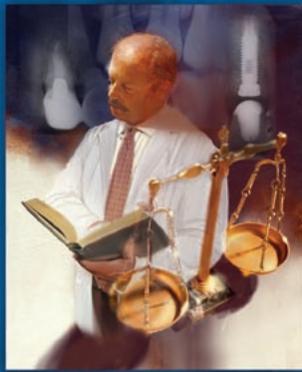


ENDODONTICS



*Colleagues for
Excellence*

Summer 2007

*Treatment Planning: Comparing
the Restored Endodontic Tooth
and the Dental Implant*



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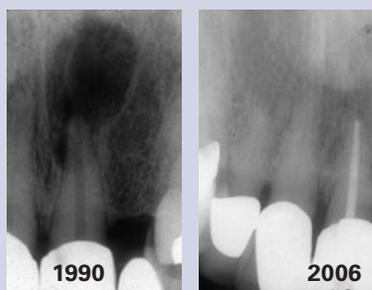


Fig 1. Pre- and post-operative radiographs of a central incisor treated with nonsurgical root canal therapy. Radiographs courtesy of Dr. Louis Rossman.

It was the fall of 1990, gasoline cost about \$1 per gallon, the Academy Award went to *Dances With Wolves* and Mrs. Smith received a nonsurgical root canal treatment on her maxillary central incisor. Spin the calendar forward by 16 years to 2006. Gasoline cost about \$3 per gallon, the Academy Award went to *Crash* and Mrs. Smith returned to her endodontist for a recall appointment. As seen in the radiographs in Figure 1, Mrs. Smith has experienced what millions of other dental patients have received—successful, long-term outcomes from endodontic treatment.

New studies provide compelling evidence that root canal treatment affords excellent clinical outcomes for our patients. In this issue of the *ENDODONTICS: Colleagues for Excellence* newsletter, we will explore these studies and describe factors that contribute to this high level of clinical success.

Predictable Success of Nonsurgical Root Canal Treatment

One useful measure of success is the survival of a tooth after root canal treatment. This allows

one to evaluate outcomes from practitioners delivering care in a private practice setting, which compliments findings from other studies conducted in an academic setting. For example, do you accept Delta Dental insurance in your practice? If so, your patients may have been included in a recent nationwide survey of outcomes of root canal treatment in patients insured by Delta Dental. This massive study of more than 1,400,000 root canal-treated teeth demonstrated that 97 percent of root canal-treated teeth were retained within an eight-year follow-up period (1). Thus, **actual** clinical outcomes of patients receiving care from practicing dentists across the entire United States provide dramatic evidence that endodontic treatment saves natural teeth with an extremely high level of success. These results are illustrated in Figure 2. Many clinical treatments are advocated on the basis of research that studies perhaps 10-100 patients. No other dental treatment has ever been studied on more than **one million** patients, and these results confirm the outcomes experienced by Mrs. Smith—endodontic treatment provides outstanding clinical success for our patients.

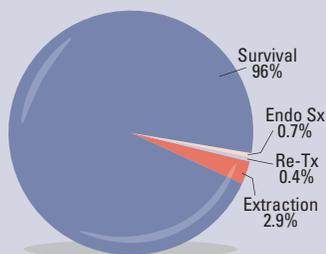


Fig 2. Pie chart illustrating the outcomes of 1,463,936 root canal-treated teeth with an eight-year follow-up. Data is from Delta Dental insurance database and represent patients from all 50 states of the United States. (Source: Salehrabi and Rotstein. **Endodontic treatment outcomes in a large patient population in the USA: an epidemiological study.** *Journal of Endodontics* 2004; 30(12):846-50. Reproduced with permission.)

Another study of 44,000 patients confirms these results and provides important lessons in our understanding of successful root canal treatment. In this study, 94 percent of the root canal-treated teeth were retained with an average three-and-a-half-year follow-up period (2). Again, a large study using outcomes from practicing dentists in the United States reveals the great benefits afforded by nonsurgical endodontic treatment. However, an important lesson emerges from this study. Teeth that had no permanent restoration placed after root canal treatment were about two to four times more likely to be extracted than teeth that had permanent restorations, and this result is similar to that observed in the preceding study (Figure 1). Other studies have confirmed this observation that permanent restorations improve the outcome of root canal treatment (3-5).

Thus, saving the natural tooth requires both good endodontic treatment and follow-up restorative treatment. This is a central theme of this newsletter—by combining the expertise of outstanding endodontic care and subsequent restorative treatment we can save our patients' natural teeth with years of satisfaction and improved quality of life. Indeed, it is not merely the presence

of a restoration, but instead, it is the quality of the permanent restoration that serves as an important predictor of long-term success of root canal treatment (3, 4). Moreover, the quality of the endodontic treatment is important, with greater success rates and patient satisfaction observed when endodontists perform either nonsurgical (6, 7) or surgical (2) endodontic procedures. Thus, high-quality endodontic and restorative procedures play an important role in obtaining the high level of success that our patients expect and deserve (8).

A patient's natural smile is a thing of beauty and quality of life is an important benefit of all dental care. Large-scale surveys of hundreds of post-endodontic patients have demonstrated that endodontic treatment not only saves the natural tooth, resulting in more than 97 percent of surveyed patients reporting being satisfied with their endodontic treatment, but also significantly improves their quality of life (7). Our treatment choices should be based not only on the expected overall benefit to oral health, but should include improvements in quality of life. Thus, quality of life is an important factor when considering alternative procedures such as single-tooth implants, where both esthetic problems (9, 10) and multiple repair appointments (8, 10) can impact this important patient issue (Figure 3).



Fig 3. Esthetic problems occurring with placement of dental implants in the "esthetic zone." Photograph courtesy of Dr. David Cagna.

Treatment Planning Decisions: Nonsurgical Root Canal Treatment or Implants?

A goal of evidence-based dentistry is to establish appropriate treatment decisions based on the best available clinical evidence, the individual factors of each particular case, the clinician's expertise and the patient's informed consent. Dental treatment planning decisions often include either saving a tooth by endodontic treatment and restoration, or extracting the tooth and replacing it with a single-tooth implant. Until very recently, there has been little evidence directly comparing survival of post-endodontically treated teeth with the single-tooth implant. However, a recent study by Doyle and colleagues has compared the outcomes of 196 post-endodontically treated teeth with 196 matched, single-tooth implants, with both treatments provided in the same setting (8). Interestingly, both groups had 94 percent survival rates. The survival curves for these two groups are provided in Figure 4. Even though the survival rates were similar, the implant group experienced a much greater incidence of post-operative complications (e.g., prosthetic repairs, etc.) (8).

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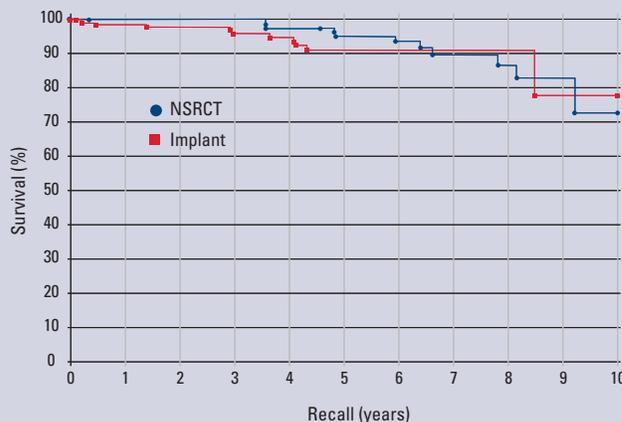


Fig 4. A matched-case comparison of survival rates after treatment with either a restored endodontically treated tooth (n=196) or a restored single-tooth implant (n=196) performed at the same institution. (Source: Doyle et al. **Retrospective cross sectional comparison of initial non-surgical endodontic treatment and single-tooth implants.** *Journal of Endodontics* 2006;31. Reproduced with permission.)

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A recently published meta-analysis provides a detailed examination of the relative survival rates of single-tooth implants versus endodontically treated and restored natural teeth. This study (11) reported the results of a comprehensive review of the literature using a database and search strategy organized by the Academy of Osseointegration, which was presented at an international consensus meeting entitled the State of the Science on Implant Dentistry in August 2006. Three international databases (MEDLINE, EMBASE and PubMed) were searched for studies on the survival of single-tooth implants and restored endodontically treated teeth. The studies that met the inclusion criteria included 57 studies (totaling ~12,000 implants) on single-tooth implants and 13 studies (totaling ~23,000 teeth) about restored, root canal-treated teeth. Once again, the outcomes for the two treatments were equivalent. There was **no difference** between the implant and endodontically treated teeth in any of the observation periods. The survival rates for these two groups are shown in Figure 5. Based upon this analysis, the authors concluded that "...the decision to treat a compromised tooth endodontically or replace it with an implant must be based on factors other than treatment outcome" (11).

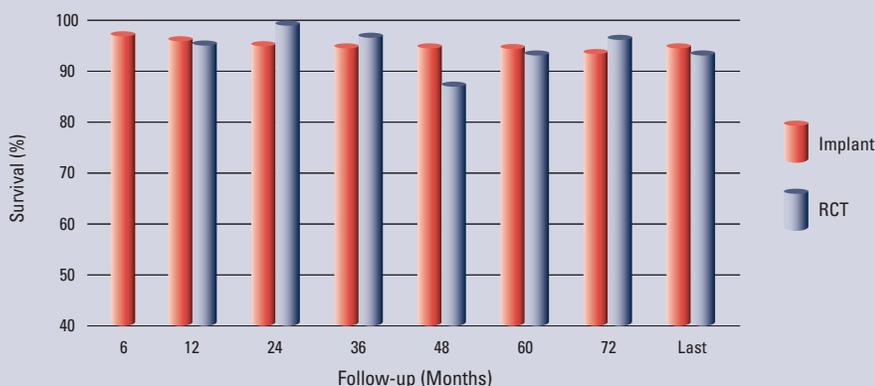


Fig 5. Derived from a meta-analysis comparison of the survival rates of the restored endodontically treated tooth and the restored single-tooth implant. (Source: Iqbal and Kim. **For Teeth Requiring Endodontic Treatment, What Are the Differences in Outcome of Restored Endodontically Treated Teeth Compared to Implant-Supported Restorations?** *International Journal of Oral Maxillofacial Implants* 22(Suppl):96-119, 2007.)

If the results from these thousands of studied patients indicate that the restored endodontically treated tooth results in similar survival rates as the restored implant, then other factors should be considered in making treatment decisions. Table 1 provides an overview of case-specific factors that should be considered in making this treatment decision.

Table 1
A Selected List of Local and Systemic Factors to Consider in Treatment Planning

Factor	Example
Location of tooth	<ul style="list-style-type: none"> • The “esthetic zone,” especially in the anterior maxillary region, often represents a challenge for implants (9) • Implant survival may be lower in the posterior maxilla compared to mandible (12) • Proximity to anatomical structures (sinus, nerve canals, etc.)
Quality of bone	<ul style="list-style-type: none"> • Poor bone quality reduces survival of dental implants (13) • Implants tend to have greater survival in host bone compared to graft bone (14) • Osteoporosis is associated with reduced implant survival, particularly in post-menopausal females without estrogen replacement (15)
Periodontal status and tissue type	<ul style="list-style-type: none"> • May require both periodontal and endodontic treatment to save the tooth (16), or the tooth may have hopeless periodontal condition • Periodontally hopeless teeth may require extraction • Poor hygiene is associated with reduced survival of implants (17) • Evidence of vertical or certain horizontal root fractures may require extraction of the tooth
Restorability	<ul style="list-style-type: none"> • Endodontic therapy may be required for retention of restoration • May require consideration of extraction if tooth cannot be restored (16)
Systemic factors	<ul style="list-style-type: none"> • Smoking reduces survival of implants (18) and possibly endodontically treated teeth (19) • Saving a tooth by endodontic treatment may be indicated in certain patients taking bisphosphonates (20) to reduce the risk of bisphosphonate-associated osteonecrosis of the jaw • Diabetes may reduce survival of implants (21) and reduce periradicular healing in endodontically treated teeth (5, 22) • Hypertension is associated with reduced survival of endodontically treated teeth in the American Indian population (5)

In addition to a consideration of local and systemic factors, it is critical to include the patient’s concerns as part of informed consent. Common patient factors include costs, potential for adverse outcomes and satisfaction with treatment. In terms of costs, a recent analysis of 2005 insurance data concluded that restored single-tooth implants cost about 75-90 percent **more** than similarly restored endodontically treated teeth (23). Thus, the restored endodontically treated tooth offers considerable economic advantages to the patient. As described above, relatively few studies have directly compared the restored endodontically treated tooth with the restored single-tooth implant. However, in one study of about 400 patients, the restored single-tooth implant required nearly five times more post-operative interventions than similarly restored endodontically treated teeth. This increased post-operative care directly impacts patients in terms of additional visits, lost wages, unforeseen costs, etc. Other adverse events can occur during implant surgery, including paresthesia, hematoma, hemorrhage and devitalization of adjacent teeth (10). Finally, surveys indicate high (97 percent) levels of patient satisfaction with a positive impact on quality of life after endodontic treatment (7).

Endodontic treatment has been shown in multiple studies to dramatically and significantly reduce pain. In one study of 558 patients, endodontic treatment combined with only **placebo** tablets resulted in an 80 percent reduction in severe pre-operative pain within 48 hours (24). This study, as well as many other randomized clinical trials, has established that endodontic treatment

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reliably reduces pre-operative pain. Moreover, many patients are fearful of surgical procedures; this fear is sufficient enough to cause them to withdraw from studies, even when the implant is provided free of cost (25). Consequently, patient-related factors such as cost, fear and immediate pain relief should be considered when providing informed consent.

A final and important consideration in making treatment decisions is that of ethics. Treatment planning is a complex process that should include a frank consideration of treatment alternatives that will provide maximum benefit to the patient. The clinician should always place the best interest of the patient at the forefront. Should it be necessary, experts from the dental team may need to be called upon to assist the clinician in rendering the highest quality of care allowing for the best possible outcomes in each case. Adjuncts for consideration of case difficulty and assessment for treatment versus referral have been reviewed in prior issues of this newsletter, and are available at www.aae.org/dentalpro/educationalresources/guidelines.htm.

Conclusions

Recent, large-scale studies involving literally millions of patients provide strong support that the restored endodontically treated tooth offers a highly predictable, long-term way of saving nature's "implant"—the tooth. Thus, excellence in endodontics followed by an immediate restoration of equal quality promises to give our patients service and function while maintaining their esthetics for years. Both matched-pair study designs and meta-analyses indicate that these high survival rates are similar to those reported for the restored single tooth implant. Therefore, in making treatment planning decisions, the clinician must consider additional factors including local and systemic case-specific issues, economics, the patient's desires and needs, esthetics, potential adverse outcomes and ethical factors. Although this process is complex and new information is still emerging, it is clear that appropriate treatment must be based with the patient's best interests and long-term quality of life at heart.

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This issue of the *ENDODONTICS: Colleagues for Excellence* newsletter is available online at www.aae.org with the following **exclusive bonus material**:

- Full-Text Article: Salehrabi R, Rotstein I. Endodontic treatment outcomes in a large patient population in the USA: an epidemiological study. *J Endod* 2004;30(12):846-50
- Full-Text Article: Doyle S, Hoidges J, Pesun I, Law A, Bowles W. Retrospective cross sectional comparison of initial non-surgical endodontic treatment and single-tooth implants. *J Endod* 2006;31
- "Ask the Author" Discussion Board for all of your questions and comments

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