CHANGING CONCEPTS IN ENDODONTIC RETREATMENT

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THE ROLE OF ENDODONTIC RETREATMENT

A few years ago many dentists considered root-canal therapy to be a controversial and questionable treatment with unpredictable results. Root-canal therapy was mostly performed on carefully selected single-rooted teeth. Infected or diseased posterior teeth were routinely extracted and replaced with removable or fixed prostheses. Endodontic failures were routinely treated by extraction or apical surgery.

Today, root-canal therapy is considered a routine part of dental care. It is universally accepted among dentists as a predictable treatment with sound biologic principles and consistently successful results. Endodontic therapy has improved the dental and general health of the public and has significantly contributed to the advancement of many other dental specialties, such as restorative dentistry and prosthodontics.

Endodontic therapy can be successfully performed on any tooth regardless of the patient's age, sex, or systemic condition. Today, endodontic failures are retreated with great success and, when maintained, serve as important and strategic abutments in restorative plans.

Endodontic retreatment is becoming an important aspect of modern endodontic practice. Because of the findings of current endodontic research and increased clinical knowledge, endodontic retreatment is undergoing significant developments that will entail changes in the objectives and methods of evaluation and treatment of endodontic failures.

Instead of extraction or apical surgery, canal retreatment is becoming the standard of care in the management of endodontic failures or of substandard endodontics.

Regardless of the dentist's technical skill or knowledge in procedural endodontics, he or she should be most knowledgeable and skillful in the diagnosis or evaluation of endodontic success and failure. Such knowledge is essential because of the close relationship between endodontic and restorative treatment. Unfortunately, it is common to find patients whose excellent restorative dentistry is built on teeth with mediocre or substandard endodontic treatment. This contradictory standard of dental care suggests a deficiency or a definite failure in endodontic education in this area.

Before initiating new restorative dentistry, the dentist should evaluate the quality of the patient's existing endodontic condition. This evaluation should be performed regardless of the patient's symptoms.

The retreatment of poor quality endodontics prior to restorative procedures can often prevent restorative treatment failure, complications, or possible legal repercussions.

The dentist's knowledge of endodontic success and failure criteria can also prevent misdiagnosis and the embarrassment of misreferral.

If an endodontic failure is misdiagnosed and treated as a periodontal problem, the failure will worsen and a rapid tissue breakdown will follow. Similarly, treating endodontic failures by surgical apicoectomy or retrofill instead of canal retreatment is ineffective and may lead to further complications.

THE CHANGING ROLE OF APICAL SURGERY

Traditionally, endodontic failures are treated by apicoectomy or retrofilling procedures. The rationale for using this ineffective and often detrimental treatment is to protect or save costly restoration!

A good example of this approach was unfortunately published in the *Journal of Endodontics* (1986) by Friedman and Stabholz:

1. Surgical endodontics is dictated if the restoration removal may endanger the tooth or if the restoration is costly.
2. It is generally possible to evaluate the obturation only by radiograph.
3. Successful endodontics with unsatisfactory obturation does not have to be retreated if a new restoration is not needed."

Indications for Apical Surgery

Clinical evidence shows that apicoectomy and retrofilling procedures are indicated when treating endodontic failures on teeth with apparently good quality gutta-percha fillings associated with some procedural errors, such as gross overfills, underfills, apical perforations, apical ledges, and inaccessible curvatures, or untreated anomalies. (See Table I)

Apical surgery is most effective in treating endodontic failures of the apical third that are easy to visualize and correct.

Limitations of Apical Surgery

1. Apical surgery procedures are of little value in eliminating the causes of failure on teeth with poor or substandard quality, such as resorbable paste fillers, corroded silver points, poor gutta-percha fillings, or untreated canals. Performing an apicoectomy procedure on a tooth with an under-condensed root filling often uncovers additional canals or transfers the apical foramen coronally, creating a larger, unsealed apical foramen and causing increased tissue fluid leakage, recurrent failure, infection spread and a larger apical lesion.

2. The ability to detect and visualize the cause of the failure depends on the flap design and the extent of the surgical access. Scalloped flap often prevents the clinician from seeing the buccal cervical root level; he will therefore miss any periodontal or root defects at the site.

3. Apical surgery on molar teeth with full-coverage restorations does not allow the clinician to see the pulp chamber floor. Thus, pulp chamber

perforations, cracks, or untreated canals remain undetected. Performing an apicoectomy and retrofilling on a root end is most ineffective if the cause of failure is a perforation or a crack along the root surface, furcation zone, or untreated canal hidden lingually to the buccal root.

4. Finally, the most serious disadvantage of apical surgery is perhaps the clinician's inability to debride the bacteria, toxins, and other materials causing the failure.

Most endodontic failures are caused by problems within the canal itself which can be corrected only by effective canal re-preparation and refilling, which apical surgery cannot accomplish.

ENDODONTIC RETREATMENT GUIDELINES

In endodontic therapy, there is a need for a systematic, valid, and accurate evaluation procedure to determine the quality of the endodontic treatment, other than the radiograph. A better evaluation is needed for the following reasons:

1. The multiplicity of endodontic materials and methods.
2. The limitations of periapical radiographic evaluation.
3. The lack of relationship between the patient's symptoms and the extent of the patient's pathologic involvement.
4. The slow progress of endodontic and apical disease.

The following principles are applied in evaluating and treating any old or existing endodontic therapy prior to any restorative, periodontal, or orthodontic treatment and, most importantly, prior to any surgical retreatment.

1. Defective restoration removal is a prerequisite of accurate endodontic evaluation.

2. The quality of the endodontic post retention is determined only by direct clinical examination. Defective or substandard posts are removed as a part of the diagnostic procedure.

3. The periapical radiograph can be used to identify radiographic technical success or failure.

4. The technical quality of canal obturation, the type of filling materials, or evidence of procedural errors are determined only by clinically exploring the root canal filling.

5. Substandard endodontic treatments are removed as part of the diagnostic process and always retreated first. This principle applies even when surgical intervention is indicated or planned.

6. Gutta-percha endodontics that shows apparent technical success, yet is clinically failing, is evaluated for quality and is accepted, modified, or retreated before considering any surgical endodontics.

7. Endodontic periapical radiolucencies are considered pathological lesions unless previous radiographs indicate significant regression of the size of a previous lesion.

8. Apical scars are histologic entities and cannot be diagnosed radiographically.

9. Apical scars are rare; five percent of all periapical radiolucencies are found mostly on anterior teeth with evidence of successful endodontic therapy. Apical scars do not develop in the presence of substandard endodontics. In such situations, apical scars should be considered chronic asymptomatic lesions.

10. The absence of a periapical radiolucent area with substandard endodontics should not be considered evidence of success. Cancellous jaw-bone lesions are not always radiographically visible. Many lesions (small and large) are missed because of being hidden or masked by a thick cortical plate, tori, maxillary sinus, maxillary tuberosity, mylohyoid ridge, or the interradicular bone of multi-rooted teeth.

Table I: Nonsurgical and Surgical Retreatment Indications

Nonsurgical	Surgical
1. Substandard Endodontics	1. Acceptable quality gutta-percha fillings in conjunction with:
2. Paste fillings	a. Gross overfills failure
3. Silver point failures	b. Apical perforations
4. Untreated canals	c. Incomplete apical fillings due to curvature
5. Gross underfills	d. Amputation of fractured roots
6. Procedural errors	e. Hemi-section of one damaged root
a. Broken instruments	
b. Ledges	
c. Perforations	
7. Iatrogenic Posts	
a. Short Posts	
b. Screw Post	
c. Post Perforations	

11. The progress of periapical lesions on teeth with relatively recent (6 to 12 months) good quality endodontics is monitored.

12. Painless swelling on teeth with substandard endodontics or with apparent technical failure should not be considered evidence of success.

CLASSIFICATION OF ENDODONTIC FAILURES

An analysis of endodontic retreatment cases reveals that the most common causes of failure in teeth with poor quality or substandard endodontic therapy are within the canal itself. These problems are associated with the endodontic material, endodontic method, or both. On teeth with good quality endodontics, failure either has a non-endodontic origin (such as periodontal disease) or is caused by subsequent procedures that compromised the endodontic therapy, such as post-perforation.

Endodontic failures, therefore, are classified as Primary endodontic failures and Secondary endodontic failures.

Primary Endodontic Failures

Definition: Failures caused by factors directly related to the quality of endodontic material, endodontic method or both.

Material Failures:
1. Breakdown and resorption of zinc oxide or formaldehyde pastes
2. Leakage, root resorption, and failure caused by corroded silver points
3. Leakage caused by chloropercha shrinkage
4. Lesions caused by complications and toxicity of formaldehyde paste overfills

Methods Failures:
1. Single-point fillings in tapered large canals
2. Under-condensed fillings
3. Procedural errors, such as perforations, untreated canals, gross overfills, gross underfills, incomplete debridement, and untreatable broken instruments

Surgical-Method Failures:
1. Apicoectomy on under-condensed root-canal fillings
2. Apicoectomy on paste fillings

3. Apicoectomy on loose or corroded silver points
4. Improper defective retrofills
5. Iatrogenic surgical errors

Secondary Endodontic Failures

Definition: The failure of good-quality endodontic treatment in a tooth concurrently involved with dental disease, trauma, or iatrogenic procedures that directly cause treatment failure.

Concurrent Dental Diseases: Advanced periodontal disease; occlusal trauma; bruxism; untreatable dental anomaly, such as lingual groove; and tooth-structure cracks or fractures.

Failures Involving Concurrent Iatrogenic Procedures: Restorative failures; posting errors, such as post perforation, post dislodgement, tooth fracture by faulty posting, and an overextended post that is compromising the root filling.

DIAGNOSIS OF ENDODONTIC SUCCESS AND FAILURE

Endodontic treatment can be evaluated according to one or more of the following criteria.

Histologic Criteria

Microscopic evaluation of a specimen of the periapical tissue to confirm lack of pathologic change or the return of the periapical tissue to normal function and structure. Although such histologic guidelines are most valid, their limitations in clinical patient care are obvious. Histologic criteria, therefore, are used mainly in experimental endodontic research.

Radiographic Criteria

Although the periapical radiograph has played a significant role in the development and progress of the endodontic specialty, its scientific and clinical value has been exaggerated and often misused. Many clinicians use the radiograph solely in their diagnosis and treatment decisions. Seventy-six percent of the endodontists surveyed by Riley (1974) regarded the radiograph as "singularly most important in the evaluation of endodontic success"; 6.3% favored clinical examination; and 17% used the patient's subjective symptoms! Many clinicians also use the radiograph to determine the need for endodontic retreatment, routinely sending a radiograph of an endodontic treatment to an endodontist to inquire about the need for endodontic retreatment!

The greatest value of the periapical radiograph has been its use in endodontic treatment, such as root measurement, canal preparation, and filling procedure. The periapical radiograph as a diagnostic tool is useful in the diagnosis and detection of the following conditions:
- Large lesion formations
- Lesion regression or resolution
- Detection of root resorption defects
- Detection of significant alterations in root anatomy, such as obvious fractures, perforations, calcifications, or other anomalies
- General evaluation of existing endodontic therapy, especially poor quality or substandard endodontic treatment.

The limitations of the periapical radiograph in the evaluation of the success or failure of endodontic therapy can be summarized as follows:

1. Cancellous bone lesions cannot be seen on the radiograph (Pauls, Trott, 1966).

2. Cortical plate perforations or lesions do not alter the radiographic appearance of the bone trabecula, the periodontal ligament space, or the lamina dura (Ramadan and Mitchell, 1962) and therefore do not show on the radiograph.

3. It is impossible to detect the presence and extent of periapical lesions if the buccal or lingual plate is intact or has not been perforated by the pathological process (Bender, Seltzer, 1961).

4. There is no correlation between radiographic appearance of the lesion and the actual tissue destruction or the histological constitution of the lesion.

5. The ability of dentists to agree on radiographic interpretations varies greatly. Among dentists evaluating the same radiograph on two different occasions, there was less than 50% inter-dentist agreement and about 80% intra-dentist agreement.

6. The periapical radiograph is of little value in determining the actual quality of canal obturation.

Clinical Criteria

Most clinicians determining treatment results agree on the value of a patient's responses to clinical repair . The clinical criteria are most observable immediately or within months following treatment. The reliability of the clinical criteria is obvious and can easily be determined by careful testing and examination of the tooth and supporting tissue.

It is important to interpret these criteria in relationship to time. Most of these clinical criteria can be achieved within 1 to 12 months after therapy, sometimes even longer. The clinical success criteria are:

- Absence of spontaneous or provoked pain
- Absence of swelling
- Absence of drainage
- Fistulae tract closure
- Furcation lesion repair
- Isolated, narrow periodontal pocket repair
- Normal function
- Normal physiologic mobility
- Absence of tissue inflammation
- Absence of tissue discoloration

RETREATMENT CONSIDERATIONS

Prior to the initiation or selection of any treatment option, the clinician should analyze the endodontic failure to determine the most effective and appropriate method of treatment. This analysis should focus on the four clinical guidelines (the 4 R's):

1. **R**eport of history
2. **R**adiographic evaluation of current and previous radiographs
3. **R**esponse testing, such as probing, percussion, canal exploration, and so on.
4. **R**estorative index or plan, such as present restorations, proposed restorations.

The ideal or desirable criteria for acceptable or unacceptable endodontic results is listed in Table II. Using this clinical, comprehensive and integrated evaluation, the clinician should focus his analysis on the following retreatment considerations:

1. Patient management
2. Present symptoms and exploratory diagnosis
3. Quality of existing restorations
4. Quality of existing endodontics
5. Canal retreatment feasibility

1. Patient Management

Endodontic retreatment presents a special challenge to the clinician. First, retreatment patients are usually in pain, are anxious, and are often distressed about their dental experience. Some hostility is usually directed at the current attending dentist. Also, the technical aspects of endodontic retreatment can be difficult, tedious, and time consuming. Endodontic retreatment results are difficult to predict and may require further treatment, surgical intervention, or tooth extraction. Therefore, in the initial visit the clinician should have the following objectives:

a. To obtain current radiographs and conduct initial clinical examination of the condition.
b. To obtain a proper dental and medical history, especially if surgical endodontics is needed.
c. To provide emergency care in symptomatic situations, mainly incision and drainage, and prescribe supporting drug therapy as needed.
d. To establish a proper rapport with the patient by relieving his anxiety and demonstrating that the clinician cares about the patient's condition.

Table II: Suggested Guidelines for Evaluation of Endodontic Therapy
(1-24 months)

Clinical Guidelines	Endodontic Success	Endodontic Failure
Report	Normal Function Absence of pain Absence of swelling Absence of drainage	Spontaneous, recurrent pain and swelling, and drainage, inability to use the tooth in mastication.
Radiograph	A. Canals Canals filled to 0.5-1 mm from apex Well-condensed canals Uniform density No technical errors Perforations Broken instruments Gross overfills>2 mm Gross underfills>2 mm No untreated canals Basic root anatomy is maintained	A. Canals Incomplete fillings > 2 mm underfills > 2 mm overfills Voids alongside the root filling Evidence of perforation with lesion or root filling materials present. Untreated canals Broken instruments preventing adequate fillings. Broken instruments in apex-periapical zone. Post perforations
	B. Supporting Tissue No filling material in supporting tissue No lesions alongside the roots Uniform, intact periodontal ligament space Continuous lamina dura No apical root resorption Arrest of pre-existing root resorption No new radiolucent lesions Resolution of pre-existing radiolucent lesions No new radioopaque lesions Disappearance of previous overfills Continuation of apical root formation and closure.	B. Supporting Tissue New lesion formation Increased in pre-existing lesion size New lesion alongside the root Apical root resorption Symptomatic radioopaque lesions

(Table II continues on next page.)

Table II (cont'd): Suggested Guidelines for Evaluation of Endodontic Therapy
(1-24 months)

Clinical Guidelines	Endodontic Success	Endodontic Failure
Response	A. Tissue Percussion - normal Physiologic mobility Palpation - normal Disappearance of swelling Tissue color - normal Fistual tract closure Furcation lesion repair Periodontal pocket repair No drainage No response to thermal tests	A. Tissue Percussion - pain, or tenderness or normal Mobility - normal or pathologic Palpation - pain or normal Tissue - change in color Persistence or development of fistula tracts New furcation involvement Evidence of periodontal isolated pockets Evidence of cervical zone drainage
	B. Canals All anatomical canals are found All canals are well condensed throughout the canal with gutta-percha material Intact pulp chamber No evidence of leakage or stains or hemorrhage	B. Canals Pulp chamber floor perforations Some canals are untreated or unexposed Poor root filling condensation Evidence of paste filling Evidence of loose gutta-percha fillings Evidence of stained, corroded, loose silver points Canal exudate and staining
Restorative	Tooth is restored within 2-12 weeks following endodontic therapy Acceptable restoration Acceptable endodontic posting Acceptable periodontal health Acceptable occlusal relations	Unrestored tooth Post perforation Defective restorations

e. To explain to the patient the need for a comprehensive exploratory diagnosis.
f. To inform the patient that it may be necessary to remove the existing restoration and to explain the financial implications.
g. To emphasize at the outset the difficulties involved in retreatment; its unpredictable results, possible complications, possibility of surgical intervention, or tooth loss. The clinician should avoid definitive treatment plans or definitive commitments.

2. Present Symptoms and Exploratory Diagnosis

a. Symptoms: The patient's condition during the evaluation of endodontic failure can be either asymptomatic or symptomatic, suffering from acute pain and swelling.

The clinician should treat patients with pain and swelling by anesthetizing the area, performing incision and drainage procedures, and administering antibiotic therapy. Within a few days the patient is rescheduled for further diagnosis and treatment.

Patients with pain and no swelling and symptomative patients are anesthetized and advised of the need for exploratory diagnosis, which may require removing the existing restoration, initiating retreatment procedures, and administering antibiotics.

b. Exploratory Diagnosis: The involved area is anesthetized for thorough exploration. The periapical tissue is palpated for swelling or fluctuance. The periodontal condition is evaluated by probing or sounding procedures to assess the extent of furcal involvement and the depth and extent of the periodontal pocket. Mobility tests are used to differentiate between restoration failure, coronal fracture, periodontal disease, or advanced periapical lesions. The periodontal attachment is examined for tissue exudate. Fistulae tracts are explored by placing a fresh gutta-percha point (size 35-40) into the fistula and obtaining a periapical radiograph. The gutta-percha marker usually travels to the source of the problem. This test is most useful in situations where multiple and adjacent endodontic treatments are present.

3. Quality of Existing Restorations

An important phase of the exploratory diagnosis is to evaluate the quality of the existing restoration for marginal integrity, structural defects, and so on. Good or acceptable quality restorations shouldn't be removed. If the canal is retreatable, an access opening is prepared through the existing restoration. The clinician removes the contents of the pulp chamber to expose and visualize all canal orifices to evaluate the type and quality of each canal seal.

Defective restorations should be removed before initiating any definitive retreatment plans.

Defective anterior restorations are removed only when a proper esthetic provisional restoration is assured.

The removal of pre-existing restorations is the most important preparatory step for any proper endodontic diagnosis and treatment procedure.

4. Quality of Existing Endodontics

Substandard endodontics caused by endodontic material, method, or procedural errors can be screened by the periapical radiograph and should be planned for canal retreatment first.

Apical surgery should follow canal retreatment as the final step in refinement.

Apparently good or technically successful gutta-percha or silver-point endodontics is planned to evaluate the canal seal or to detect the cause of failure. If canal exploration does not reveal any significant findings, the canal is refilled and apical surgery is planned.

5. Canal Retreatment Feasibility

Endodontic failures on teeth with post restorations, broken instruments, canal obstruction, perforations and silver points should be scheduled before canal exploration and retreatment are attempted. Although the radiograph may show that such obstacles complicate retreatment, only clinical exploration can determine the seriousness of their effect on the feasibility of retreatment.

The exploratory procedure may also reveal

that extraction is required.

In summary, the most effective method to determine the feasibility of retreatment is to try retreatment first, regardless of the findings of endodontic radiograph.

PROCEDURES FOR ENDODONTIC EXPLORATORY EVALUATION

The dentist should examine the quality of all pre-existing endodontics. Once the full-coverage restoration is removed because of defects or retreatment purposes, all intracoronal fillings, caries, or unsupported tooth structure is removed with proper high- and slow-speed instruments. A new radiograph documents the "findings" that were hidden by the full-coverage restoration. A bite-wing radiograph is especially useful in situations where the restorability is questionable or where the floor of the pulp chamber has been damaged by excessive drilling or perforations. The relationship of the periodontal tissue to the debrided tooth margins is evaluated as part of the dentist's attempt to determine whether or not restoration is indicated.

Assuming the tooth is restorable the following procedures are suggested:

1. Apply the rubber dam.
2. Debride the pulp chamber of all endodontic filling materials to expose each canal orifice.
3. Trans-illuminate the pulp chamber to detect any crack lines, perforation, staining, untreated canal orifices, or calcification.
4. Determine the type of endodontic filling gutta-percha, cements, silver, and so on.

Having in mind what he finds out about the pulp chamber and type and quality of endodontic filling materials, the clinician continues.

If he has found substandard endodontics, he should remove the filling materials and begin retreatment.

If he has found good-quality gutta-percha or silver-point fillings, he should perform the necessary build-up on posting and prepare the patient for further treatment—either new restorations or apical surgery if endodontic failure is evident.

GUTTA-PERCHA FAILURES

Most gutta-percha failures are caused by improper preparation and filling methods rather than by the gutta-percha material itself.

Primary gutta-percha failures are associated with using a single gutta-percha point in tapered large canals or with not enlarging the canal sufficiently (minimum size of 35-40 file) to allow the canal to be filled and condensed. Furthermore, the condensation instrument will not reach the critical apical one-third level. In such situations, the endodontic filling will be undercondensed and short, and it will eventually fail.

Another primary failure occurs when excessive amounts of chloroform are used in conjunction with the diffusion method. Once the chloroform evaporates, the remaining gutta-percha significantly shrinks, causing voids along the canal walls and subsequent leakage and treatment failure.

When procedural errors such as a broken file, perforation, ledge, or calcification interferes with the successful completion of proper gutta-percha filling, the treatment will fail.

In the above examples, the gutta-percha filling should be removed to eliminate the cause of the failure and the dentist should retreat the canal properly.

Exploration of Gutta-Percha Fillings

Technically, most gutta percha fillings are well condensed at the cervical third and midroot level. This condensation, however, becomes weaker apically. It is essential to remove the cervical gutta-percha to enable a direct and

accurate evaluation of the canal seal throughout the canal length, especially at the apical one-third level.

Technique

1. Use a new #2 Peeso drill or any proper engine-driven rotary instrument; remove the cervical gutta-percha to a depth of 3-5 mm from the canal orifice. Use a plunging up-and-down motion with occasional water spray for better debridement and visibility of the canal. **In very narrow canal orifices or curved canals this step is not recommended**. Use hand instruments.

2. Insert a #20 or #25 or #D11T spreader along the mesial, distal, buccal, and lingual walls of the canal and force it apically, trying to bypass the remaining gutta-percha filling and the apical foramen if possible.

3. Obtain a radiograph to confirm the location of the endodontic instrument and its relationship to the root filling.

4. Passing through the apical foramen indicates apical perforation, apical root resorption, or both. This phenomenon often explains the failure and provides the clinician some information about the size of the needed initial measurement file.

5. A well-condensed gutta-percha is difficult to penetrate; therefore, the canal filling is accepted and the root is posted if indicated and treatment is successful.

6. Retreatment decisions are initiated according to the results of this exploratory test—rather than on the appearance of the root filling in a radiograph.

Retreatment of Gutta-Percha Fillings

1. Use a #2 Peeso drill to remove the cervical third gutta-percha. In large, straight canals the drill is inserted 4-6 mm from the canal orifice in narrow or curved canals. Use electrical heat sources (Touch-Heat, Analytic Technology) or proper-size, heated instruments.

2. Place a few drops of chloroform in the enlarged canal cervical third and pulp chamber.

3. Use a #15 or #20 K-type file to incorporate the chloroform with the remaining apical gutta-percha filling.

4. Allow time for the chemical softening process; add a few drops of chloroform as needed.

5. Use a #25-30 K-type or larger file to remove the softened material from the canal. Use 2 x 2 gauze to clean the file. If the canal size permits, Hedstrom files are most effective to debride and enlarge the canal.

6. Another very effective method is to use the endosonic to flush out the softened gutta-percha.

7. Establish the endodontic measurement and proceed with canal preparation and filling procedures.

SILVER POINT FAILURES

The successful use of silver points in endodontics requires a round canal preparation design to ensure a perfect fit of the silver point against the canal walls. The "attractive" radiographic opacity of the silver point makes such treatment appear well sealed when in fact the canal is clinically void. It is impossible for the rigid silver-point surface to seal the rigid canal wall. The seal is therefore dependent on the endodontic sealer.

Currently, it is believed that silver points are chemically unstable and can corrode following fitting procedures and contact with the fluids in human tissue. The corrosion products are toxic and can cause periapical disease as well as tooth and tissue discoloration. Furthermore, as a foundation for posting procedures, the silver point has been found to be inferior to gutta-percha because of increased leakage. We do,

however, encounter silver point cases that have been successful for years.

Analyzing such cases reveals: (1) the canals have been aggressively enlarged and thus cleaned; (2) the silver point terminates short of or at the apex; (3) it is impossible to remove the silver point because of its perfect fit and tight seal throughout the canal space; and (4) the absence of silver staining of the tooth structure.

Blair (1972) indicated that if the apical foramen is prepared to a size of a #100 file, a good apical seal can be achieved by forcing the silver point through it. This recommendation, despite its obvious validity, cannot be clinically applied in situations where the canal is straight and the apex can be enlarged to a size #100 file! Other clinically successful cases should be considered as non-acute lesions or failures-in-formation. Many individuals can harbor chronic infection without clinical or radiographic signs. Today silver-point cases are clinically explored for preventive retreatment prior to any restorative procedures. For years we have seen many "clinically successful" endodontic cases that were infected. The root-canal sealer had disappeared, and the corroded silver point was found floating in a canal filled with tissue fluids, bacteria, and necrotic debris.

Successful, unstained, well-sealed and well-retented silver points are accepted unless a post build-up or dowel core is considered.

Removal of Silver Points

Removing the coronal full-coverage restoration is an essential prerequisite to removing difficult silver-point filling. Preparing the endodontic access through existing full-coverage restoration can inadvertently damage the silver point head, complicating its removal. Once the crown is removed, the pulp chamber contents can be alloy, composite cement, gutta-percha, or zinc phosphate cement.

Using #1 A.P.E.X. (Hufriedy) rigid explorers, attempt to chip away the cement around the silver point head. Avoid the use of engine-driven drills since they may damage the silver point head.

Alloy and composite build-up around the silver points is best removed by undermining build-up with 699.L burr drilling the interface between the build-up and the tooth structure.

The build-up is now leveraged, or lifted, with rigid, large-size excavators or any other suitable instruments. Some build-ups may have to be segmented or sectioned prior to removal. If the silver points are lodged within the canal or if its protruding head was severed off, one or more of the following methods is suggested.

1. Use #10 or #15 K-type new instrument to file alongside the point circumferentially to loosen the seal. Try entering the canal along all four walls (M-D-L-B).

2. Use solvents such as chloroform orange-solvent, sodium hypoclorite or endodialtor (Union Broach, UBCO).

3. Use endosonic irrigation.

4. Engage the point with multiple, new, 25 long K-type files and withdraw in straight line.

5. Use fine pliers whenever possible (in pull motions) along the long axis of the root.

6. Use Hedstrom files to file corroded Ag points once the small K-type files open the canal sufficiently.

7. Once the silver point is removed, debride the canal with endosonics.

8. Establish the endodontic measurement.

9. Enlarge the canal 3-5 sizes larger than the first file that fits snugly into the canal measurement. This is an essential step to debride the canal walls from the toxic products.

10. Fill the canal with gutta-percha and AH26 sealer (Caulk, Dentsply).

Occasionally, a posterior tooth may present

one root with apical lesion caused by ill-fitted and corroded silver point, whereas the other root may reveal a normal apical appearance with a well-fitted silver point that cannot be removed. In such situations, the root with endodontic failure is retreated and filled with gutta-percha, and the tooth is evaluated for exploratory apical surgery or hemisection or is provisionally restored to monitor the healing process for 3 to 6 months.

The selection treatment is dependent on patient management factors, the risks involved, and the strategic value of the involved tooth.

In summary, clinical evidence indicates that well-fitted, well-cemented silver points seldom fail. Undersized, ill-fitted, corroded silver points will deteriorate and corrode, causing apical root resorption, apical lesions, staining of the tooth and mucosa, and eventually pain and swelling.

PASTE FILLING FAILURES

A variety of liquid, powder, or premixed pastes are available for injection into the root canal. These materials are commercially marketed with a complete system of instructional materials and instruments. Their stated purpose is to simplify endodontics. The N_2 materials and method was the center of much controversy in the 1970s. Today, research findings and other evidence have replaced the clinical and emotional opinions of the 1970s. Because paraformaldehydes, lead oxides, and a variety of other medicaments were present, most N_2 or RC2B formulas were found irritating and toxic.

Evidence gathered during the past 10 years from studies on human and animal tissue-cells has confirmed the cytotoxicity, instability, and absorption of the formaldehydes can lead into the bloodstream. The reader is referred to Laband (1978), Spangberg (1974), West (1980), Brown et al. (1978), Cohler et al. (1980), Block et al. (1977), Oswald (1975), and England (1980).

Another paste (gel) that received attention in the early 1980s is hydron, which is a hydrophillic gel with barium sulfate (Poly-2 hydroethelemethacrylate). Originally, hydron was considered an important discovery because of its flow properties and conformity to the canal walls (its hydrophillic quality).

Langland et al. (1981) found hydron to be an unstable material (it developed voids and cracks) like an "acrylic." Biologically, hydron was transported in blood vessels in macrophages, and severe foreign-body reactions were observed.

Tanzilli et al. (1981) compared hydron with gutta-percha and found hydron unacceptable because of the long-range inflammatory response observed (six months following injection). Many other zinc oxide-eugenol or fortified zinc oxide material or calcium hydroxide pastes are radiographically very opaque and thus mislead the clinician since they are confused with gutta-percha. All pastes are resorbable and will be transported via the macrophages, rendering the apical third filling porous and void. All pastes produce incomplete fillings because of our inability to condense material. All pastes are uncontrollable; therefore, overfilling is commonly found in these methods. Formaldehyde paste, overfilling into the mandibular canal, can chemically damage the mandibular nerve and cause chronic paresthesia. The medico-legal complications of using paraformaldehyde pastes, especially gross overfills, are becoming increasingly serious and should be considered when using uncontrollable and highly toxic materials such as the N_2 paste.

Paste fillers are not used by endodontists, nor are they taught as a subject in any dental schools in the United States.

Paste Fillings

1. Debride the pulp chamber contents.
2. Expose all canal orifices.
3. With a #2 Peeso drill, remove the cervical third canal contents.

4. Place solvents in the canal and file with small files (chloroform or orange solvent).
5. Use endosonics to flush out paste fillers.
6. Establish root length measurement.
7. Prepare the canal.
8. Fill the canal with gutta-percha filling and AH26 cement.

EVALUATION AND RETREATMENT OF ENDODONTIC POST FAILURES

Clinically, endodontic posts and dowel-core restorations are considered obstacles to endodontic retreatment, and apical surgery is therefore indicated. A more effective method is to explore the post quality and the possibility of retention or removal.

Generally speaking, poor-quality post restorations, such as screw post, short post, or post perforations, are easy to remove. Good-quality posts are difficult to remove. The periapical radiograph does not reveal the quality of the post. On the radiograph many failing posts appear difficult to remove; clinically, however, they are easily removed because of leakage and tissue breakdown. Prefabricated posts can be unscrewed. Short posts can be drilled out or dislodged.

Post-Removal Methods

Remove the full-coverage restoration.

1. Remove all build-up materials and expose the post-head.
2. Marginally release the cast posts and core.
3. Rotate counterclockwise carefully with straight, locked hemostat.
4. Marginally release against the cast material with #699.L bur.
5. Use trans-illumination against the buccal and lingual mucosa to avoid perforation when the post is being drilled off.
6. Use endosonics to loosen the remaining post segments.
7. Do not forcibly unscrew the post. Good-quality, well-retained, and successful posts are difficult to remove. Poor quality and failing posts can be easily unscrewed and removed.
8. If the post is mobile, be certain that the mobility is limited to the post and not the root itself. While you are gently moving the post with a hemostat, observe the root surface at the cervical zone or the remaining tooth structure for concurrent mobility. If it occurs, the post should not be removed since tooth fracture may result.

SUMMARY

The quality of endodontic treatment should not be evaluated solely on the basis of the periapical radiograph. Rather, a comprehensive diagnostic method should be based on clinical, radiographic, and exploratory guidelines.

Absence of symptoms does not indicate treatment success. The majority of endodontic failures remain asymptomatic because of the slow progress of endodontic failures. Unlike restorative failures, endodontic failures are seldom clinically obvious and are difficult to detect in their developmental stages. Endodontic failures often begin years before pain, swelling, or lesion formation develops. Endodontic failures may require 2 to 10 years to become clinically detectable.

Endodontic retreatment of substandard endodontics is therefore essential prior to any restorative therapy regardless of the patient's symptoms.

When treating endodontic failures on teeth with poor or substandard endodontic treatment, apical surgery may provide a quick resolution to the patient's symptoms. However, this resolution is often temporary and unpredictable.

On the other hand, nonsurgical retreatment enables the clinician to perform a more accurate diagnosis; a more facile treatment, a more predictable prognosis, and a more permanent, successful treatment.

Questions

Endodontic Retreatment
Dr. Marwan Abou-Rass

1. Today's standard of care in the management of endodontic failures or of substandard endodontics suggests we perform:
   a. apical surgery
   b. extraction
   c. canal retreatment
   d. antibiotic therapy

2. Apical surgery is most effective in treating endodontic failures:
   a. of the occlusal third
   b. of the apical third that are easy to visualize and correct
   c. due to substandard endodontics
   d. due to iatrogenic posts that are poorly placed

3. Perhaps the most serious disadvantage of apical surgery is:
   a. the clinician's inability to debride the bacteria, toxins and other materials causing the failure
   b. it leaves an apical scar
   c. it transfers the apical foramen coronally
   d. it causes increased fluid leakage

4. Endodontic perapical radiolucencies are:
   a. always considered pathological
   b. always considered non-pathological
   c. considered pathological lesions unless previous radiographs indicate significant regression of a previous lesion size

5. Apical scars:
   a. are histologic entities
   b. cannot be diagnosed radiographically
   c. are rare and found mostly on anterior teeth
   d. all of the above

6. Most endodontic failures with poor quality or substandard endodontic therapy are caused by problems:
   a. with the restorative on the tooth
   b. within the canal
   c. outside the canal
   d. with the dentist's technique

7. Failures caused by factors directly related to the quality of endodontic material, endodontic method or both are termed:
   a. primary endodontic failures
   b. secondary endodontic failures
   c. iatrogenic endodontic failures
   d. methodology endodontic failures

8. The results of endodontic treatment can be evaluated using which of the following criteria:
   a. histologic criteria
   b. radiographic criteria
   c. clinical criteria
   d. all of the above

9. The greatest value of the periapical radiograph in endodontic treatment has been its use in:
   a. root measurement
   b. canal preparation
   c. filling procedures
   d. all of the above

10. The author recommends that a retreated tooth be refilled with:
    a. gutta-percha
    b. silver point
    c. a paste filler
    d. any of the above

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