Continuing Education

Endodontic Re-treatment or Implants: A Contemporary Conundrum

After reading this article, the reader should be able to: • identify the 2 most common reasons for endodontic failure. • list some of the factors that should be evaluated when treatment planning a case in which an endodontically treated tooth is failing. • discuss the impact of re-s-torations on failures of endodontically treated teeth and/or implants.

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Learning Objectives:

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Abstract: **In recent years, dental implants have become a common alternative in dental care. Of course, not all patients present with clear-cut treatment needs. Treatment planning an endodontically treated tooth that may require re-treatment vs extracting that same tooth and placing an implant may be one such conundrum. Given the disparity between the implant and endodontic re-treatment literature and the relative paucity of data-based results for indications and contraindications of endosseous root-form implants vs endodontic re-treatment, treatment planning can become a complex task. This article presents a few criteria to consider when treatment planning endodontic re-treatment vs extraction and subsequent**

restorations on failures of endodontically treated teeth and/or implants.

implant placement. Because treatment planning can become such a complex issue, using all the varied resources of the dental team is imperative.

In recent years, dental implants have become a common alternative in dental care. Though implants have been used in dentistry for decades, the idea that something man-made can become osseointegrated and used to restore function where it had long been lost still instills a certain amount of awe. Of course, the fact that they are described as alternatives1,2 suggests there are other treatment options available. Indeed, a recent study3 suggested endodontic success rates reaching as high as 99.5%. The authors believe that the natural dentition is the best implant, and the first goal should be the preservation and restoration of a healthy dentition. Of course, not all patients present with clear-cut treatment needs. One such conundrum is treatment planning an endodontically treated tooth that may require re-treatment vs extracting that same tooth and placing an implant.

This dilemma is further compounded by the dearth of literature addressing root canal therapy vs extraction and implant placement.[4]

Implants and Re-treatments Are Challenging to Treatment Plan

When a tooth that had previously been endodontically treated begins to fail, some practitioners are quick to call for its extraction and replacement with an implant. The astute practitioner would be better served by questioning why the endodontics are failing and determine what treatment plan is best for the patient. Endodontically treated teeth can be deemed failing because of:

- Missed canals
- Poor patient healing
- Inadequately cleaned canals
- Psychological problems
- Inadequate obturation
- Neurological problems
- Operator error
- Restoration failure
- Overloaded occlusion
- Trauma
- Interfering occlusion

- Caries
- Bruxism
- Periodontitis

Many of these factors can lead to implant failure if not resolved. Furthermore, while most implant failures are directly related to the implant, most endodontic failures are related to the restoration.[5]

Given the disparity between the implant and endodontic re-treatment literature, and the relative paucity of data-based results for indications and contraindications of endosseous root-form implants vs endodontic re-treatment,6 treatment planning becomes a complex task. There are a myriad of factors to consider, ranging from esthetics and functional prognosis to patient expense (both time and money).

Evidence-based Approach toTreatment Planning

Evidence-based care has become the new paradigm for the dental profession. Significant developments in the concepts and principles of evidence-based care (for example, standards in clinical trials design) have provided the profession with the tools to assess therapeutic interventions.[1] More specifically, evidence-based care means the judicious use of current best evidence, recognizing that no study is perfect in every respect or necessarily applicable to every patient. Alternatives, such as implantation therapy, are more than just the design and application of a given treatment modality, but also a process of patient care.[1]

Compare Alternatives

Success Criteria

If one is to embrace an evidence-based approach, a critical dissection of the literature is in order. When reviewing the implant literature for partially edentulous treatment, several clinical studies reported survival rates ranging from 62% to 97%.[7-17]

On the other hand, in a review of several endodontic re-treatment studies the reported success rates range from 47% to 98%.18-24

Of course, the wide range of reported success rates is the result of case selection,

variances in success criteria, and variances in failure criteria.

Implant Case Selection

The high implant success rates reported in many studies often come at the expense of excluding patients and/or sites. A few of the exclusions found in the implant literature includes smokers, diabetics, type IV bone, bruxism, preloading failures, hemophilia, renal failure, corticosteroid treatment, and untreated or uncontrolled periodontal pathology.[2,4,10,25-27] In fact, Fiorellini and colleagues reported on a retrospective study of implants in diabetic patients and found only an 85% success rate.[25] In another study, researchers found type IV bone associated with only a 65% success rate.[15] Finally, several authors have strongly implicated smoking as a significant risk factor for implant placement.[2,16,17,28] Bain even reported a success rate as low as 62% in patients who smoked.[16]

Re-treatment Case Selection

The reported success rates of endodontic re-treatment merit closer scrutiny as well. According to Mandel and Friedman,[29] a primary goal of endodontic re-treatment is to re-gain canal patency so that the entire root canal system can be treated. This objective was supported by Wolcott and colleagues30,31 who reported a significantly higher incidence of the second mesiobuccal (MB2) canals in re-treated teeth compared with initial treatments, thus suggesting that untreated canal space can lead to failure. With this in mind, several authors have reported better suc-cess rates for endodontic re-treatments when addressing previous technical shortcomings.[21-24] Conversely, endodontic re-treatments done on teeth with large periapical lesions have been shown to have a significantly worse prognosis.20,23

Re-treatment Criteria

Another factor that impacts the reported re-treatment success rates is the criteria used to assess successes vs failures. In 1956, Strindberg32 proposed criteria for evaluating endodontic healing based on radiographic findings. However, as early as 1966, Bender and Seltzer33,34 stated there was no definite correlation between histologic findings and radiographic findings in endodontically treated teeth. Subsequently, multiple authors have suggested the determination of success or failure based solely on radiographic criteria is ill advised.[18,21,35,36] Unfortunately, however, some studies still use Strindberg's dated

criteria.18-20,23,37 If the results of those studies are adjusted to account for more contemporary criteria, the average success rate goes from 74% up to 90%.

Granted, redefining criteria retrospectively is rife with pitfalls, but a recent study by Fristad and colleagues21 reinforces the importance of appropriate criteria. In the study, the authors found a 95.5% radiographic success rate with re-treated teeth recalled 20 to 27 years postoperatively. This is in comparison to an 85.7% radiographic success rate in the same population when recalled at 10 to 17 years postoperatively. This study not only shows the potential for late healing, but also the inadequacies of a "radiograph only" assessment. Obviously, the teeth deemed to be failures radiographically at the 10-to-17-year recall were still functioning after another 10 years. So as stated by Seltzer, "The use of the term adequate clinical function is more realistic and satisfies the need of the clinician, inasmuch as the retention of the tooth in function is the ultimate goal of endodontic therapy."36

Finally, there is one more aspect of the success/failure comparison that needs to be addressed, and that is the impact the subsequent restoration has on either the implant or the re-treated tooth. The primary impact restorations have on implants is the physical load. With this in mind, some implant studies excluded patients with known bruxism habits.[2,4] Meanwhile, the endodontically re-treated tooth, while not only affected by parafunctional loading, is also greatly affected by the overall quality of the restoration. It is well known that a leaking restoration may lead to endodontic failure.[5,21,38-40] In fact, in his 1991 study, Vire examined the various reasons for endodontic failure and concluded that 91.4% of endodontic failures are caused by factors other than the root canal therapy itself.5 Thus, while most implant failures are directly related to the implant, most endodontic failures are related to the restoration.

Prosthetic Complications

In spite of the impact the prosthesis may have on the endodontic prognosis, the literature suggests a higher incidence of complications with implant prosthetics. Goodacre and colleagues41 found that, "even though it was not possible to calculate an overall complications incidence for implants and their associated prostheses, there appears to be a greater number of clinical complications associated with implant prostheses than any other types of prostheses evaluated."

Defining Failure

Figure 1A—Preoperative image of tooth No. 18. Note the grossly short fill, indicative of untreated canal space.

Figure 1B—Tooth No. 18 at 9-month recall appointment. Note additional canal space that had been treated, resulting in subsequent bony healing.

A major problem in this area is that a strict definition for a failing implant does not exist.[6,28] Furthermore, even if the implant is not deemed a failure there can still be notable complications.41,42 Some factors not considered as failures are pain, paraesthesia, and hematomas to something as simple as loose or fractured screws. Additionally, implant placement may compromise function, esthetics, and phonetics.

So how does one define endodontic failure? A clear definition of what constitutes success or failure does not exist necessarily among all practitioners.[35] Persistent asymptomatic apical radiolucencies do not necessarily indicate endodontic failure.[21] The determination of success or failure based solely on radiographic criteria is ill-advised because clinical findings must be integrated into the decision-making process.[32,33,35] Based on this clinical function concept of endodontic success, Bender and Seltzer32,33 suggested the following, more realistic criteria of success:

- Absence of pain or swelling
- Disappearance of fistula
- No loss of function
- No evidence of tissue destruction
- Radiographic evidence of an eliminated or arrested area of rarefaction after a posttreatment interval of 6 months to 2 years.

If the ultimate retention of the tooth in asymptomatic clinical function is the goal of endodontic therapy, then many cases can be classified as clinically successful using the above criteria. Case selection, evaluator bias, and patient factors can, however, overwhelmingly skew levels of success or failure.

Case Selection Criteria

Figure 2A—Preoperative image of tooth No. 14. Note asymmetry of the fill within the mesial-buccal root. Indicative of a fourth (missed) canal.

Figure 2B—Postoperative image of tooth No. 14. Note the now treated mesial-buccal 2 canal.

According to the most recent American Association of Endodontists Guide to Clinical Endodontics,[43] nonsurgical root canal re-treatment is indicated if any of the following clinical conditions exist:

A. Continued periradicular pathosis.

B. Radiographic evidence of a deficiency in the quality of the root canal obturations, when periradicular pathosis or symptoms continue after endodontic therapy.

C. Persistent symptoms.

D. Anticipated restorative or prosthetic procedures will compromise any preexisting root canal obturations.

E. Anticipated restorative or prosthetic procedures on a tooth where the previous treatment quality is questionable.

F. Salivary contamination when bacterial leakage into the root canal system is suspected.

As the list above demonstrates, endodontic re-treatment may be indicated for both "failures" and "successes."

Beginning with criterion A, a "suitable period of time" may well run into the decades.[18,21] According to Bender and Seltzer,[32,33] "complete bone regeneration following endodontic therapy, although desirable, is not always achieved." Thus, a better interpretation of criterion A may be an eliminated or arrested area of rarefaction after a suitable period of time.

Criteria B and C deal with cases of endodontic "failure," the quintessential re-treatment

cases. When the diagnosis of endodontic failure has been made, only 3 modes of therapy exist to resolve the problem: conservative re-treatment, apical surgery, and extraction.[44] Apical surgery is beyond the scope of this article, but it is worth noting that the literature indicates success of re-treatment is higher than surgical treatment when access to the root canals is feasible.[19] Furthermore, when apical surgery is indicated, its success rate is higher when it supplements nonsurgical re-treatment.[24,45]

Figure 3A—Preoperative radiograph of tooth No. 25. The previous restoration was leaking, thus coronal recontamination.

Figure 3B—Postoperative radiographtooth No. 25, 41-month recall. Not only able to retrieve the old silver point, but also note the bony healing at the 3-year mark.

Untreated root canal anatomy is a major cause of endodontic failure.[46,39] More specifically, failure of endodontic re-treatment in most cases is a result of microorganisms persisting in the root canal system. This probably occurs because sufficient numbers of microorganisms causing the initial infection, along with sufficient substrate, remained in the canal after inadequate cleaning of the root canal system.35 Therefore, it would seem that debridement of the entire canal system through proper cleaning and shaping would be of paramount importance in successful re-treatment (Figures 1A and 1B).

For a successful re-treatment, all of the obstructions preventing direct access to the root canals have to be removed.[29] Obstructions can take various forms, such as cast post-and-cores, separated instruments, ledges, hard pastes, and rigid obturator cores. Thus, any thorough preoperative assessment will include evaluating what is already in the canal. According to Gorni and Gagliani,[22] the variable that seems to be most significant is previous canal alteration. When comparing teeth with root-canal morphology that has been respected by previous endodontic treatment with teeth whose morphology has been altered, an almost twofold difference in healing is noted. The clinical success of

endodontic re-treatment seems to be inversely proportional to the extent of alterations in the natural course of the root canals caused by previous treatment.[22]

Conversely, any thorough preoperative assessment also will include evaluating what has not already been done within the canal. Before re-treating, each case must be evaluated for the possibility of unfilled root canals, especially teeth demonstrating anomalous anatomy.[46] In fact, Hoen40 found missed canals in 42% of re-treatment cases. Additionally, another study found missed canals in 67% of maxillary first molar re-treatments.[47] Hoen and colleagues,40 when only evaluating cases that had previous radiographically asymmetrical obturations, found and treated additional canal space 89% of the time. These studies reinforce the idea that careful case assessment is instrumental in good case selection (Figures 2A and 2B).

Re-treatments performed for criteria D and E usually have the best prognosis. When divided by reasons for re-treatment, Allen and colleagues19 found that teeth re-treated for restorative purposes alone succeeded 96.2% of the time. Other studies have shown teeth re-treated for technical inadequacies alone succeeded 94% to 98% of the time.[23,24] Ideally, a new prosthetic restoration requires a sound endodontic prognosis. Apart from the cost and effort involved, prosthetic restorations may prohibit endodontic re-treatment in the case of a future failure. Therefore, before restoration of a poorly obturated tooth, either re-treatment or follow-up should be considered.[19,46]

Regarding criteria F, it is now understood that coronal leakage is an important cause of failure of endodontic treatment.[48-51] Therefore, from a clinical standpoint, coronal exposure of the root canal obturation to saliva for a relatively short period of time might be considered an indication for re-treatment39 (Figures 3A and 3B).

Of course, endodontic re-treatment should be avoided in teeth that cannot be satisfactorily restored. Additionally, in cases with periodontal involvement, the prognosis of combined therapy should be assessed before proceeding with the re-treatment.[46]

Who Makes Re-treatment Decisions?

When treating a patient, the clinician should diagnose and manage the care of the patient appropriately, which may include referring the patient to a specialist. This is especially pertinent if one considers the varied backgrounds and knowledge bases multiple practitioners bring to dentistry. In fact, according to McCaul and colleagues,[52] the input of

various factors, including clinical experience, disparate training, and specific specialty philosophies to treatment, contribute to differences in decision-making processes among clinicians.

In spite of this disparity, the same authors showed that the endodontists, as a group, were more consistent than general practitioners and other specialists in their interpretations and treatment planning of endodontic re-treatment. One can assume that additional specialty education/training broadens the knowledge of the practitioner in diagnosis, treatment, and treatment planning.53,54 This suggests that, when treatment planning complex cases, it is prudent to use specialists.

Certainly, endodontic re-treatment can be an integral part of a very complex case. In this situation it has been shown that endodontists have a more “optimistic” attitude than general practitioners.[53,55] While there doesn’t seem to be a consensus on a definite re-treatment criterion, Kvist and Reit56 showed that endodontists above all seemed to act in terms of possible consequences, and that the more potential utility that could be produced, the more the endodontist tended to prescribe re-treatment.

Team Concept

According to the ADA Council on Scientific Affairs,1 “It is important for the clinician to provide a comprehensive assessment of, and information on, realistic outcomes of each proposed treatment modality, with or without implantation therapy. This will allow the patient to make an informed decision.” An example might be a failing anterior tooth with an existing post and crown, wherein the clinician must weigh the complexities of re-treatment against the alternative implant and the additional esthetic issues it entails. In this situation, involving the patient is a key part of the informed consent process, because managing the care of the patient often entails interfacing with other specialists, such as periodontists, orthodontists, oral/maxillofacial surgeons, prosthodontists, and endodontists.

Conclusion

There are no panaceas in dentistry. Dental implants are an extraordinary service and have opened up options never before dreamed of, but a healthy natural dentition is still the best implant. This is why re-treatment of an endodontically treated tooth also can be an

extraordinary service for the patient. Subsequently, maintaining the original dentition in a state of health should be the first alternative. As with other aspects of clinical practice, it invariably comes down to case selection. This article presents a few of the criteria to consider when treatment planning endodontic re-treatment vs extraction and subsequent implant placement. Certainly it can be a very complex issue, which is why using all the varied resources of the dental team is so imperative. According to Bader,6 "there is no generic answer to this clinical issue, and every patient, indeed every site, must be examined on an individual basis."

Your patient deserves the best information and treatment the profession has to offer. It is the primary dentist's responsibility to use the dental team to that end.

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Quiz3

1. What has become the new paradigm for the dental profession?
a. reasonable and customary treatment
b. evidence-based care
c. Internet-based discussion groups
d. treatment within community standards

2. The wide range of reported success rates is the result of:
a. case selection.
b. variances in success criteria.
c. variances in failure criteria.
d. all of the above

3. Seltzer used what term to describe something that “satisfies the need of the clinician, in-asmuch as the retention of the tooth in function is the ultimate goal of endodontic therapy”?
a. adequate clinical function
b. late healing
c. radiographically reasonable
d. contemporary success

4. The primary impact restorations have on implants is:
a. occlusal shock absorption.
b. that the orientation of the restoration must not change.
c. physical load.

6. A strict definition for a failing implant:
a. involves morbidity.
b. involves periimplantitis.
c. involves occlusal disharmony.
d. does not exist.

7. Endodontic retreatment may be indicated for:
a. failures only.
b. successes only.
c. both failures and successes.
d. neither failures or successes.

8. When the diagnosis of endodontic failure has been made, what modes of therapy exist to resolve the problem?
a. conservative retreatment
b. apical surgery
c. extraction
d. all of the above

9. Failure of endodontic re-treatment in most cases is a result of:
a. obturation overfill.
b. microorganisms.
c. coronal shaping excesses.
d. missed canals.

10. It is important for the clinician to provide a comprehensive assessment of, and information on, realistic outcomes of

d. that the screw must remain tight.

5. Vire examined various reasons for endodontic failure and concluded what percent of endodontic failures are caused by failures other than the root canal therapy itself?

a. 7.9%

b. 13.3%

c. 27.8%

d. 91.4%

each:

a. proposed treatment modality.

b. procedure that must be referred to a specialist.

c. procedure that the dentist can do.

d. procedure that the patient can afford.

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