Understanding Success and Failure
Healing vs. Persistent Pathosis

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**Retreatment: Why and When**

Why retreat?

Implants have eliminated the need for nonsurgical endodontic retreatment.

Implants have eliminated the need for apicoectomies.

As the saying goes, “if you only have a hammer, everything is a nail.”

As endodontists we have a complete set of tools, along with the knowledge and experience to use them to our patient’s advantage. We perform osseous surgery, soft tissue surgery, and internal nonsurgical restorative endodontic procedures. If we need to put a post in a tooth we can do that. If we need to put a titanium post in the bone we can do that also.

So why retreat a tooth? If it is in the patient’s best interests why not retreat it? Unless retreatment is a service that one can not provide.

In deciding whether to extract or retain a tooth who is more qualified than an endodontist? Endodontists successfully treat teeth that other practitioners condemn. Only endodontists have the skills and experience necessary for successful endodontic treatment of complex cases. If the only treatment option a dentist or dental specialist can offer requires extracting the tooth, is the patient being offered a treatment plan in their best interests or the providers?

Of course the converse is also true. If the only service you can offer for a failing tooth is a heroic attempt at retreatment, are you able to provide for the patients best interests? Not every tooth should have an attempt made at saving it when more predictable options exist.

Endodontists perform some of the most complex dental procedures. From conventional endo where we work within _ to 1/2mm tolerances, to placing retrogrades in roots near vital structures in small spaces with challenging access requirements. Replacing a tooth with a titanium screw is a lot less complicated than providing an endodontic service.

The specialty of endodontics is fortunate to be able to offer our patients the best that dentistry can provide for them. We can predictably save teeth, and without any conflict of interest provide implant services when appropriate. No other branch of dentistry can make this claim.

When considering endodontic treatment or retreatment versus an extraction some factors to consider include:

Is the tooth restorable?

What function does this tooth provide?

What is the expected functional lifetime of the resultant restoration?

Are the patient’s desires and expectations realistic?

What are the number, types, and duration of the procedures required?

What are the surgical risks and potential complications?

Of course no treatment can claim 100% success. Endodontics has its limitations. Vertically fractured roots, nonrestorable teeth, and hopeless periodontally involved teeth should be extracted. Teeth that if retained may interfere with long term outcomes should also be removed even if they can be treated. An example of this would be trying to save a single mandibular incisor where implants are being used to restore the mandibular dentition.

Implants also have their limitations. Treatment in the esthetic zone (the esthetic zone being wherever the patient says it is) is a major concern. Often the implant site needs to be developed with bone, or soft tissue grafting for optimal esthetic results. Without a good recipient site for the implant, esthetics will be compromised.

Implants used to restore adjacent tooth extraction sites often present an esthetic challenge. Esthetic results are significantly related to preservation of the papilla and its supporting bone. The papilla is present
when the interproximal crest of alveolar bone exists. This alveolar bone is resorbed when adjacent teeth are missing. Between adjacent implants there is often no interproximal crest of alveolar bone that provides for the scalloped appearance of the periodontal tissues that form a papilla. Natural roots can have an esthetic advantage due to their ability to preserve the natural papilla.

Rationale for Retreatment
When considering treating teeth with failing endodontic therapy, several options exist. They include endodontic surgery, extraction, no treatment, or endodontic retreatment.

The patient’s chief complaint needs to be investigated. Postendodontic treatment complaints may include, sensitivity to; temperature, biting, pressure, palpation, and recurrent sinus tracts.

When a patient complains of temperature sensitivity after endodontic therapy, their complaint is often dismissed. Thermal testing should be performed to see if their complaint is reproduced. If it is the endodontic treated tooth that responds, the presence of untreated pulp is suspected.

When an endodontic treated and restored tooth that has been asymptomatic for years begins to become sensitive to biting, pressure, or palpation, endodontic failure should be suspected. This is especially true if no recent dentistry or trauma has taken place. Occlusal adjustment and antibiotics will temporarily abate the symptoms but they will usually return repeatedly. As with virgin teeth exhibiting these symptoms an endodontic abscess should be suspected. (Figures 1, 2)

Patients are often aware of a “gum boil” that comes and goes. When presenting for an exam the sinus tract may be difficult to see. Palpation in an apical to coronal direction on the buccal and lingual may result in exudate being expressed through the mucosa. The sinus tract may now be traced to its source.

Evaluation of the Existing Treatment: Radiograph interpretation in evaluation for retreatment
When retreatment is being considered the quality of the previous endodontic therapy and subsequent restoration must also be evaluated. This is a subjective evaluation based in part on experience.

A thorough radiographic examination can make evaluation of existing conditions more objective. Radiographs angulated from the mesial and distal, as well as straight on, are needed. Furcations can be evaluated with a bitewing film. The bitewing films can also be taken from more coronal and apical directions. These different angles can help identify missed canals, fractures, perforations, while also evaluating the quality of the existing endodontics.

Most causes of endodontic failure are related to contaminated root canal spaces. There are several categories of endodontic failure for which retreatment is promising. They include:
- Missed canal (Figures 3, 4)
- Incomplete obturation (Figures 5, 6, 7)
- Perforations (Figures 8, 9)
- Coronal leakage (Figures 10, 11)

Missed Canals
Angled radiographs can show missed canals in several ways:
- By observing that the obturation is not centered in the canal. Since the root forms around the centrally located pulp, an eccentrically located obturation may indicate additional untreated canal space. (Figures 12, 13)
- Observing the radiographic apex having a bi-convex shape. Maxillary molar MB roots and mandibular molar distal roots with two canals often exhibit this anatomical marker. (Figures 14, 15, 16)
- Angled radiographs project superimposed roots onto the film as described with the cone shift rule, also called the buccal object rule, or the SLOB rule. The result of angling the radiograph is the identification of these otherwise superimposed roots. (Figures 17, 18)
Figure 1  Upon a quick inspection the endodontics in the first molar appears adequate to outstanding. The patient was persistently symptomatic.

Figure 2  The patient’s symptoms were relieved after retreatment of the previously under-treated canals, and treatment of a previously missed second MB canal. Almost all maxillary molars have four canals.

Figure 3  The second premolar has a radiolucency that extends from the apex to the CEJ along the distal root surface.

Figure 4  This tooth was found to have three separate canals.

Figures 5-7  Without the use of the surgical operating microscope, retreatment of this central incisor would be extremely difficult. With the microscope the apical bifurcation can be seen and managed.
Figure 10 Endodontic surgery has failed to resolve this extensively treated first molar. The margins on the crown are suspect. The leaking crown needs to be addressed if endodontic retreatment is to succeed.

Figure 11 Healing has occurred after post removal, silver point removal, gutta percha removal, endodontic retreatment, and a new crown.

Figure 12-13 The obturation of the MB root on this first molar is eccentrically positioned. When the root was retreated, a second MB canal was found.
Figure 14-16 This first premolar case illustrates the value of multiple angled preoperative views and the significance of lateral canals. The outline of a second untreated canal can be seen on the second view. After the silver point is removed and the tooth retreated, the anatomical complexity of this root canal is revealed.

Figure 17 The radiograph of the lateral incisor reveals a deep concavity on the root surface. The presence of this concavity is often indicative of multiple canals within the root.

Figure 18 The presence of two canals is demonstrated on the postoperative radiograph.

Figure 19 Indistinct obturation as seen in this molar is cause for concern. After the crown was placed, symptoms developed, necessitating endodontic retreatment.

Figure 20-21 The original treatment terminated at a ledge that was created when the original path of the canal was not followed. Upon retreatment the ledge was bypassed, allowing access and treatment of the original canal, which terminates with its foramen centrally located in the periapical radiolucency.
in the canal during obturation, the volume that the more radiopaque obturation materials can occupy is limited. The result is a diminished radiopacity of the obturated canal.

- The radiopacity of the obturation becomes less distinct in an apical direction. This is another indication that significant debris may remain in the canal. (Figure 19)

- The obturation does not reach the PDL. Mesial, distal, and straight on radiographs will show the most apical obturation level. If none of the radiographs show obturation to the PDL it is reasonable to assume that the obturation is short of the cavosurface of the canal. (Figures 20, 21)

- A vertical void (a black line) visible between the obturation material and the canal wall. The canal may be filled in terms of length, but incompletely filled in three dimensions. This black line could also indicate a vertical fracture.

- Evidence of endodontic surgery without retrograde placement

- Evidence of endodontic surgery with retrograde placement in the root, but not the canal. (Figure 22)

- The obturation does not seem to follow the curve of the root, or terminate in the center of the radiolucency. This could indicate a ledge or perforation. (Again, see Figures 20, 21)

- The presence of silver points.

- The presence of separated instruments.

Perforations
Perforations create areas of persistent inflammation, and resolution of perforations depends to a large extent on where they are located. The amount of supportive tooth structure remaining is also a critical factor in the long-term success or failure of perforation repair efforts.

Perforations should be suspected when radiographs reveal:
- A radiolucency at the apical extent of a post.
- A furcal radiolucency exists adjacent to minimally remaining furcal tooth structure.
- A sinus tract that traces to the furcation, or to the mid root area where the external root surface is concave (a strip perforation).

The Coronal Seal
The quality of the coronal seal can be evaluated radiographically by examining for the following, as they can provide avenues for micro leakage:
- Open margins
- Recurrent decay
- Voids parallel to posts

If the etiology of the failure can be assigned to one of these four categories there is reason to explore retreatment as an option for the patient.

Root Fractures
Fractures also create areas of persistent inflammation that may necessitate extraction. Fractures are often difficult to see on radiographs. Sometimes their presence is indicated when radiographs show:
- A vertical black line between the obturation material and the root
- A “halo” shaped radiolucency surrounding a root. (Not the typical circumscribed radiolucency associated with a chronic apical abscess.)
- Changing the vertical angulation of the central ray may allow detection of horizontal fractures (usually caused by trauma). A radiograph should be taken at a right angle to the long axis of the root, along with two additional views, one at 45 degrees toward the apex and one at 45 degrees toward the crown.
These retrogrades may have esthetic value but are not sealing the canals, as evidenced by the files extending past them.

The preoperative radiograph of the second premolar suggested the presence of a vertical root fracture on the distal side of the root. Irrigating this with NaOCl would have been a major iatrogenic mistake. When the apex locator reading is aberrant, investigate the cause before proceeding.

The second molar has silver points perforating both mesial canals. The first molar is fractured through the furcation and decayed. The patient has been asymptomatic for more than 20 years. Regaining access to the calcified mesial canals apical to the perforation is a challenge. Surgery or extraction are more predictable treatment options for the second molar.
**The Clinical Exam**

**The Coronal Seal**
The integrity of the coronal restoration needs to be evaluated clinically and visually, as coronal leakage is a factor in endodontic failure.

Open margins on coronal restorations can be revealed by the production of bubbles when apical pressure is applied to the occlusal surface. Use of an explorer and mobility testing is also required.

**Periodontal Evaluation.**
Periodontal disease may be misdiagnosed as an endodontic failure. The opposite is also true. The clinical exam needs to include periodontal probing of the entire tooth including any furcations. Ideally the entire quadrant should be probed. When the general periodontal health is good, finding an isolated deep periodontal defect that is narrow in a horizontal direction may actually be a draining sinus tract. Periodontal defects that are wider coronally than apically are more indicative of fractures or periodontal pathosis.

**Perforations**
Perforations that can be probed through the sulcus have an unfavorable prognosis. This is because reattachment of the periodontal fibers and regeneration of the alveolar bone is compromised. Due to salivary contamination a persistent supraosseous, subgingival inflamed pocket will remain.

Perforations that are in 5 or 6 walled bony defects have an excellent prognosis when repaired with MTA.

**Fracture Identification**
Fiber optic transillumination when applicable is an excellent diagnostic aide for fracture identification. A fracture is indicated when the light transmission is halted at a darkened interface. This interface is where the fracture line exists. Crowns and large restorations can limit the usefulness of fiber optic transillumination.

Staining with a dye such as methylene blue will also help elucidate the fracture. The stain can be used in conjunction with transillumination. When the tooth is extensively restored, the dye can be placed in the gingival sulcus. A spoon excavator or similar instrument may than be used to reflect the soft tissue away from the root. The root can be examined for a fracture with magnification and fiber optics.

Apex locator readings that are aberrantly short should be compared with a measurement film. The apex locator reading could be due to a fracture or perforation. (Figures 23, 24)

Observation of multiple sinus tracts that trace to the same root often occurs when the fracture separates the root in half, creating buccal and lingual sinus tracts.

**Past History of the Tooth**
Information on the technique used during the initial endodontic treatment may be difficult to obtain. It could be useful to know if irrigants were used. The type of irrigants and how they were used could also be useful. The importance of using NaOCl and EDTA to produce as clean a canal as possible has been well established. If a less than ideal protocol was followed during the original treatment, retreatment may result in healing.

**Prognosis**
When all the information required to diagnose the etiology of the endodontic failure is analyzed a prognosis for retreatment can be offered.

A Poor prognosis is given for:
- Vertical root fractures with probing depths that are markedly greater than immediately adjacent sites. This indicates that the fracture, in addition to being subgingival extends infraosseously. This bone is expected to eventually be lost due to bacterial infection of the fracture.
- Furcation perforations with a sulcular communication.
- Apical third perforations in roots with abrupt apical curvature. It can be very difficult to reenter the natural canal to complete the endodontics in this situation. Surgery is usually a more predictable approach here. (Figure 25)
A Good prognosis can be given failures with an etiology of:

- Separated instruments
- Silver points
- Perforations coronal to the periodontal attachment
- Root perforations in the coronal to middle third without sulcular communication (5 or 6 walled defects)
- Apicoectomies without retrogrades placed
- Retrogrades placed in the root but not in the canal
- Missed canals
- Incomplete obturation
- Coronal leakage

**Deciding Upon Endodontic Retreatment**

As described previously, there are several factors that make endodontic retreatment the preferred method for treating endodontic failures, they include:

- When the natural root and the bone it preserves is the best option.
- When the decision is made to retain the tooth, retreatment addresses more of the apical anatomy than surgery.
- Infraosseous perforations that don’t communicate through the sulcus can be addressed in a more conservative fashion from a coronal approach than a surgical approach.

When discussing a comprehensive treatment plan, patients should be made aware of the status of their existing endodontic treatments. Asymptomatic teeth with questionable endodontics should be considered for retreatment prior to completion of their comprehensive treatment plan. Before proceeding with retreatment, the potential need for additional procedures needs to be assessed. New restorations, crown lengthening or other periodontal needs should be explained to the patient in order for an informed decision to be made. When pre-existing endodontic pathosis or teeth with questionable endodontic treatment become symptomatic shortly after overall treatment has been completed, patient doctor relations can be strained. This is especially true if the patients were not informed ahead of time of the findings from their comprehensive exams.