APICAL SURGERY: A REVIEW OF CURRENT TECHNIQUES AND OUTCOMES

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Abstract: *Apical surgery is considered a standard oral surgical procedure. It is often a last resort to surgically maintain a tooth with a periapical lesion that cannot be managed with conventional endodontic (re-)treatment. The main goal of apical surgery is to prevent bacterial leakage from the root-canal system into the periradicular tissues by placing a tight root-end filling following root-end resection. Clinicians are advised to utilize a surgical microscope to perform apical surgery to benefit from magnification and illumination. In addition, the application of microsurgical techniques in apical surgery, i.e., gentle incision and flap elevation, production of a small osteotomy, and the use of sonic- or ultrasonic driven microtips, will result in less trauma to the patient and faster postsurgical healing. A major step in apical surgery is to identify possible leakage areas at the cut root face and subsequently to ensure adequate root-end filling. Only a tight and persistent apical obturation will allow periapical healing with good long-term prognosis. The present paper describes current indications, techniques and outcome of apical surgery.*

Keywords: *Apical surgery; Computed tomography; Mineral trioxide aggregate.*

Apical surgery belongs to the field of endodontic surgery, which also includes incision and drainage, closure of perforations, and root or tooth resections. The objective of apical surgery is to surgically maintain a tooth that primarily has an endodontic lesion that cannot be resolved by conventional endodontic (re-)treatment. It is therefore of clinical relevance to perform a thorough clinical and radiographic examination of the tooth before apical surgery (including adjacent and opposing teeth), in order to decide whether surgical or non-surgical endodontics should be considered. According to the updated guidelines by the European Society of Endodontology, indications for apical surgery comprise (1) radiological findings of apical periodontitis and/or symptoms associated with an obstructed canal (the obstruction proved not to be removable, displacement did not seem feasible or the risk of damage was too great), (2) extruded material with clinical or radiological findings of apical periodontitis and/or symptoms continuing over a prolonged period, (3) persisting or emerging disease following root-canal treatment when root canal re-treatment is inappropriate, and (4) perforation of the root or the

floor of the pulp chamber and where it is impossible to treat from within the pulp cavity.

The use of a surgical microscope is strongly advocated in apical surgery since it allows inspection of the surgical field at high magnification with excellent and focused illumination, detection of microstructures (additional canals, isthmus) and root integrity (cracks, fractures, perforations), distinction between bone and root, and identification of adjacent important anatomical structures. The incision and flap design should be chosen according to clinical and radiographic parameters, including condition, biotype and width of gingival tissues, presence of a restoration margin, location and extent of the periapical lesion, and patient's esthetic demands. A small osteotomy is produced to locate the root-end that is resected by about 3 mm. The resection plane should be perpendicular to the long axis of the tooth. At this stage, all pathological tissue should be removed and adequate hemorrhage control be established. The application of 1–2% methylene blue dye aids in the careful inspection of the cut root face. It is important to identify possible areas of leakage such as root-fractures, un-negotiated accessory canals or isthmuses, and gaps between the existing root-canal filling and the root-canal walls. Root-end cavity preparation is performed with sonic- or ultrasonic driven microtips. The use of rotary instruments to prepare a root-end cavity is no longer recommended. The retrocavity should have a depth of 3 mm, follow the original path of the root canal, and also include accessory canals and isthmuses, if present. How to surgically manage dentinal cracks has not been clarified yet, but teeth with vertical root fractures must be extracted. With regard to the root-end filling material, mineral trioxide aggregate (MTA) appears to become the standard. Although it is a comparatively expensive material and the clinician has to become familiar with its handling, MTA has excellent biocompatibility, ideal adherence to the cavity walls, and low solubility. Clinical (comparative) studies have reported excellent success rates for MTA ranging from 90% to 92% (follow-up periods from 1 to 5 years).

With regard to healing outcome, the classification of healing should be based on defined clinical and radiographic healing criteria. Cases should be monitored at yearly intervals until a final diagnosis (success or failure) can be established. It has been shown that 95–97% of cases classified as successful at the 1-year control remain so over the long term (5 years). Generally, lower success rates have been reported for re-surgery cases, and for teeth with combined endodontic–periodontal lesions. For both problems, the indication to perform apical surgery must be carefully weighed against extraction and implant/prosthodontic rehabilitation.

Apical surgery is now considered a predictable treatment option to save a tooth with apical pathology that cannot be managed by conventional, non-surgical endodontics. The use of magnification and illumination, preferably a surgical microscope, and the application of microsurgical principles are also important requirements for obtaining successful outcomes after apical surgery.

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