

Endodontics Or Implants: A Review Of Decisive Criteria And Guidelines For Endodontic And Dental Implant Therapy

Abstract

A complex problem faced in contemporary dental practice is the decision between treating a tooth endodontically or extracting and replacing it with an implant. When considering this issue, there are many factors to be taken into account. The aim of this review is to evaluate these factors allowing the clinician to make decisions on the basis of best available evidence. The authors examined publications (research, literature reviews and systematic reviews) related to the factors affecting decision making in such cases. The factors included patient-related factors, oral conditions, site-specific aspects, the restorative prognosis of the endodontically-treated tooth and operator skill. It can be concluded that endodontic treatment represents an economical and practical method to preserve teeth and that implants are a good alternative in cases where the prognosis is compromised.

Key Words

Endodontics, extraction, implants, preservation, RCT

Introduction

A fundamental principle in traditional dental practice has been the preservation and rehabilitation of natural teeth. Endodontic treatment procedures have played a key role in this context in the retention and restoration to function of teeth affected by pulpal and periapical pathosis. The extraction of teeth has generally been considered undesirable and as a treatment of last resort due to the limitations of alternative prosthodontic replacements such as bridges and removable prostheses. In recent years however, this paradigm has been challenged by emerging trends in implant dentistry, with implant replacements being touted as equal to or even superior to the preservation of natural teeth^{[1], [2], [3], [4], [5]}.

A MEDLINE search (PubMed) was conducted using different keyword combinations including the terms 'root canal therapy', 'dental implants', 'decision making', 'treatment planning', and 'outcome'. In addition, bibliographies of all relevant papers and previous review articles were handsearched. Titles were excluded, if no abstract was available, single case reports or conference reports were presented, or the topic was not related to the subject of the current review.

This review will discuss the major factors that can affect the decision regarding whether a tooth receives endodontic treatment or is extracted and replaced by an implant.

Indications of Endodontic Treatment and Implant Therapy

An analysis of the causative factors of root canal treatment performed indicated that approximately 60% of root canal treatments were necessitated by caries, 19% by restorative failures, 13% by post-treatment apical periodontitis, and six percent by dental trauma^[6].

When dental implants were first introduced by Branemark in 1977^[7], they were envisioned as a replacement for missing teeth and indicated for patients who might otherwise have received removable prosthesis. As more research on dental implants was conducted, the potential range of applications was expanded to encompass a larger population of teeth that otherwise would have been referred for restorative procedures including endodontics. An analysis of single-tooth implant studies indicates that endodontic complications, trauma, and caries are commonly cited as the leading causes of tooth extraction and replacement with single-tooth implants. Contrary to the preponderance of

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Submission : 29th January 2013

Accepted : 10th December 2013

Quick Response Code



evidence, the presence of apical periodontitis is increasingly being used to recommend tooth extraction and immediate implant placement^{[6], [8], [9]}.

General Endodontic and Implant Contraindications

There are virtually no medical contraindications to endodontic treatment except for uncontrolled diabetes and possibly a recent coronary event. However, certain factors may affect the outcome of endodontic treatment in adverse ways. They are as follows:

- Patients with high caries activity.
- Patients with diabetes, particularly in cases with preoperative periradicular lesions.
- Impaired integrity of the patient's nonspecific immune system.

Other patient-related factors such as age and smoking had no impact on the healing rate^{[10], [11]}.

When implant treatment was introduced in the 1970s, several restrictions were defined in order to minimize the risk of implant failure or complications. Hence, implant therapy was not recommended in

patients with xerostomia, osteoporosis, aggressive forms of periodontitis and heavy smokers. Today, it is evident that the peri-implant tissues are not affected by hyposalivation and/or the symptoms of xerostomia. Further, a reduced bone mineral density in osteoporotic patients entails a reduced bone-to-implant contact, but does not appear to inhibit osseointegration. Implant indications have been extended to patients with a history of periodontitis and also to smokers accepting an increased risk for complications and failures.

Presently, there are few absolute and permanent implant contraindications, but several temporary restrictions^{[12], [13], [14]} such as

- Incomplete cranial growth
- An implant may be precluded if the site impinges on vital anatomic structures,
- Insufficient mouth opening
- Patients who are unlikely to maintain a high level of oral hygiene should not be considered for an implant.
- Patients under intravenous bisphosphonate medication for more than two years.
- Certain medications such as antiosteoporosis drugs.
- Smoking is a significant risk factor for implant treatment and augmentation procedures accompanying implant therapies.
- A history of alcoholism, immune disorders, and other conditions that impair healing.
- Implants in patients with diabetes can be successful, at least in the short term. Medium to long-term follow-ups are lacking.

Case Selection & Factors Influencing Prognosis of Endodontic and Implant Treatments

Appropriate case selection plays an important role in the outcome of any dental treatment. However, patient selection remains a difficult and controversial area when comparing implant and endodontic studies. All patient-related, oral and site specific factors should be evaluated systematically, the strategic value of the tooth determined and a risk analysis performed before any definitive decision is taken. The patient's expectations, medical contraindications and his/her financial position are further aspects taken into account during treatment

planning.

A. Patient-Related Factors

1. Systemic risk factors

A number of systemic risk factors have been evaluated for their impact on the survival rates of endodontically treated teeth or dental implants. In general, diabetes seems to have a deleterious effect on the prognosis of both implant and root canal treatment. A negative effect of smoking on apical periodontitis has been reported in endodontic literature. A recent systematic review has reported that smoking also reduces implant survival rates. Therefore, factors that alter the host response to inflammation, such as smoking, might also indirectly influence the risk of infection in both implants and root canal treatment groups^[15].

2. Physical Pain of Procedure

The incidence of postoperative pain is one of the major concerns when evaluating endodontic treatment alternatives. It has been reported that the public's perception of endodontic treatment is negative because of the association of endodontic treatment with pain. In contrast, the results of one study have demonstrated that pain was not the major cause of dissatisfaction with endodontic treatment. Moreover, even placebo treated patients report that root canal treatment substantially reduces pain compared with preoperative levels. In another study, implant placement was found to be a mild to moderately painful and anxiety provoking procedure. Taken together, these results indicate that the pain experienced after root canal treatment and implant surgery fall within the guidelines for adequate control of perioperative pain^[6].

3. Length of Treatment

In general, endodontic therapy takes fewer visits and a shorter time for completion than implants. Implants are placed in either single or two stages. In the two-stage protocol, a four-to-six week period may be recommended to allow for soft tissue healing over the extraction site before the implant is placed. Once the implant is placed, a four-to-six month period for the mandible and maxilla, respectively, is allowed before the implant can be restored. In practice, this may need to be extended to six and eight months.

Time can be saved if the single-stage protocol is followed. Single-stage placement has been associated with an increased risk of failure protocol. However, other studies show that single-stage placement with immediate loading has a predictable outcome^[6].

4. Financial Implications

A cost-benefit analysis comparison between endodontic treatment and a single-tooth implant concluded that endodontics and a crown is less expensive, entails fewer office visits and is completed more quickly than the implant. The analysis did not take into account the possible adjunctive procedures before implant placement such as sinus lift and bone grafts, which would increase the cost of an implant^{[6],[16]}.

5. Patient satisfaction

Gibbard and Zarb reported that only 80% of patients were somewhat satisfied or extremely satisfied with single-tooth implants, while another study, which assessed quality of life after endodontic treatment, clearly demonstrated that endodontic treatment significantly improved quality of life for all measures investigated. As far as quality of life assessments are considered, both endodontic and single-tooth implant studies are quite comparable to each other^{[6],[17]}.

B. Oral Conditions

1. General oral situation

The situation of the remaining dentition and the full-mouth treatment planning decides, at least in part, whether or not to maintain a questionable tooth. Hence, a tooth with a relatively good prognosis, but requiring tremendous pre-treatment efforts may be intended for extraction, as treatment requirements in the adjacent tooth positions (either tooth- or implant supported) overrule the decision made for the single tooth^{[15],[18]}.

2. Occlusion

Occlusal overloading and parafunction can play a significant role in failure of endodontically treated teeth due to crown and root fracture. On the other hand, occlusal trauma may cause a more rapid destruction of the bone supporting an implant compared with similar forces on a natural tooth. When planning either implants or endodontic therapy in such patients, the underlying factors should be

recognized and resolved for a successful outcome^[5].

3. Periodontal factors

In endodontics, periodontal disease is a negative factor, but it rarely precludes treatment. Conversely, the periodontal health of the peri-implant tissue is critical in determining the outcomes of implant placement. Hence, the elimination of periodontal disease is mandatory in prospective implant patients^[15].

C. Site-Specific Aspects

1. Bone characteristics and Regional anatomy

Not much information is available in the endodontic literature regarding survival of root canal-treated teeth according to the quality of bone or the anatomic zone. The quality and quantity of bone for implant placement must be sufficient. Patients with both low density and quantity of bone are at the greatest risk of implant loss. In addition, anatomical limitations are a principal reason for not performing implants^{[6],[15]}.

2. Esthetics

The natural tooth restoration should be strongly considered when esthetic demands are of paramount significance. The most frequent problem with implants is esthetics in the anterior maxilla. In patients with high aesthetic demands and a thin mucosal biotype, greater efforts should be made to save a questionable anterior tooth in order to ensure preservation of the soft tissue architecture. Posterior teeth with questionable prognosis, however, are replaced by an implant with less restraint, than in the aesthetic zone^{[5],[6]}.

D. Restorative Prognosis Of The Endodontically-Treated Tooth

Contemporary literature supports the direct relationship between a coronal restoration and the positive outcome of endodontic treatment. Iqbal et al. identified poor crown margins as one factor significantly associated with the presence of post-treatment periapical lesions. Poor fitting crowns may allow bacterial leakage and reinfection of the root canal system, and in vitro studies identify leakage as a possible cause of a negative outcome following root canal treatment. These observations indicate that, provided endodontic treatment is performed with good case selection and sound restorative procedures, long-term

survival rates are comparable to implant survival rates. Dawson and Cardaci noted that the restorative prognosis of a tooth being planned for endodontic treatment or retreatment is likely to be the most important factor in deciding whether to retain or replace. The patient's own preferences are also likely to play a key role in this decision-making process^{[6],[18]}.

E. Operator Skill

It is conceivable that a significant predictor of both implant and endodontic treatment may be the expertise of the clinician and the technical quality of the treatment. This may be a problem in endodontics with training in new technology. Initially, most implants were placed by specialists, but it is expected that over time most implants will be placed and restored by general dentists. Pure training courses as opposed to formal education and academically-based experiences may be only of a few days' duration and the practitioner may lack the necessary diagnostic, surgical and prosthetic skills^{[5],[20]}.

The most important factor promoting a successful result is the technical quality of the surgery, reflecting the skill of the operator. Referral to a more experienced colleague is in the best interest of the patient and should be actively encouraged when appropriate.

Endodontics and Implants: Success vs. Survival

Treatment outcome or 'success' in endodontics is usually measured by an absence of clinical symptoms and specific radiographic criteria. The concept of 'survival' is applied to implant studies. Implant survival has been defined as 'a retained non-mobile implant capable of supporting a crown'. However, some of these implants may have associated bone loss and periodontal defects. Such a broad definition makes a comparison with the strict criteria for a positive endodontic outcome not possible^[18].

Further Treatment Modalities In Case Of Failure

Fortunately, a negative outcome following nonsurgical root canal treatment can be managed with more flexibility, and in stages. Non-surgical retreatment, periapical surgery, periradicular surgery (hemisection and

tooth sectioning), intentional replantation, or transplantation can prolong the life of the tooth. Restorations are retained and function is unaltered^[18].

The failure of an implant is always clinically significant because extraction is the only alternative. The extraction may require surgery. Restorations must be removed, leading to altered function and possibly appearance. The bony defect must heal before further treatment can be undertaken. Further reimplantation may then entail additional bone augmentation in a staged approach^[18].

Implant vs. The endodontically-treated tooth

In general terms, the arguments favoring tooth retention focus on the advances in endodontic treatment which allow the provision of a greater range of treatment options with greater predictability. This treatment option has also been proposed to be more conservative, less invasive and less costly than implant placement. The effects of "failure" are also seen to be more significant with implant therapy as compared to endodontic treatment (i.e., loss of fixture in implant therapy vs. non-healing after endodontic treatment which may still be managed and result in tooth retention).

Arguments favoring implant placement focus on the perceived poor outcomes of endodontic treatment when compared to implant "success" rates of over 90 per cent and concerns over the structural durability of a weakened endodontically treated tooth to support a coronal restoration. An implant fixture is seen as a better foundation for restorative dentistry than an endodontically-treated tooth. The implant has also been seen as a restorative option that requires little follow-up when compared to endodontic-prosthetic rehabilitations, which is seen to be at a greater risk of further problems due to caries, periodontal disease and structural deficiencies^{[5],[9]}.

Conclusions

Factors such as patient expectations, dental and medical health status, regional anatomy and bone characteristics, risk associated with treatment, treatment time, costs, prognosis and consequences of a negative outcome need to be individually assessed for a specific

clinical situation. As discussed previously, comparisons of prognosis are difficult when comparing endodontic treatment and implant therapy due to differences in treatment procedures, outcome measures and complications. If the available data are based on survival, it is apparent that endodontic treatment outcome in general practice is comparable to implant therapy in prospective studies. In conclusion, restorability and periodontal stability should be the major factors in determining whether to replace or rehabilitate.

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Source of Support : Nil, Conflict of Interest : None declared