

Endodontic Treatment Failure & its Management: A Review

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Abstract: The main goal of endodontic treatment is the correct diagnosis, optimal mechanical and chemical preparation and three-dimensional obturation of the root canal. The causes of the endodontic failures can be variations in the anatomy of the teeth, the presence of additional root canals, lateral canals, depend on technical, biological and iatrogenic factors which contribute to accomplishment of treatment. During nonsurgical endodontic retreatment, endodontic instruments are forced apically to remove the root canal filling material and regain canal patency. Undiscriminating burrowing down the canal in the apical direction may be fruitless and harmful. To avoid complications, the dentin overhanging the canal orifice must be removed and an unobstructed access established to the root filling material, so as to facilitate its removal. Re-instrumentation of the filled canal must take into consideration the nature of the filling material and the physical properties of endodontic instruments, as well as the dynamic aspects of canal preparation. This article discusses the mechanical considerations pertaining to root canal retreatment and outlines a step by step rationale approach to retreatment. [Solanki V Natl J Integr Res Med, 2019; 10(3):68-74]

Key Words: Root canal treatment, Endodontic Failures, Root Canal Retreatment

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Introduction: There has been a massive growth in endodontic treatment in recent years. This upward surge of clinical activity can be attributable to better trained dentists and specialists alike. With all the potential for endodontic success, the fact remains that clinicians are confronted with post treatment endodontic disease.¹

Increasingly, patients are becoming reluctant to lose teeth, which has led to the practitioner being faced with requests for retreatment of failing root canal treatment. As the life span of the population increases, the need to maintain a patients dentition for a longer period of time has led to a barrage of advanced procedures that were non-existent years ago.²⁻³ Before commencing with any treatment, it is profoundly important to consider all interdisciplinary treatment options in terms of time, cost, prognosis, and potential for patient satisfaction.²⁻³ Endodontic failures must be evaluated so a decision can be made between non-surgical retreatment, or extraction.⁴ The primary difference between non-surgical management of primary endodontic disease versus post treatment disease is the need to regain access to the apical area of the root canal space in the previously treated tooth.³

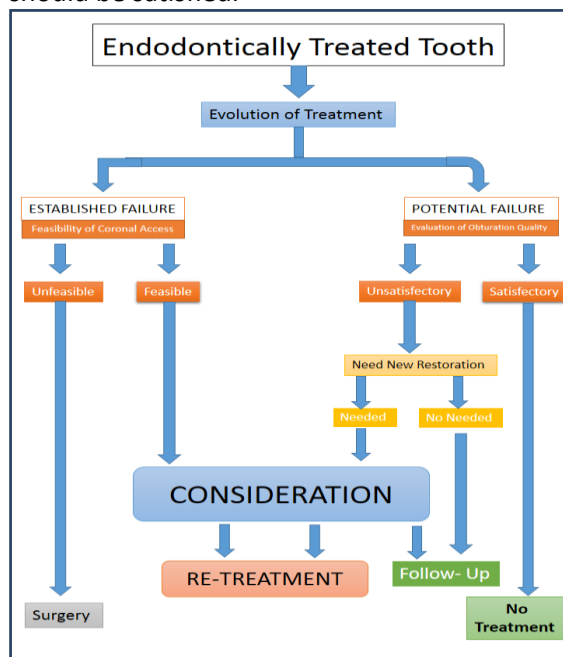
Retreatment is usually initiated if the original treatment appears inadequate. The aim of root canal retreatment is to eliminate microorganisms that have either survived previous treatment or

have re- entered the root canal system. Nonsurgical endodontic retreatment procedures have enormous potential for success if the guidelines for case selection are respected and the most relevant technologies, best materials and precise techniques are utilized.⁴ Success rate of endodontic retreatment ranges between 40-100 %.⁵

Factors Influencing Success & Failure :Historically the concept of success or failure of root canal therapy has centred on 'sterilization' of the root canal system, coupled with need to achieve a hermetic apical seal. A more thorough understanding of pulpal and per radicular disease processes indicates that the key to success in endodontic therapy is the debridement and neutralization of any tissue, bacteria or inflammatory products within the root canal system. To achieve success there must be a concomitant focus on the need for proper diagnosis, thorough knowledge of dental anatomy that can be integrated into a repair – predictive retreatment – oriented approach to case management.³ Each case should be individually assessed on regard to the percentage probability of success.

Success – defined by the following criteria: Patient should be asymptomatic and be able to function equally well on both sides. The periodontium should be healthy, including a normal attachment apparatus. Radiographs should demonstrate healing or progressive bone

fill overtime. Principles of restorative excellence should be satisfied.¹⁸



(Figure-1: Evolution of Treatment)

The clinician should be able to differentiate between success and failure and evaluate it. Factors that affect root canal failures can be attained from previous radiographs. Films that were taken preoperatively and postoperatively can demonstrate presence, absence, or healing of periapical pathosis. The history of the previous endodontic treatment can allow the clinician to discern what treatment was rendered and why.¹⁶ Failure to achieve the desired aims of therapy may lead to root canal therapy failure. As with all dental treatment multiple integrated factors influence the outcome of endodontic therapy.¹⁷ Factors influencing success and failure Strindberg related treatment outcomes to biologic and therapeutic factors.

Some of the factors that influence outcome include:

Presence of apical pathosis , Extension of the obturation (short or long) , Tooth type, age, sex Quality and technique of obturation Observation period Type of intracanal medication and bacterial status of the canal before obturation

Some consistent factors are: Extension of a filling (over filling or material under filling) Poor obturation quality Longer observation period do indeed negatively influence treatment results. Presence of periapical pathosis prior to treatment Medical status of the patient.

Many failures are attributed to: Abundance of misinformation and misconceptions about endodontics. (additional failures) Clinicians tend to resist change they hesitate to embrace relevant, new and emerging technologies, instruments and materials.¹⁸

ETIOLOGY

Reasons for failure of root canal therapy

Intraradicular Causes include: Necrotic material remaining in the root canal, either through failure to identify all canals or treating canals short. Contamination of an initially sterile root canal during treatment Persistent infection of a root canal after treatment Bacteria left in accessory or lateral canals Loss of coronal seal and reinfection of a disinfected and sealed canal system¹⁹

Extraradicular Causes Include: Persistent periradicular infection, Radicular cysts, and Vertical root fractures

Iatrogenic Causes Include : Post perforation , Bacterial infection is the major cause of persistent periapical inflammation following root canal treatment. However, there are technical failings that may predispose the root canal system to inadequate disinfection:

Poor aseptic technique incorrect irrigant inability to prepare the canal to length missed canals procedural errors poor obturation poor restoration and coronal micro leakage Resistant bacteria²⁰⁻²¹

The benefits of using a rubber dam for root canal treatment include:

- prevention of microbial contamination
- the safe use of sodium hypochlorite
- airway protection
- retraction of the soft tissues
- unimpeded vision, which is useful with
- magnification
- quicker and more pleasant treatment
- reduction of microbial aerosol
- allows the operative field to be dried.¹⁵

Diagnosis: There may be different ways of treating a disease however there can be one correct diagnosis. The accurate diagnosis is probably the most important portion of any endodontic procedure. Endodontic treatment

failures are assessed by clinical, radiographic and histologic studies.

Clinical examination: Signs and symptoms are commonly assessed – the presence of either if marked and persistent is an indication of failure.

Clinical criteria for success outlined as follows (Bender and associates)

- Absence of pain and swelling
- Disappearance of sinus tract
- No loss of function
- No evidence of soft tissue destruction, including probing defects.
- Persistent findings like (swelling or sinus tract) indicates failures.²⁹

Radiographic Findings: The importance of radiographic evaluation in determining endodontic success or failure cannot be overemphasized. It is a universal tool in the assessment of treatment results without which no claim of success could be justified. Since the radiographic evaluation plays a basic role in the assessment of treatment results, any fallibility associated with the interpretation of radiograph directly distorts the reported rates of success and failure.

Histologic Examination: Routine histologic evaluation of periradicular tissues after root canal treatment is impractical and not possible without surgery. If treated tooth were to be evaluated histologically, successful treatment would be indicated by reconstitution of periradicular structures and an absence of inflammation.²³⁻²⁴

TREATMENT PLANNING & OUTCOME

If root canal treatment has failed, there are usually five possible treatment options:

- review or do nothing
- root canal retreatment
- root end surgery
- extraction
- referral

Criteria for case selection

The purpose of case selection is to determine the feasibility and practicality of treatment, so as to

avoid treating cases that will fail regardless of the quality of treatment.

Diagnosis: The presence or absence of periradicular disease is determined according to clinical and radiographic findings. Differential diagnosis of non-endodontic disease is also considered.

Selection of Treatment: Currently, the patient ultimately selects the treatment, based on information communicated by the clinician.¹⁰

Treatment of Existing Disease: Post-treatment disease definitely requires intervention, even when symptoms are absent. When treatment is preferred over extraction, re-treatment and apical surgery should be considered for both. Comparing the two modalities, retreatment offers a greater benefit and better ability to eliminate the disease's etiology (root canal infection) with minimal invasion and a smaller risk such as significantly less postoperative discomfort and a lesser chance of injuring nerves, sinuses or other structures. Therefore, case selection is based on patient, tooth and clinician considerations that either preclude retreatment or restrict its feasibility in a way that decreases the potential benefits and increases the potential risks; the modified benefit-risk balance may not outweigh that of apical surgery.

Endodontic Mishaps & Outcome

1. Incorrect Diagnosis: Incorrect oral examination leading to incorrect diagnosis is usually due to an interpretation of pain, vitality test and radiographs. Recognition-The wrong tooth has been treated is sometimes a result of re-evaluation of a patient who continues to have symptoms after treatment.

2. Missed Canal: Some canals are not easily accessible or readily apparent from the chamber.⁶ Recognition- Missed canal occurs during or after treatment. During treatment, an instrument or filling material may be noticed to be other than exactly centered in the root, indicating that another canal is present.¹¹

3. Access cavity perforations: One of the irreversible complications of endodontics is perforation into the furcation area while gaining access to pulp chamber of tooth. Recognition- If the access cavity perforation is above the periodontal attachment, the first sign of the presence of an accidental perforation will often be the presence of leakage: either saliva into the

cavity or sodium hypochlorite out into the mouth, at which time the patient will notice the unpleasant taste.

4. Apical perforations: Perforations in the apical segment of the root canal may be the result of file negotiating a curved canal or not establishing accurate working length and instrumenting beyond the apical confines. A paper point when inserted to the apex, will confirm a suspected apical perforation. Recognition- An apical perforation should be suspected if the patient suddenly complains of pain during treatment, if the tactile resistance of the confines of the canal space is lost. A paper point inserted to the apex will confirm a suspected apical perforation.¹³

5. Crown Fractures: The tooth may have a preexistent infarction that becomes a true fracture when the patient chews on the tooth weakened additionally by an access preparation. Such fracture is usually recognized by direct observation.¹⁷

6. Separated Instruments: Limited flexibility and strength of intracanal instruments combined with improper use may result in an intracanal instrument separation.

Recognition- Removal of small size file with a blunt tip from a canal and subsequent loss of patency to the original length are the main clues for the presence of a separated instrument.¹⁷

7. Canal Blockage: Canal blockage can occur during the process of canal enlargement. Files are known to compact debris at the apex; even vital tissue can be compacted against the apical restriction. Suddenly, working length is shorter because the instruments are working against the packed mass at the apex.²⁷ Recognition-When the confirmed working length is no longer attained canal blockage is recognized. Evaluation radiographically will demonstrate the file is not reaching near the apical terminus. Canal blockage corrections are accomplished by means of recapitulation. Starting with the smallest file used, the quarter turn technique using a chelating agent can be helpful.

8. over or under extended Root Canal Fillings: Root canal filling material is sometimes inadvertently extruded beyond the apical limit of the root canal, ending up in the periradicular bone, sinus or mandibular canal or even protruding through the cortical plate.

Inaccurately placed root canal filling usually takes place when a post-treatment radiograph is examined. Under extended filling is accomplished by re-treatment.⁶⁻¹³

9. Vertical Root Fracture : A sudden crunching sound during obturation is a clear indication for the root fracture. This may occur during compaction of gutta-percha. It occur more often during lateral than vertical compaction. Recognition- Sudden crunching sound, similar to that referred to as crepitus in the diseased temporo-mandibular joint, accompanied with pain reaction on the part of the patient, is a clear indicator that the root has fractured. It can be prevented by avoiding over preparation of the canal and the use of a passive, less forceful obturation technique and seating of posts.²⁻⁴

10. Tissue Emphysema: It is relatively uncommon but should not be overlooked. Two actions may cause tissue emphysema to happen: a blast of air to dry a canal, and exhaust air from high-speed drill directed toward the tissue and not evacuated to the rear of the handpiece during apical surgery. The usual sequence of events is rapid swelling, erythema and crepitus.³⁰

RETREATMENT OPTIONS

I. Retreatment of Pastes and Cements

A) Soft-setting pastes- Normally soft-setting pastes do not interfere with the negotiation of the root canal. Therefore, their removal does not require specific techniques. In such cases, instrumentation of the root canal with the use copious irrigation suffices to remove the paste.

B) Hard-setting cements- If possible, hard-setting cements should be dissolved. When this is not possible, their removal may be attempted by either of the following two techniques:

- i. Dispersion by Ultrasonic Vibration- Endosonic files are placed in the orifice of the obturated canal and activated with light apical pressure. The ultrasonic vibration pulverizes the cement, while the continuous irrigation flushes out the dispersed particles. This procedure is gradually continued apically, until the entire obturation is removed.¹⁴
- ii. Drilling with Rotary Instruments- Hard cements may be drilled out by rotary endodontic instruments, such as Beutel-rock or engine reamers or by using bur.

II) Retreatment of gutta-percha**A) Techniques for Dissolving Gutta-Percha**

- i. Solvents of gutta-percha- Gutta-percha is soluble in chloroform, methylchloroform, carbon disulfide, carbon tetrachloride, benzene, xylene, eucalyptol oil, halothane and rectified white turpentine.
- ii. Hand Instrumentation- This is the most commonly practiced technique, although it is time-consuming and occasionally yields limited results. By the use of solvent, the canal is negotiated with files or reamers to the desired working length estimated from the preoperative radiograph.
- iii. Automated Instrumentation- This technique is fast and safe and short-filled curved canals may be negotiated beyond the obturation. Thus, a radiograph may be obtained at an early stage, without the need to first instrument the canal extensively to remove the bulk of the material from it. The Canal Finder system also has a built in apex locator that may be used as an aid in preventing overinstrumentation with this technique.¹²
- iv. Ultrasonic Instrumentation- Ultrasonic instrumentation following softening with chloroform does not facilitate the removal of gutta-percha from the root canal, even when continuous irrigation with a solvent is used.²²

B) Solid Gutta-Percha Techniques

- iii. **Pulling out gutta-percha-** Reamers or K-files are used to bypass the obturation, and Hedstrom files are engaged into the loosely condensed gutta-percha cones, which are then retrieved in one piece by pulling back the instrument.
- iv. **Rotary removal of gutta-percha-**Removal of gutta-percha with rotary instruments is safe only in straight canals.¹⁴⁻¹⁵

1. Retreatment of Solid Objects

A) Bypassing with hand instruments- Reamers and files may be used to bypass an obstructing object in the root canal, and solvents can be used to soften its cementation.²⁹

B) Bypassing with automated and ultrasonic instruments- Silver cones that cannot be bypassed with hand files may be bypassed and subsequently retrieved by the Canal Finder.¹²

C) Special grasping devices-

- i **Masserann and alternative extractors-** The Masserann kit consists of an extractor into which the object to be retrieved is locked.⁴

- ii **Wire loop technique-** A thin steel wire is inserted into a 25-gauge hypodermic needle. On the sharp side of the needle a loop is formed and on its other side, the free ends of the wires arc pulled to tighten the loop. The needle is placed in the canal so that the loop contacts the broken instrument, and then the loop is tightened and the instrument may be retrieved by pulling the needle back.³¹

Conclusion: We have seen a variety of techniques with post treatment endodontic disease. However not all failures are amenable to successful non-surgical retreatment. Clinicians need to weigh risk versus benefit and recognize that, at times, a referral, surgery or extraction might be in the patients best interest.

As the health of the attachment apparatus around endodontically treated teeth becomes appreciated, the naturally retained tooth will be recognized as the *ultimate dental implant*. Post treatment follow up is as essential as retreatment planning. If any delays in the restorative process are anticipated, a more definitive temporary restoration such as reinforced zinc oxide eugenol or light cured intermediate composite should be placed. Treatment must never be considered complete until the tooth is restored to function.

All filling techniques attempt to prevent recurrent leakage. No ionic or covalent bonds come into play, only physical interfaces among dentin, sealer and gutta-percha.

All obturation techniques leak. As long as the clinicians continue to fill canals keeping non surgical retreatment in mind, they will never improve on obturation techniques.

The saying "It's what you take out, not what you put in" is as true as it was 100 years ago. So newer and best techniques of obturation and correct methods of root canal treatment. Should be advocated to get the best outcome such that non-surgical retreatment is not required in the future. Thus properly performed, endodontic treatment is a cornerstone of restorative and Reconstructive dentistry.

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