

ENDODONTICS



Colleagues for Excellence

PUBLISHED FOR THE DENTAL PROFESSIONAL COMMUNITY BY THE AMERICAN ASSOCIATION OF ENDODONTISTS

Fall/Winter 2003

Contemporary Endodontic Treatment... *Its Role in Retaining Our Patients' Natural Dentition*

Welcome to *ENDODONTICS: Colleagues for Excellence*...the newsletter covering the latest in endodontic treatment, research and technology. We hope you enjoy our coverage on the full scope of options available for patients through endodontic treatment and conventional prosthodontics, and that you find this information valuable in your practice. Future issues of *ENDODONTICS* will keep you up to date on the state of the art and science in endodontic treatment.

The dental profession's most important goal is to maintain the health and integrity of patients' dentition through prevention and, when necessary, reconstructive treatment. Throughout the last decade, dentistry witnessed a biomechanical revolution in endodontics. This revolution provided the public with treatment options never before available to them.

Endodontic treatment and retreatment, as well as diagnosis and endodontic surgery, achieve new levels of success and predictability. The development of nickel-titanium files, coupled with improvements in devices, such as the apex locator and the incorporation of microscopy and microsurgical instruments, created a whole new paradigm in treatment. These advances place endodontic care at the forefront as the primary treatment of choice for tooth retention when the dental pulp is compromised or when the removal of the dental pulp would facilitate other reconstructive dental treatment.

The purpose of this issue of *ENDODONTICS: Colleagues for Excellence* is to provide clinicians with an appreciation of the full scope of options available for their patients through endodontic treatment and conventional prosthodontics. When teeth cannot be successfully treated endodontically, conventional prosthetic restorations, *i.e.*, crowns, bridges and implants, are one of the significant alternative treatment plans for patients who can no longer retain their natural dentition. Dental health care providers should accurately educate the public on the value of retaining natural dentition and allay concerns when root canal treatment is not a viable option.

Patients find tremendous value in retaining their natural dentition. Continued proprioception and normal physiological

movement during functions, the ability to withstand the normal forces of mastication, arch and soft tissue continuity, and overall esthetics are but a few benefits of retention. These benefits are especially true when there are sufficient amounts of sound dentin available for the rehabilitation of teeth through the use of sophisticated and technologically proven restorations and restorative materials. Techniques of crown lengthening and tooth rebuilding are reliable, predictable and expeditious in the presence of a sound and stable periodontium.

One of the major advantages of employing endodontics with fixed and removable prosthetics is the rapid return of patients' compromised dentitions to full function and esthetics. This rapid return is in contrast to a more extended treatment protocol employing implants with the use of provisional restorations, while waiting for osseous integration. The endodontic-restorative continuum is a treatment modality that usually minimizes time spent in treatment and presents a cost-effective approach to optimal treatment.

The advent of dental implants presents treatment options that practitioners have not been able to attain in the past. However, research on the long-term efficacy and success of dental implants is still ongoing. Practitioners should have a comprehensive understanding of the needs of patients and a full appreciation of what endodontic therapy and dental implants bring as modern dental therapies. Patients should be fully educated so they understand the benefits and drawbacks of all treatment plans presented, as well as the length of treatment, projected outcomes and cost considerations.

Treatment Choices and Outcomes

Modern endodontics provides a greatly increased scope of treatment modalities available to the dental practitioner. Endodontic treatment options now offer patients a wide range of choices for tooth retention. These plans include initial nonsurgical root canal treatment and retreatment; surgical intervention such as periradicular surgery, perforation repairs, root or tooth resections with the retention of viable and sound root structures; root submergence for ridge stability; and intentional replantation or autotransplantation. Practitioners are able to manage the challenges of various types of root resorption predictably, whether iatrogenic or secondary to trauma, thereby retaining a sound dentition. Adjunctive services of significant value that enhance tooth retention include root/tooth extrusion and crown lengthening. The test of time still advocates that the best “implant” is a natural root.

Studies and research have consistently shown that even outstanding root canal treatment will not be successful when covered by a leaking coronal restoration. A higher level of tooth retention results only when there is excellent synergy between the restorative and endodontic treatments. With a commitment from patients to a daily regimen of home care that promotes a healthy and sound periodontium, teeth can be retained many years in symptom-free function at a 90 percent or greater level of success. Without a natural periodontal ligament, this challenge to the patient escalates dramatically.

The literature strongly suggests that persistent intraradicular or secondary infections, and in some cases extraradicular infections, are the major causes of failure in both poorly and well-treated root canals. Some patients may not heal even with meticulous and conscientious endodontic treatment, often for unknown reasons. Practitioners can offer these patients a multitude of treatment options, such as nonsurgical retreatment or surgical intervention, or in more compromised cases, intentional replantation or autotransplantation. The literature also supports retreatment of these cases when periradicular radiolucencies and clinical signs and/or symptoms are present. Subsequent survival rates are over 90 percent.

Tooth retention in conjunction with conventional prosthetics, as opposed to an extraction in favor of a conventional/implant-supported prosthetic replacement, is still a desirable goal. Teeth that may be perceived as “endodontic failures” or that lack healing can still be saved. Practitioners and their patients can benefit from a team approach to determine the cause of refractory endodontic cases and to provide successful treatment.

Assessment of Teeth for Possible Removal and Artificial Replacement

Tooth retention decisions involving poor prognoses usually include the following considerations:

- Need to manage a compromised dental pulp in the presence of severe periodontal disease, deep carious or fractured tooth margins;
- Ability of a particular tooth or teeth to serve as abutments for fixed or removable prostheses if treated endodontically;
- Quality of prior endodontic treatment and the ability to retreat/perform surgery and retain;
- Ability to repair or salvage roots/teeth with iatrogenic defects; and/or
- Presence of teeth with suspected cracks or fractures.

Some of these situations present insurmountable obstacles to successful endodontic treatment. In these situations, practitioners should advise patients about extraction. Patients have several good options available for tooth replacement when extraction is the treatment of choice. Both the endodontist and the referring dentist should explain these options to patients to facilitate informed choices. At this point, it may be necessary to refer these patients to other specialists, *i.e.*, periodontists, prosthodontists or orthodontists, to meet the unique needs of the clinical situation presented.

Treatment Options When a Tooth Cannot be Retained

The following options should be considered in the treatment planning process when endodontic, periodontal and restorative treatments cannot be used to retain a natural tooth:

- Replacement with a tooth-supported, fixed prosthesis (fixed partial denture);
- Replacement with a removable prosthesis or modification of an existing prosthesis (removable partial denture);
- Replacement with an implant-supported prosthesis (crown/fixed partial denture);
- Replacement by transplanting a nonfunctional (impacted) third molar tooth;
- Orthodontic movement to reposition teeth; or
- No replacement, as in the case of a second or third molar where there is no opposing dentition.

The prognosis for tooth replacement with the listed options varies significantly within the treatment plan and the status of the remaining dentition. For example, placement of a fixed prosthesis will require preparation

of the adjacent teeth. Conventional prosthetics offer clinicians many conservative choices to conserve tooth structure, a removable prosthesis, etched retained fixed partial dentures, partial veneer prosthesis, etc. Before initiating treatment, practitioners should evaluate the pulpal status of each tooth serving as an abutment.

Alternative treatment choices such as an implant can create challenges for both practitioners and their patients. Implants can fail biologically, functionally or iatrogenically, and may require pretreatment sinus lift or ridge augmentation to alter ridges that are too narrow or have insufficient bulk to support an implant. Another important cause for concern is the possible loss of proprioception. Additional complications to choosing an

1990s, the terms “success” and “failure” were in vogue with endodontic treatment. Now choices include “healed,” “tendency to heal,” “not healed” and “regression,” because patients can relate to the process of disease, treatment and healing. However, mere changes on a radiograph cannot determine the extent of the periradicular healing process. The absence of clinical signs and symptoms is not an accurate barometer for healing. Regrettably, this concept is used on a global basis for case assessment and determination of further treatment or no treatment at all.

An assessment of past “success-failure” studies in endodontics is difficult because of multiple variables. These studies have erroneously included failures due to

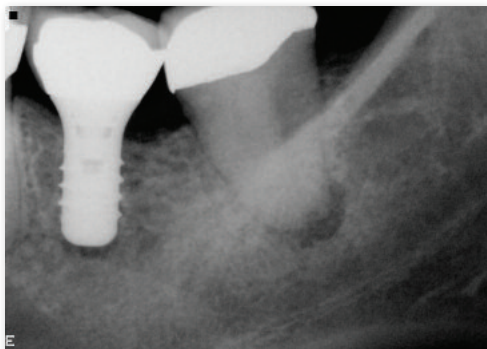


Fig 1: A preoperative radiograph shows presence of a periradicular pathosis in the mandibular left second molar. A dentist initially recommended extraction and replacement of this tooth with an implant. The patient requested a second opinion from an endodontist who found the tooth to be treatable.

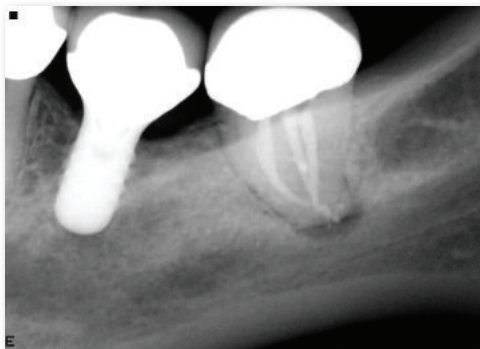


Fig 2: An immediate postoperative radiograph of the tooth following root canal therapy.

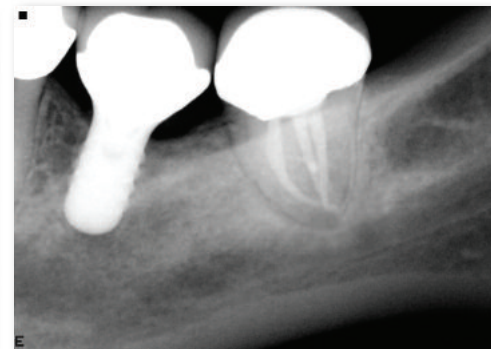


Fig 3: A postoperative radiograph six months later demonstrates periradicular healing following successful root canal treatment.

implant may include pain or sensitivity, mobility or periodontal disease that affects the implant. Implants and conventionally restored natural teeth share many of the same post-treatment complications, including pain or sensitivity, mobility and periodontal disease. Implants have a unique complication—the loss of proprioception leading to occlusal over-load complications.

If circumstances for a transplant were optimal, a surgical extraction may be indicated with an accompanying surgical preparation of the recipient site. Finally, with some patients, replacement of the tooth is not an option for various reasons, and treating dentists should recognize and respect this option. All treatment possibilities, including no treatment, should be explained to patients objectively, with the option to seek additional opinions from other experts.

Risk Assessment of Tooth Retention Versus Removal and Replacement

Parameters for assessing the outcomes for the entire range of endodontic treatment have been limited primarily to clinical and radiographic criteria. Until the

periodontal disease, root fractures, inappropriate restorations and the presence of coronal leakage. *These are not endodontic failures.* Historically and contemporarily, without substantiation, endodontically treated teeth have been considered “weak links” in the restorative-periodontal continuum.

However, contemporary scientific studies on the structure of dentin and the impact of endodontic procedures do not support these beliefs. The key is to combine endodontic and prosthodontic treatment to retain the greatest amount of sound dentin. When the studies are considered “en masse,” endodontic treatment results in more than a 90 percent success rate when microbial challenges are eliminated through thorough canal cleaning, shaping and three-dimensional obturation; coronal leakage is negated through proper, *sound* restorations; and the patient practices preventive oral self care. Outcomes following more contemporary treatment modalities and incorporating biologically based parameters of care are presently being determined to provide further predictable directives for the practitioner.

Endodontic treatment and tooth retention, especially when endodontic treatment and reconstructive dentistry are indicated, should be selected. By not choosing this option, the patient can incur an increased potential for dental complications, further damage to oral tissues, a significant time without full function, a less than satisfactory outcome and increased costs. The 10-year survival rate for conventional prosthodontic treatment and those teeth treated endodontically are the same. Removable prostheses have a significantly poorer prognosis for the abutment teeth adjacent to the edentulous space.

While survival rates are comparable to endodontic treatment with the placement of some types of implants, these rates are not true for all designs and all areas of the mouth. Complications associated with the placement of implants rarely exist with quality endodontic services. However, potential complications could include:

- paresthesia (numbness);
- mechanical trauma to bone and bone loss;
- perforations of or intrusions into vital anatomical structures;
- infections;
- implant and superstructure breakage;
- inappropriate placement and inability to restore;
- premature loading followed by lack of healing/integration and implant mobility; and/or
- loss of proprioception.

Multiple, lengthy visits are required, along with longer healing periods and increased costs that are not likely borne by third-party insurers. Most importantly, no consensus exists on what constitutes implant survival versus true success, and many studies that extol high rates of success can be misleading.

Currently, there is a lack of prospective, randomized clinical trials in all areas of dentistry, including tooth retention incorporating endodontic services versus tooth removal and replacement by various means. Direct comparison of tooth retention rates versus tooth replacement rates with any type of restorative modality would essentially be comparing “apples to oranges.”

Patients would benefit from practitioners considering the entire range of available treatment options. These options should be based on sound biological principles and individually tailored treatment plans that consider patients’ best interests and preferences, and deliver the quality of care that will result in the highest level of success for the patients.

Because many important and integrated concepts have been addressed in this issue of ENDODONTICS: Colleagues for Excellence, the AAE encourages readers to review the enclosed reading list to obtain further information or support for the clinical and evaluative parameters regarding the importance of tooth retention, outcomes, rationale for choices and alternative considerations in the maintenance of arch integrity for the patient.

The AAE Public and Professional Affairs Committee, and the Board of Directors developed this issue with special thanks to James L. Gutmann, D.D.S., coauthor, and Marc Balson, D.D.S., coauthor and source of radiographs.

The information in this newsletter is designed to aid dentists. Practitioners must use their best professional judgment, taking into account the needs of each individual patient when making diagnoses/treatment plans. The AAE neither expressly nor implicitly warrants any positive results, nor expressly nor implicitly warrants against any negative results, associated with the application of this information. If you would like more information, call your endodontic colleague or contact the AAE.

Did you enjoy this issue of *ENDODONTICS*? Did the information have a positive impact on your practice? Are there topics you would like *ENDODONTICS* to cover in the future? We want to hear from you! Send your questions and comments to the AAE at the address below:



ENDODONTICS: *Colleagues for Excellence*

American Association of Endodontists
211 E. Chicago Ave., Suite 1100
Chicago, IL 60611-2691
www.aae.org



Reading List

Endodontics: Colleagues for Excellence, Fall/Winter 2003 **Contemporary Endodontic Treatment...Its Role in Retaining Our Patients' Natural Dentition**

Endodontic Treatment Outcomes–Nonsurgical–Retreatment–Surgical

Abou-Rass M. Evaluation and clinical management of previous endodontic therapy. *J Prosthet Dent* 1982;47:528-34.

Allen RK, Newton CW, Brown CE Jr. A statistical analysis of surgical and nonsurgical endodontic retreatment cases. *J Endod* 1989;15:261-6.

Danin J, Strömberg T, Forsgren H, Linder LE, Ramsköld LO. Clinical management of nonhealing periradicular pathosis. Surgery versus endodontic retreatment. *Oral Surg Oral Med Oral Pathol* 1996;82:213-7.

Friedman S. Considerations and concepts of case selection in the management of post-treatment endodontic disease (treatment failure). *Endodontic Topics* 2002;1:54-78.

Halse A, Molven O. A strategy for the diagnosis of periapical pathosis. *J Endod* 1986;12:534-8.

Halse A, Molven O. Follow-up after periapical surgery: the value of the one-year control. *Endod Dent Traumatol* 1991;7:246-50.

Heffernan M, Martin W, Morton D. Prognosis of endodontically treated teeth? *Quintessence Int* 2003;34:558-561. (Including editorial response from Glickman G.)

Hepworth MJ, Friedman S. Treatment outcome of surgical and non-surgical management of endodontic failures. *Can Dent Assoc J* 1997;63:364-71.

Kvist T. Endodontic retreatment. Aspects of decision making and clinical outcome. *Swed Dent J* 2001;144(suppl)1-5.

Kvist T, Reit C. Results of endodontic retreatment: a randomized clinical study comparing surgical and nonsurgical procedures. *J Endod* 1999;25:814-17.

Kvist T, Reit C. The perceived benefit of endodontic retreatment. *Int Endod J* 2002;35:359-65.

Kvist T, Reit C, Esposito M, Mileman P, Bianchi S, Petterson K et al. Prescribing endodontic retreatment towards a theory of dentist behaviour. *Int Endod J* 1994;27:285-90.

Lazarski MP, Walker WA III, Flores CM, Schindler WG, Hargreaves KM. Epidemiological evaluation of the outcomes of nonsurgical root canal treatment in a large cohort of insured dental patients. *J Endod* 2001;27:791-6.

Messer HH. Clinical judgment and decision making in endodontics. *Austral Endod J* 1999;25:124-32.

Molven O, Halse A, Fristad I. Long-term reliability and observer comparisons in the radiographic diagnosis of periapical disease. *Int Endod J* 2002;35:142-7.

Molven O, Halse A, Grung B. Incomplete healing (scar tissue) after periapical surgery – radiographic findings 8 to 12 years after treatment. *J Endod* 1996;22:2643-8.

Molven O, Halse A, Grung B. Observer strategy and the radiographic classification of healing after endodontic surgery. *Int J Oral Maxillofac Surg* 1987;16:432-9.

Molven O, Halse A, Grung B. Surgical management of endodontic failures: indications and treatment results. *Int Dent J* 1991;41:33-42.

Ørstavik D. Time-course and risk analysis of the development and healing of chronic apical periodontitis in man. *Int Endod J* 1996;29:150-5.

Nair PNR, Sjögren U, Figdor D, Sundqvist G. Persistent periapical radiolucencies of root-filled human teeth, failed endodontic treatment, and periapical scars. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1999;87:617-27.

Reit C. Decision strategies in endodontics: on the design of a recall program. *Endod Dent Traumatol* 1986;3:233-9.

Siqueira JF Jr. Aetiology of root canal treatment failure: why well-treated teeth can fail. *Int Endod J* 2001;34:1-10.

Sjögren U, Hägglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. *J Endod* 1990;16:498-504.

Tronstad L, Asbjørnsen K, Døving L, Pedersen I, Eriksen HM. Influence of coronal restorations on the periapical health of endodontically treated teeth. *Endod Dent Traumatol* 2000;16:218-21.

Van Nieuwenhuysen J-P, Aouar M, D'Hoore W. Retreatment or radiographic monitoring in endodontics. *Int Endod J* 1994;27:75-81.

Vire DE. Failure of endodontically treated teeth: classification and evaluation. *J Endod* 1991;17:338-42.

Restorative Options–Outcomes–Tooth Retention–Strength of Endodontically Treated Teeth

Aquilino SA, Caplan DJ. Relationship between crown placement and the survival of endodontically treated teeth. *J Prosthet Dent* 2002;87:256-63.

Aquilino SA, Shugars DA, Bader JD, White BA. Ten-year survival rates of teeth adjacent to treated and untreated posterior bound edentulous spaces. *J Prosthet Dent* 2001;85:455-60.

Bergman B, Lundquist P, Sjögren U, Sundqvist G. Restorative and endodontic results after treatment with cast post and cores. *J Prosthet Dent* 1989;61:10-5.

Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JYK. Clinical complications in fixed prosthodontics. *J Prosth Dent* 2003;90(1):31-41.

Huang TJ, Schilder H, Nathanson D. Effects of moisture content on endodontic treatment on some mechanical properties of human dentin. *J Endod* 1992; 18:209-15.

Jameson MW, Hood JA, Tidmarsh BG. The effects of dehydration and rehydration on some mechanical properties of human dentin. *J Biomech* 1993; 26:1055-65.

Lertchirakarn V, Palamara JL, Messer HH. Anisotropy of tensile strength of root dentin. *J Dent Res* 2001; 80:453-456.

Linn J, Messer HH. Effect of restorative procedures on the strength of endodontically treated molars. *J Endod* 1994;20:479-85.

Papa J, Cain C, Messer HH. Moisture content of vital vs. endodontically treated teeth. *Endod Dent Traumatol* 1994; 10:91-3.

Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. *Int Endod J* 1995;28:12-8.

Reeh ES, Douglas WH, Messer HH. Stiffness of endodontically-treated teeth related to restoration technique. *J Dent Res* 1989;68:1540-4.

Reeh ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. *J Endod* 1989;15:512-6.

Sedgley CM, Messer HH. Are endodontically treated teeth more brittle? *J Endod* 1992;18:332-5.

Sorensen JA, Martinoff JT. Endodontically treated teeth as abutments. *J Prosthet Dent* 1984;53:28-35.

Valderhaug J, Jokstad A, Ambjørnsen E, Norheim PW. Assessment of the periapical and clinical status of crowned teeth over 25 years. *J Dent* 1997;25:97-105.

Implants—Outcomes—Survival—Success

Albrektsson T, Zarb GA, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. *J Oral Maxillofac Implants* 1986;1:11-25.

Buch RS, Weibrich G, Wagner W. Criteria of success in implantology (in German). *Mund Kiefer Gesichtschir* 2003;7:42-6.

d'Hoedt B, Schulte W. A comparative study of results with various endosseous implant systems. *Int J Oral Maxillofac Implants* 1989;4:95-105.

Esposito M, Hirsch J-M, Lekholm U, Thomsen P. Biological factors contributing to failures of osseointegrated oral implant. (I) Success criteria and epidemiology. *Eur J Oral Sci* 1998;106:527-51.

Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JYK. Clinical complications with implants and implant prostheses. *J Prosth Dent* 2003;90(2):121-132.

Heydenrijk K, Meijer HJ, van der Reijden WA, Raghoobar GM, Vissink A, Stegenga G. Microbiota around root-form endosseous implants: a review of the literature. *Int J Oral Maxillofac Implants* 2002;17:829-38.

Lekholm U, Gunne J, Henry P, Higuchi K, Bergström C, van Steenberghe D. Survival of the Brånemark implant in partially edentulous jaws: a 10-year prospective multicenter study. *Int J Oral Maxillofac Implants* 1999;14:639-45.

Malmqvist JP, Sennerby L. Clinical report on the success of 47 consecutively placed core-vent implants followed from 3 months to 4 years. *Int J Oral Maxillofac Implants* 1990;5:53-60.

Morris HF, Ochi S. Influence of two different approaches to reporting implant survival outcomes for five different prosthodontic applications. *Ann Periodontol* 2000;5:90-100.

Piatelli A, Scarano A, Favero L, Iezzi G, Petrone G, Favero GA. Clinical and histologic aspects of dental implants removed due to mobility. *J Periodontol* 2003;74:385-90.

Roos J, Sennerby L, Lekholm U, Jemt T, Gröndahl K. A qualitative and quantitative method for evaluating implant success: A 5-year retrospective analysis of the Brånemark implant. *Int J Oral Maxillofac Implants* 1997;12:504-14.

van Steenberghe D. Outcomes and their measurement in clinical trials of endosseous oral implants. *Ann Periodontol* 1997;2:291-8.

Vehemente VA, Chuang SK, Daher S, Muftu A, Dodson TB. Risk factors affecting dental implant survival. *J Oral Implantol* 2002;28:74-81.

Willer J, Noack N, Hoffmann J. Survival rate of IMZ implants: a prospective 10-year analysis. *J Oral Maxillofac Surg* 2003;61:691-5.