Treatment planning: Retention of the natural dentition and the replacement of missing teeth

By Scott L. Doyle, DDS

Preservation of the natural dentition is the primary goal of dentistry. Published surveys indicate that patients generally value prevention in an effort to save their natural dentition in favor of extraction whenever possible.1–4 Significant technological and biologic improvements have been made toward achieving this goal. When making long-term retention of natural teeth more attainable, patients should be involved in the decision-making process regarding the maintenance and restoration of their oral health and function. It is essential to employ an evidence-based, interdisciplinary approach that addresses the interests of the patient when determining the best possible course of treatment. In July 2004, the American Association of Endodontists, in collaboration with the American College of Prosthodontists and the American Academy of Periodontology, hosted a two-day Joint Symposium titled “Teeth for a Lifetime: Interdisciplinary Treatment Planning: Success.” Approximately 375 general dentists and specialists assembled in Chicago to learn about preserving the natural dentition.

The educational program included evidence-based presentations on advanced regenerative techniques, implantology, minimally invasive restorative methods and best practices for interdisciplinary treatment planning. Dr. Alan Gubkin, chair of the 2014 Joint Symposium Planning Committee, concluded that the current evidence directs clinicians to consider saving the natural dentition as the first option when developing treatment plans. Dental implants are one of the most significant advancements in contemporary dentistry. This innovation has profound effects on endodontic, periodontic and prosthodontic treatment planning for the rehabilitation of edentulous spaces and teeth with an unfavorable prognosis.5–10 Implant-supported restorations minimize unnecessary preparation of intact abutment teeth and allow fixed prosthetic alternatives when suitable abutments are absent. With appropriate usage and case selection, implant dentistry provides a viable option for the replacement of missing teeth.11 This has been an increasing trend toward replacing diseased teeth with dental implants. Often, an inadequate or inappropriate indication for tooth extraction has resulted in the removal of teeth that may have been salvagable.12 Teeth compromised by pulpal or periodontal disease retain value and should not be extracted without thoroughly evaluating restorability and potential treatment therapies.

A recent systematic review published in the Journal of the American Dental Association highlights a key question: “Is the long-term survival rate of dental implants comparable to that of periodontally compromised natural teeth that are adequately treated and maintained?”13 Nineteen studies with a follow-up period of at least 15 years were included in the analysis. The results show that implant survival rates do not exceed those of compromised but adequately treated and maintained teeth. These findings support other studies comparing long-term survival of implants and natural teeth, providing an important message. Periodontally compromised teeth can be retained with quality treatment and appropriate maintenance. Therefore, it may be advisable to post-treatment implant consideration for the periodontally susceptible patient to fully utilize and expand the capacity of the natural dentition.

Treatment planning options

A key focus of the Joint Symposium involved treatment planning decisions regarding endodontic treatment and implant therapy. Should a tooth with pulpal disease be retained with root canal treatment and restoration, or be extracted and replaced with an implant-supported restoration? This assessment involves a challenging and complex decision-making process that must be customized to suit the patient’s needs and desires.14 The topic has received considerable attention in the literature, the media and at dental continuing education courses. Endodontic treatment and implant therapy should not be viewed as competing alternatives, rather as complementary treatment options for the appropriate patient situation. Treatment planning is indicated for restorable, periodontally sound teeth with nonrestorable conditions or apical pathosis. Endodontic treatment on teeth with nonrestorable crowns or teeth with unacceptable periodontal conditions is contraindicated, and other options such as implant placement should be considered.15

When making treatment decisions, the clinician should consider factors including outcome assessment, local and systemic case-specific issues, costs, the patient’s desires and needs, potential adverse outcomes and ethical factors.16

Outcome assessment: Success and survival

Treatment outcomes play a key role in the assessment of different treatment options. Patients often ask whether a procedure is going to be successful or not. This question can be challenging for a clinician to answer due to the variety of reported outcomes in the literature.17 There are differences in the methodology and criteria used to evaluate the outcomes for root canal treatment and implant prosthodontics, which makes comparisons between success rates difficult, if not impossible.18

Endodontic studies have historically used “success” and “failure” as outcome measures and have focused on a strict combination of radiographic and clinical criteria. In contrast, the implant literature has primarily reported “survival,” i.e., the implant is either present or absent. Therefore, implant studies that solely evaluate survival as an outcome measure will likely publish higher success rates than endodontic studies that rely on biologic healing and factors related to the entire restored tooth. To establish more valid and less biased comparisons, the same outcome measures should be used. A more patient-centered measure is to compare the outcome of survival, which is considered to be an asymptomatic tooth/implant that is present and functioning in the patient’s mouth.22,23 A more patient-centered measure is to compare the outcome of survival, which is considered to be an asymptomatic tooth/implant that is present and functioning in the patient’s mouth.22,23 Multiple large-scale studies including millions of teeth have used survival to assess the outcome following root canal treatment. An investigation using an insurance database of more than 1.4 million root canal-treated teeth demonstrated that 97 percent were retained within a eight-year follow-up period.44 Other studies show similarly high survival rates (Table 1).43 An epidemiological approach allows for the assessment of tooth retention in a large sample of patients experiencing actual care in private practices. Systematic reviews45 and controlled studies from academic settings complement the previous findings. Two prospective trials each reported 95 percent survival rates at four years46 and four to six years retention at initial root canal treatment.

Predictable tooth retention: Nonperiodontal root canal treat- ment and restoration

The majority of endodontic treatment is performed by general dentists with a high degree of success.24 For complex cases, referral to an endodontist with additional training and expertise may result in more favorable outcomes25 and improved decision making.24,25 Interdisciplinary care is important for the management of periodontally compromised teeth. The restorative dentist plays a significant role in the outcome of periodontally compromised teeth. The restorative dentist plays a significant role in the outcome of periodontally compromised teeth. The restorative dentist plays a significant role in the outcome of periodontally compromised teeth.

Table 1. Survival rates following initial nonsurgical root canal treatment. (Table Provided by American Association of Endodontists)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Number of Teeth</th>
<th>Follow-up (years)</th>
<th>Survival (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shabahang and Renton (51)</td>
<td>143,636</td>
<td>8</td>
<td>97</td>
</tr>
<tr>
<td>Durr et al. (32)</td>
<td>135,508</td>
<td>8</td>
<td>97</td>
</tr>
<tr>
<td>Lazzarini et al. (34)</td>
<td>48,013</td>
<td>3.5</td>
<td>94.4</td>
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Comparative studies: Endodontically treated teeth and single-tooth implants

Large-scale systematic reviews have addressed the relative survival rates of endodontically treated teeth and single-tooth implants. The Academy of Operative Dentistry conducted a meta-analysis using 15 studies (approximately 52,000 teeth) showing endodontically treated teeth and 51 studies (approximately 12,000 implants) on single-tooth implants. The outcome data demonstrated no difference in survival rates between the two groups during any of the observation periods.47 Another systematic review supported findings from the American Academy of Endodontics that compared the outcomes of endodontically treated teeth with those of a single-tooth implant-recessed crown, fixed partial denture and treatment options for extraction. At 97 percent, the long-term survival rate was essentially the same for endodontically treated teeth and implant therapy. Both options were superior to extraction and replacement of the missing tooth with a fixed partial restoration.
In systemic and to local factors, it is critical to include the patient’s concerns during treatment planning. Common patient-centered factors include costs, treatment planning decisions, all of which must be in the best interest of the patient. Based on similar survival rates, the decision to treat a compromised tooth endodontically or replace it with an implant must be based on factors other than tooth outcome anymore. Several factors influence the decision-making process. The following list outlines some of the most common factors that should be considered in making this treatment decision.

**Systemic factors**

- There are few medical conditions that directly affect endodontic treatment outcomes. Risk factors that may be associated with decreased survival of root canal-treated teeth include smoking, diabetes, and poor oral hygiene.
- Caries risk and oral hygiene:
  - Patients taking antidepressants or antipsychotics (i.e., benzodiazepines) may have an increased risk of adverse outcomes associated with endodontic treatment.
- Ethanol consumption, smoking, and poor oral hygiene.

**Local factors**

- Caries risk and oral hygiene:
  - Restorability assessment: removal of the restoration, adequate access.
- Strategic nature of the tooth as it relates to the comprehensive restorative plan.
- Occlusion and parafunction.
  - Proximity to anatomical structures (e.g., sinus, nerve, eye, nerve, etc).
- Implant esthetics in the anterior region may be challenging.

**Endodontic treatment options**

The list of potential factors for peri-implantitis or implant failure is extensive. It includes systemic diseases (e.g., diabetic retinopathy, chronic drug or alcohol consumption, smoking, periodontal disease, radiation therapy, diabetes, etc.) and local factors (e.g., mechanical and esthetic/phonetic). In addition, the incidence of post-treatment complications requiring subsequent treatment intervention is significant. Postoperative care can impact patients’ overall satisfaction, lost wages and unforeseen costs.

Clinicians should consider the patient’s preferences related to comfort, and esthetics. Tooth loss is associated with an increased risk of subsequent treatment failure, and surveyed patients express a clear desire to save their natural dentition whenever possible.

**Ethics and interdisciplinary consultation**

Clinicians are ethically bound to inform patients of all relevant treatment options, explain the risks and benefits associated with each available treatment option, and obtain informed consent before initiating treatment. A thorough history and physical examination should be conducted in an impartial manner.

**Case report**

A case report (Figs. 7a–h) demonstrates an alternative treatment option for a patient to save a natural tooth. A 79-year-old female presented to an endodontist’s office with a complaint of persistent pain to tooth #73. The patient had a history of root canal treatment and coronal restoration. A thorough endodontic evaluation including CBCT, led to the diagnosis of previously treated tooth #73 with symptomatic apical periodontitis. A detailed explanation of the risks and benefits associated with all treatment options was provided. The patient expressed a strong desire to save her teeth and consented to endodontic retreatment. The root was extracted, ultrasonically prepared and filled with mineral trioxide aggregate. The tooth was replanted. The patient remained asymptomatic with her treatment.

A recent systematic review and meta-analysis revealed a mean survival rate of 78.9 percent for intentional re-plantation. With careful case selection, intentional replantation may allow for a predictable, cost-effective treatment for teeth that do not heal following endodontic treatment. Clinicians are advised to explore all options before recommending extraction. Refer to an endodontist can aid in the retention of a compromised tooth.

**Conclusion**

Patients are living longer; therefore, preservation of the natural dentition is more important than ever. Helping patients maintain their “Teeth for a Lifetime” is the fundamental goal of dentistry and often aligns with the desires of the patient. A wide range of endodontic procedures result in a high level of tooth retention and patient satisfaction. Large-scale studies provide strong support that the restored endodontically treated tooth offers a highly predictable, long-term approach to preserving “nature’s implant”—a tooth with an intact periodontal ligament. Thus, excellent endodontic treatment followed by an immediate restoration of equal or greater precision can be given to patients service and function while maintaining their esthetics for years to come. Clinicians indicate that the high survival rates reported for teeth treated with endodontic retreatment can be achieved in an informed choice regarding all replacement options. If a tooth has a questionable prognosis, the endodontic specialist becomes a central player in the replacement treatment planning team. The endodontist has experience with various replacement options that have potential to preserve the natural dentition. Consultation regarding a questionable tooth is often in the patient’s best interest prior to considering extrac- tion. If a tooth is categorized as questionable or unfavorable in multiple areas of evaluation, endodontic retreatment should be considered after appropriate consultation with an appropriate specialist. Only then is the decision to extract an informed choice. Extraction is an irreversible treatment option, and re-implantative therapy, dental implants provide an excellent option to replace missing teeth (Figs. 6a, b).

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