotary nickel-titanium instruments can also be used to remove gutta-percha; orifice openers (Maillefer, Ballaigues, Switzerland) are particularly effective and should be rotated at 600 rpm. A Hedstroem file is then used to remove any free cones and further fragments of gutta-percha. Finally, a few drops of solvent, such as chloroform, are placed in the canal. Files are rotated into the mass of gutta-percha and withdrawn; after wiping clean on a gauze square, the process is repeated. Finally, a few more drops of chloroform are placed in the root canal and paper points are used to wick any remaining dissolved gutta-percha. When the paper points are clean on removal, the root canal system should be completely devoid of gutta-percha filling material. Using chloroform too early in treatment leaves a messy layer of dissolved gutta-percha coating the root canals and pulp floor, which can then be more difficult to remove. If most of the gutta-percha has been removed mechanically, then a minimal amount of chloroform is required to dissolve the remaining filling material completely.

Heat

Heat supplied by a *System B* tip (Analytic Endodontics, Redmond, WA, USA) or heated plugger can be used.

Solvents for Gutta-Percha

Solvents include chloroform, xylene, rectified turpentine, methyl chloroform and eucalyptus oil. Glass or polypropylene syringes should be used to dispense small amounts of these solvents, as they are not dissolved by them.

Thermafil

When removing *Thermafil* (Dentsply, Weybridge, Surrey) from root canals, it is easier to remove the carrier first and then remove the gutta-percha. The carriers have a V-shaped notch along one side, into which a Hedstroem file can be inserted. When the file is withdrawn, the carrier is usually removed. The remaining gutta-percha can be removed as previously described. Some plastic carriers are also soluble in some of the solvents used to remove gutta-percha, e.g. chloroform (Figure 9).

SILVER POINTS AND FRACTURED INSTRUMENTS

The position of the silver point within the root canal will dictate the degree of difficulty in removal:

- Coronal: easy;
- Middle: intermediate;
- Apical: difficult.

Much of this treatment is best undertaken by the specialist practitioner who will be better equipped to manage the problem predictably and less likely to

***Figure 8.** A Gates-Glidden bur is about to be used to remove gutta-percha from the distal canal of this molar.*

***Figure 9.** A Thermafil carrier removed using a Hedstroem file.*

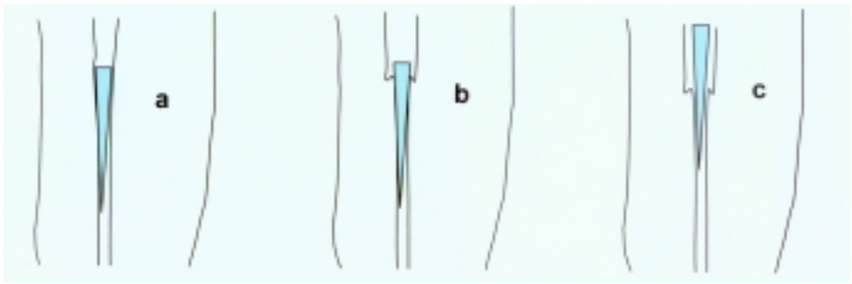

Figure 10. *Removing objects from the root canal (a) requires making sufficient space, either with a Masserann trephine or ultrasonic tip (b). Breaking up cement or compacted dentine with ultrasound (c) prior to removal.*

introduce complications (Figure 10).[3]

Cement can be removed carefully from around the coronal end of the point that projects into the pulp chamber using an ultrasonic CT4 or scaler tip. Great care must be taken not to sever the point. The point is then withdrawn using Stieglitz forceps.

If a point has fractured within the canal, or has been cut off at the level of the pulp chamber floor, then removal is much more difficult. Fractured instruments present a similar but possibly less difficult problem.

In the coronal part of the root canal, a trough can be created around the object using specialist ultrasonic tips (e.g. CT4 or UT) to remove dentine, and can be used dry or with irrigant. Gently working a Hedstroem file between the point and the canal wall may allow it to be removed. An endosonic file gently inserted alongside a point may loosen cement and dislodge the point.

This is still a demanding procedure for the specialist but the basic principle is:

- Create space;
- Use ultrasonic vibration;
- Removal.

Sufficient space in the coronal part of the canal should be created using orifice openers, ultrasonic, or Gates-Glidden burs to allow access to the fractured instrument. A Gates-Glidden bur can be modified so that is has a flat tip; this produces a neat table of dentine around the fractured instrument and allows better access for CT tips.

Under direct vision, using magnification and illumination, the piece of instrument is vibrated with ultrasound; CT tips are often too thick for use within the confines of the root canal; zirconium nitride tips are longer and thinner. Irrigant is used to wash away debris. Once the instrument is loose then it can be removed (Figure 11).

It is worth remembering that the pain experienced by a patient with a fractured instrument in his/her tooth is due to bacterial infection of the root canal space and not the offending instrument. If the object cannot be removed, then an attempt should be made to bypass it, allowing the penetration of irrigants beyond and around the fragment to disinfect the root canal. Gently working a small file alongside the fractured instrument using EDTA to soften the dentine may create enough space to bypass the fragment. If this is not possible, the root canal should be cleaned thoroughly and obturated to the level of the blockage.[4]

Removing silver points from the apical third is extremely difficult and is best undertaken by a specialist. Braiding is a technique that is effective in removing such pieces of fractured instrument. The first Hedstroem file is gently screwed into the canal alongside the object; the largest size possible should be used to help reduce the risk of file fracture. Two further Hedstroem files are then gently inserted. These files are then wound around each other and withdrawn together; the object gripped by the files should be removed. Alternatively, a cancellier may be used. A cancellier is effectively a hollow tube that can be inserted over a fractured instrument within the root canal. A small drop of cyanoacrylate adhesive is introduced to bond the two and then the instrument is withdrawn.

BYPASSING LEDGES

Ledges may have been created during root canal treatment, as a result of inadequate access or the incorrect use of root canal instruments. A small file (e.g. ISO size 06 or 08) with a tight curve in the tip will sometimes allow negotiation beyond a ledge when used with a watch-winding action; a lubricant may be helpful. Once the ledge has been bypassed, the file is worked in a filing action to attempt to smooth the ledge and allow the introduction of larger files.

PERFORATIONS

The successful repair of a perforation is dependent on two variables:

- Time of occurrence;
- Location.

Successful treatment of perforations depends on the ability to seal the area and prevent infection. The earlier a perforation can be repaired the better, and the possibility of infection must be minimized. Location is probably of greatest importance. Close proximity to the gingival sulcus can lead to contamination by bacteria from the oral cavity. Perforations located below crestal bone have a better prognosis, as do those away from canal orifices.

Perforations can be repaired non-surgically using modern endodontic

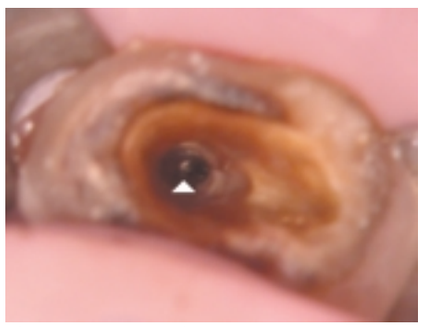

Figure 11*. The tip of a fractured instrument in the apical region of the canal prior to removal (arrowed).*

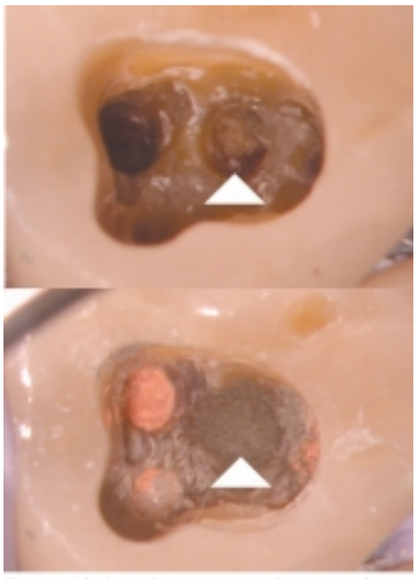

***Figure 12**. A perforation in the furcation of a mandibular molar repaired using MTA (arrowed).*

***Figure 13.** Adhesive amalgam cores can be used to restore teeth following root canal treatment prior to the placement of a cusp-coverage restoration. Packing amalgam into the coronal part of the canal increases retention.*

***Figure 14**. A cusp-coverage onlay used to restore a mandibular molar following root canal treatment.*

techniques. Direct vision is essential and treatment is facilitated by use of a microscope. The material of choice used to repair perforations is Mineral Trioxide Aggregate (MTA) (Figure 12). The perforation site must be thoroughly washed with sodium hypochlorite to eliminate bacteria before placement of the repair material. Sometimes a barrier is required to prevent excessive extrusion of the repair material. Calcium sulphate and collagen-based materials have been suggested. These are packed through the perforation into the osseous cavity using Machtou pluggers and the MTA packed against the matrix. It may not be possible to achieve a successful repair of a long-term perforation, particularly if there has been marginal periodontal breakdown.[5]

IDENTIFICATION OF UNINSTRUMENTED CANALS

Once the pulp floor and canal orifices have been cleared of extraneous material, uninstrumented canals can be located. Good access cavity preparation is important. The pulp floor should be read like a map. The dentine of the base of the chamber is generally darker than that of the walls and normally indicates the lateral extent of the pulp chamber. A sharp endodontic probe can be used under good illumination and magnification to explore the pulp floor for orifices. It may be necessary to remove overhanging ledges of dentine which can hide the canal orifice (e.g. second mesiobuccal canal of maxillary first molar). Sometimes the orifice may be on the lateral wall of a main canal (e.g. lingual canal of mandibular premolar). Running a fine file with a sharp bend in the tip along the canal wall will often engage the orifice.

PREPARATION OF ROOT CANALS

Following dismantling and removal of the existing root canal filling, the root canal system needs to be prepared properly and thoroughly disinfected as it should have been in the primary treatment. Sodium hypochlorite is the irrigant of choice; it must be given sufficient time to kill bacteria and requires replenishment. The most effective way is with endosonics. The bacterial flora of retreatment cases has been reported to be different from that in untreated teeth and therefore using medicaments, e.g. calcium hydroxide is essential, and alternatives, e.g. iodoform, may be indicated.

OBTURATION

This should be undertaken following thorough disinfection of the root canal system. The clinician can expect this state to exist after a medicament has had one week to be effective following thorough cleaning. Symptoms of inflammation should have resolved and there should not be exudates entering the canal system from the periradicular tissues. The canal system should be completely filled to eliminate space for bacteria to re-establish themselves and perpetuate apical periodontitis. It is important that this is followed by a good quality coronal restoration to prevent reinfection of the canal system (Figures 13 and 14).

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FURTHER READING

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