

UPDATE IN PERIRADICULAR SURGERY

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Abstract: Apicoectomy involves the surgical management of a tooth with a periapical lesion which cannot be resolved by conventional endodontic treatment (root canal therapy or endodontic retreatment). Endodontic treatment, or retreatment, is not feasible or is contraindicated, and hence an indication for peri radicular surgery arises. In addition to these “objective” indications, we must consider demands by the patient regarding finances, psychological issues, and treatment time. The paper showed update in periradicular surgery which included updates of treatment outcome of periradicular surgery, micro instruments, magnification and intraoperative inspection, regenerative techniques, treatment alternatives to periapical surgery, nonsurgical retreatment, root resection therapy and tooth extraction.

In conclusion, strict case selection based on clinical and radiographic parameters is of utmost importance in periradicular surgery; the advent of microsurgical principles, i.e., the use of micro instruments, illumination, and magnification, have simplified the surgical technique, and have contributed to higher success rates in peri radicular surgery; and regenerative techniques should be considered as adjunctive treatment options in peri radicular surgery.

Keywords: oral surgery, periradicular surgery

1. INTRODUCTION

Apicoectomy involves the surgical management of a tooth with a periapical lesion which cannot be resolved by conventional endodontic treatment (root canal therapy or endodontic retreatment). Because the term “apicoectomy” consists of only one aspect (removal of root apex) of a complex series of surgical procedures, the terms “periapical surgery” or “peri radicular surgery” are more appropriate. The expressions “periapical endodontic surgery” and “apical microsurgery” are also found in the literature.

The objective of periapical surgery is to obtain tissue regeneration. This is usually achieved by the removal of periapical pathologic tissue and by exclusion of any irritants within the physical confines of the affected root (Thomas von Arx, 2005). In 1884 Farrar described a “radical and heroic treatment of alveolar abscess by “amputation of roots and teeth ” with one example being very similar to the modern apicoectomy. Rhein in 1897 was advocating “amputation of roots as a radical cure in chronic alveolar abscess” with examples again like apicoectomies. In 1916 Widman also discussed apicoectomy procedures. In 1919 Garvin was demonstrating retro fillings radiographically. Since those times, apicoectomies and retrograde filling have become accepted methods of sealing root canals.

2. INDICATIONS AND CONTRAINDICATIONS

Because the most of periapical lesions are associated with endodontic pathology, except in cases of rare developmental cysts or tumors, the primary goal of treatment is orthograde occlusal approach for root canal instrumentation and obturation. However, in certain cases, endodontic treatment, or retreatment, is not feasible or is contraindicated, and hence an indication for peri radicular surgery arises. In addition to these “objective”

indications, we must consider demands by the patient regarding finances, psychological issues, and treatment time. Contraindications for periradicular surgery are listed below in the Table 1.

Table 1. Indication and Contraindication for Peri radicular Surgery (according to Ese 1994)

| INDICATIONS FOR PERIRADICULAR SURGERY | |
|--|---|
| 1. | Obstructed canal with radiologic findings and/or clinical symptoms |
| 2. | Extruded material with radiologic findings and/or clinical symptoms |
| 3. | Failed root canal treatment when retreatment is inappropriate (isthmus tissue, persistent acute symptoms or flare-ups, risk of root fracture) |
| 4. | Perforations with radiologic findings and/or clinical symptoms, and where it is impossible to treat from within the pulp cavity |
| CONTRAINDICATIONS FOR PERIRADICULAR SURGERY | |
| 1. | Local anatomical factors (eg, inaccessible root end) |
| 2. | Tooth with inadequate periodontal support |
| 3. | Nonrestorable tooth, tooth without function (no antagonist, no pillar for removable or fixed prosthesis) |
| 4. | Uncooperative patient |
| 5. | Compromised medical history |

3. TREATMENT OUTCOME OF PERIRADICULAR SURGERY

Conventional endodontic therapy is successful approximately 80-85% of the time. Many of these failures will occur after one year. The presence of continued pain, drainage, mobility or an increasing size of a radiolucent area are some of the indications to treat the case surgically. Prior to the introduction of microsurgical techniques, inconsistent success rates were reported for peri radicular surgery varying between 44% and 90%. Interestingly, conventional retreatment of teeth with apical periodontitis showed a weighted average success rate of only 66%, whereas retreatment to correct radiographically or technically deficient root fillings in teeth with periapical disease had a weighted average success rate of 95%.² Following the introduction of microsurgical techniques, treatment outcomes have improved considerably, and success rates have approached or exceeded 90%. These increased success rates are credited to several factors that have all contributed to the improved outcome of peri radicular surgery: micro instruments, magnification and intraoperative inspection, root-end filling materials, and regenerative techniques.

4. MICRO INSTRUMENTS

Root-end cavities have traditionally been prepared by means of small round burs or inverted cone burs in a micro handpiece. In the early 1990s, sonically or ultrasonically driven microsurgical retro tips became commercially available. This new technique of retrograde cavity preparation has been established as an essential adjunct in peri radicular surgery. Clinically, the most relevant advantages are the improved access to root-ends in a limited working space and the smaller osteotomy required for surgical access because of the angulation and small size of the retro tips. However, several experimental studies have demonstrated other advantages of using microtips, such as the preparation of deeper cavities, and cavities following more closely the original path of the root canal. The more centered root-end preparation also lessens the risk of lateral perforation. In addition, the geometry of the retro tip design does not require a beveled root-end resection for surgical access, thereby decreasing the number of exposed dentinal tubules and possible leakage through patent tubules. This is consistent with the criteria established for the minimal depth of a retrograde filling with regard to the bevel of the cut root face. Any concern about increased formation of cracks or microfractures by (ultra)sonic root-end preparation have been addressed and proved otherwise in several experimental studies and in one clinical study.

5. MAGNIFICATION AND INTRAOPERATIVE INSPECTION

Parallel to the advent of micro instruments, well focused illumination and magnification have been recommended as a standard of care in peri radicular surgery. Working with loupes or with a surgical microscope has become a widely accepted practice in conventional and surgical endodontics. It was discovered that only the identification and

treatment of microscopic findings, such as isthmuses, accessory canals, or microfractures of the root, would result in peri radicular healing or prevent failures, respectively.

Careful examination of lingual canals or buccal walls of retro preparation cavities is most often possible only with micromirrors, because loupes or microscopes do not allow the surgeon to look “around the corner.”

Another magnification device to circumvent such difficulties is the endoscope. Although its application has been limited in dentistry, there has been a growing interest in the use of endoscopy for intraoperative diagnostics, particularly in peri radicular surgery.

The advantages of endoscopy in peri radicular surgery compared with microscopy include rapid and easy adjustment of the viewing angle, and the direct viewing without the need for the use of dental micromirrors.

6. REGENERATIVE TECHNIQUES

It has been shown that (pathologic) interactions exist between pulpal and periodontal tissues. An endodontic infection evident as a periapical radiolucency appears to influence periodontal parameters such as probing pocket depth and attachment loss. It has also been demonstrated that a significant correlation exists between marginal periodontal and apical healing following periapical surgery.

A challenging problem in periapical surgery remains the loss of buccal bone with partial or complete root exposure (apico-marginal lesions). It has been shown that healing outcome in periapical surgery is related to the condition of the buccal bone plate. Epithelial downgrowth along the denuded buccal root surface is considered as a major negative factor preventing successful healing in such cases. Although regenerative techniques have become a standard of care in periodontology and implant dentistry, these techniques have yet to be established in endodontic surgery. A substantial number of case reports have described the successful outcome of regenerative techniques for treatment of apico-marginal lesions in periapical surgery, but there remains a great need for experimental and clinical studies. In a recent clinical study, we have found a frequency of 12% of apico-marginal lesions in 100 cases subjected to peri radicular surgery. In addition to a standard surgical protocol (root-end resection, rootend cavity preparation with microtips, Super EBA as retrograde filling), teeth with apico-marginal lesions were treated with collagen membranes or an enamel matrix derivative. Healing outcome in teeth with and without apico-marginal lesions did not differ significantly (93.2% versus 83.3%) (unpublished data). Application of regenerative techniques in teeth with apico-marginal lesions, or in teeth with through-and through periapical lesions, might further expand the field of peri radicular surgery.

7. TREATMENT ALTERNATIVES TO PERIAPICAL SURGERY, NONSURGICAL RETREATMENT, ROOT RESECTION THERAPY AND TOOTH EXTRACTION

Before planning a periradicular surgery, treatment alternatives must be discussed with the patient and/or the referring dentist. Informed and written consent should be obtained from the patient.

Revision of an existing root canal obturation should always be considered as a first option. However, pros and cons must be carefully evaluated. As discussed in the treatment outcome section, healing following conventional retreatment appears to be highly dependent on the periapical condition (lesion size), as well as on the anatomy of the endodontium.

In multirrooted molars, resection of a complete root (mostly mesiobuccal root in maxillary first molars) or tooth separation (hemisection of mandibular first or second molars) should be considered as treatment options. The procedure is indicated for roots with compromised periodontal support or deep decay.

It is generally accepted that extraction of a tooth with periapical pathology will eventually result in healing. However, subsequent vertical and/or horizontal bone loss may lead to soft and hard tissue deficiencies. This is of concern in the growing child or in the anterior maxilla with high esthetic demands. Whenever possible, teeth should be salvaged to preserve the unique scalloped anatomy of hard and soft tissues around natural teeth or to avoid multiunit edentulous spaces in the anterior maxilla, a situation that is extremely difficult to manage from an esthetic perspective.

8. CONCLUSION

In contrast to other specialties in dentistry, (like implant dentistry), long-term studies (duration of at least 5 years, dropout rate below 10%) are scarce. In addition, peri radicular surgery only implies the surgical treatment of a short part of the tooth, that is, the root end. Peri radicular surgery does not address the treatment of coronal leakage, and

therefore, a certain risk remains for peri radicular reinfection. Consequently, indications and treatment alternatives must be evaluated carefully and thoroughly.

In conclusion,

- 1) strict case selection based on clinical and radiographic parameters is of utmost importance in periradicular surgery;
- 2) the advent of microsurgical principles, i.e., the use of micro instruments, illumination, and magnification, have simplified the surgical technique, and have contributed to higher success rates in peri radicular surgery; and
- 3) regenerative techniques should be considered as adjunctive treatment options in peri radicular surgery.

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