Endodontic retreatment
Achieving success the second time around

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Root-canal treatment has been shown to have a success rate of 85%. However, as research methodologies move towards higher levels of substantiation, clinicians must rely on the best current evidence available to gain insight into the expected outcomes of their treatment. The highest level and best current evidence we have on the clinical success of endodontic treatment comes from a meta-analysis of the literature.

A meta-analysis done in 2007 by Ng et al. provides a thorough review of endodontic success rates from a variety of classical outcome studies. They found a weighted pooled success rate of 88 to 85%, with at least one year of follow-up.1 This review considers the strictest of criteria for determining that a tooth has healed, and includes many studies that were completed prior to the clinical use of dental operating microscopes and other advanced armamentaria.

When considering treatment for a tooth that has not healed successfully with root-canal therapy, there are significant challenges to address to be able to attain complete healing of the diseased tooth. The armamentarium and techniques available today allow us the ability to disconnect the root-canal system properly after initial treatment has led to post-treatment disease.

The success rate of retreatment has been shown to be in the range of 85%: healing. Phases III and IV of the Toronto Study showed such a healing rate four to six years of the Toronto Study showed such a healing rate four to six years. Phases III and IV of the Toronto Study showed such a healing rate four to six years.4

Intra-radicular bacteria are the primary aetiology of post-treatment disease and eradication of these bacteria is the primary goal of retreatment procedures. The intra-radicular bacteria present in the previously treated tooth are persistent and resistant removal methods. Bacteria are able to hide and survive in canal ramifications, deltas, irregularities (funnels) and dentinal tubules.

Figure 2 shows the complex root-canal anatomy preparatively (green areas) and the minimal amount of canal-wall cleaning that was accomplished during canal instrumentation (red areas). The remaining green areas illustrate the space that might be left untreated, thereby providing a source for bacteria and supporting substrate for intra-canal infection. The potential substrates that are found inside the canal and help the bacteria survive can include untreated pulpal tissue, the presence of a biofilm and tissue fluid. This may be present in the canal owing to a poor coronal or radicular seal and microbial proliferation. The presence of a poor seal, bacteria and substrate for their growth results in ideal conditions for persistent inflammation and disease.5

The bacteria present in the initial infection of a root canal differ markedly from the bacteria infecting a previously treated tooth. Pre-treatment flora is polymicrobial with equal numbers of Gram-negative and -positive bacteria. Post-treatment bacteria are predominantly Gram-positive and they have been shown to be able to survive in harsh environments and to be resistant to many treatment methods.

There are high numbers of Enterococcus species. Enterococcus faecalis, for example, has been shown to be a common isolate in 27 to 77% of teeth with post-treatment disease.4 A contaminated canal space may result from incomplete cleansing initially or subsequent leakage into root-canal spaces following root-canal treatment. Once present inside the canals, E. faecalis has a variety of characteristics that allow it to evade our efforts to eradicate it from the root-canal system, including the ability to invade dentinal tubules and adhere to collagen.5 It is also resistant to calcium hydroxide application inside the canal system, which is an inter-appointment treatment technique used to help remove micro-organisms and their by-products, such as lipopolysaccharides, from the canal space.6,7 E. faecalis’s resistance of calcium hydroxide action arises from its ability to pump hydrogen ions from a proton pump. The hydrogen combines with the hydroxyl ions of calcium hydroxide and neutralises the high pH value.8 E. faecalis is also able to resist calcium hydroxide by being part of a biofilm. The protection of bacteria within a biofilm matrix prevents the contact of the bacteria with the calcium hydroxide and also forms an extracellular polymeric substance that resists host defenses.9

Tooth #3 with silver-point fillings in the mesial root and a large post in the distal root. A large radiolucent periapical lesion is evident on the working endodontic radiograph. Photograph displays excellent visibility and magnification of the pulp chamber with the use of an ultrasonic tip. (Courtesy of Dr Scott S. McDonald)

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The success rate of retreatment disease is, inevitably, a result of bacteria and the host response of the patient to the bacteria. These micro-organisms are the most critical aetiology of post-treatment disease, as they are present within the root-canal system of a previously endodontically treated tooth owing to a combination of substandard endodontic techniques, iatrogenic treatment issues and restorative failure.

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dam may be a fundamental con-
treatment. Failure to use a rubber
dam to isolate the treatment field is
tissue debris. The use of a rubber

canals, and our clinical techniques
must be focused on the challenge of
eliminating them.

Iatrogenic issues encountered during the initial root-canal treat-
ment may be the cause of intra-
canal bacterial infection. These issues may include perforation, incomplete-cleansing and shaping, inadequate canal enlargement,
and must commit to effective oral hygiene techniques. Failure of the patient to perform effective oral hygiene can result in the failure of even the most well executed root-canal and restorative treatments.

With the bacterial challenges clinicians have to face, retreat-
tment techniques must be capable of effective elimination of bacteria and their substrates. The use of a dental operating microscope and ultrasonic instruments allows clinicians to uncover all existing canal anatomy properly to ensure that they are able to cleanse the root-canal system completely.
The following clinical case (Figs. 6a–b) illustrates the extent of the canal space left untreated in the initial root-canal therapy by not opening the mesiobuccal canal adequately and not locating and cleaning the hidden second mesiobuccal canal.

Endodontic ultrasonic tips are highly efficient at removing core build-up material, paste fills, posts and silver point fillings, as demon-

strated in Figure 5. These instru-
ments allow clinicians to conserve root dentine by providing excellent visibility under a dental operating microscope, thereby greatly improving the ability to retreat canals (Figs. 6a–c). A heat source such as a System B tip (Axx, SybronEndo) is efficient for the removal of gutta-percha and resin materials from the coronal third. Hand and rotary files can remove root fillings and shape canals to appropriate work-

lengths. Current NiTi rotary files are highly flexible and re-
sistant to separation and allow us to mechanically enlarge the apical third of root canals safely and effi-
ciently without alteration of the natural canal morphology, which allows effective irrigation to reach the complex apical root-canal anatomy where bacteria are able to hide and resist debridement.

Once the canals have been lo-
cated and instrumented, the ability to irrigate becomes essential to successful treatment. The irrigant solutions target the bacteria we are trying to eliminate. While sodium hypochlorite is a potent and proven antimicrobial and tissue dissolver,22 2 % chlorhexidine has been shown to prevent the adhesion of E. faecalis to dentine.23 EDTA 17 % is often used as an effective smear layer removal agent.24 Therefore, me-

chanical debridement and canal instrumentation provide a pathway for copious chemical irrigation deep into the canal.

Passive ultrasonic irrigation al-

lows clinicians to place an irrigant
solution into the pulp chamber and activate it as it is carried down to the apical end of the root canal. The IrrSafe tip from Satelec (Acteon,

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