REVIEW ARTICLE

ENDODONTIC SURGERIES-A REVIEW

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ABSTRACT
A better understanding of endodontic disease and the causes of treatment failure hasrefined the role of surgery in endodontics. The advent of newer materials, advances insurgical armamentarium and techniques have also led to an improved endodonticsurgical outcome.Endodontic surgery straddles the specialties of endodontics and dento alveolar surgery. With the advent of the operating microscope, newer endodontic filling materials and stem cell therapy, humungous strides have been taken in this area, thus enabling transmutation of peri apical surgery into an avant-garde treatment modality.
Keywords: Endodontic surgeries, microscopes, dento alveolar surgery

INTRODUCTION

DEFINITION

Endodontic surgery is a dental procedure to treat apical periodontitis in cases that did not heal after nonsurgical retreatment or, in certain instances, primary root canal therapy. It is the branch of dentistry that deals with the diagnosis and treatment of lesions of endodontic origin, which cannot be treated by or do not respond to conventional root canal therapy.[1]

The aetiology of periapical (periradicular) periodontitis is microbial:[2-4]intra-radicular microorganisms induce an inflammatory and immune response within the periradicular tissues, resulting in bone destruction. Contamination of the periradicular tissues by microorganisms and root-filling materials may compromise healing.[5]

The biological aim of endodontic treatment is to prevent or resolve apical periodontitis by controlled asepsis or through decontamination of the root canal system so as to create an environment in which periradicular healing can occur. However, if non-surgical root canal treatment is not possible or disease or symptoms persists following root canal treatment, endodontic surgery may be necessary in order to salvage a tooth.[6]

Success rates of 47–97% for primary orthograde root canal treatment have been reported, with failures more likely to be associated with pre-operative presence of periapical radiolucency, root fillings with voids, root fillings more than 2mm short of the radiographic apex, and unsatisfactory coronal restoration.[7]

In order to attain a successful outcome, an accurate diagnosis of the aetiology of persistent pathology associated with a root-treated tooth and appropriate treatment planning is, of course, essential.

HISTORICAL FRAME

Guerini documented the first endodontic surgery as incision and drainage of an acute endodontic abscess, approximately 1500 years ago[8]. Infected root sections were removed, and the healthy tooth portion was retained in attempting to cure infected teeth for about 200 years. Histological bone regeneration was demonstrated in treated cases of infected periapical lesions in 1930. For a long time, pulpless teeth were implicated in a plethora of systemic disorders like nephritis and arthritis by the exponents of the focal theory of infection.[9]

The terms apicoectomy, periapical surgery, periapical endodontics, root end surgery, apical microsurgery, and surgical endodontics have been used in the literature. Apicoectomy, which means cutting the root apex, limits theunderstanding of the procedure, which includes removal ofthe irritants in the root canal system and the periapicalpathology as well.

INDICATIONS FOR SURGICAL ENDODONTICS[10]

1. Periradicular disease associated with a tooth where iatrogenic or developmental anomalies prevent non-surgical root canal treatment being undertaken.
2. Periradicular disease in a root-filled tooth where non-surgical root canal retreatment cannot be undertaken or has failed, or when it may be detrimental to the retention of the tooth (eg obliterated root canals, teeth with full coverage restorations where conventional access may jeopardise the underlying core, the presence of a post whose removal may carry a high risk of root fracture).
3. Where a biopsy of periradicular tissue is required.
4. Where visualisation of the periradicular tissues and tooth root is required when perforation or root fracture is suspected.
5. Where it may not be expedient to undertake prolonged nonsurgical root canal retreatment because of patient considerations.

CONTRAINDICATIONS TO SURGICAL ENDODONTICS

There are few absolute contraindications to endodontic surgery, however the following should be considered:

1. Patient factors, including the presence of severe systemic disease and psychological considerations.
2. Dental factors including:

- unusual bony or root configurations
- lack of surgical access
- possible involvement of neurovascular structures
- where the tooth is subsequently unrestorable
- wherethere is poor supporting tissue
- poor general oral status.

3. The skill, training, facilities available, and experienceof the operator, should also be considered.

PRE-OPERATIVE ASSESSMENT

The pre-operative assessment includes a full medical and dental history, extra-oral and intra-oral examinations, and special investigations including radiographs. Radiographs should be taken using the paralleling technique with a beam-aiming device to provide the best views and good diagnostic yields. The full root/s and approximately two to three mm of the periradicular region should be included.[11,28]

Newer three-dimensional (3-D) imaging techniques such as cone beam computed tomography (CBCT) have been recommended for pre-operative planning of surgical cases to determine the exact location of root apices and to evaluate the proximity of adjacent

anatomical structures.[12-13] The need for a CBCT scan should be decided on a case-by-case basis. To keep the patient's radiation exposure as low as reasonably possible, a risk versus benefit analysis should be carried out beforehand. If deemed necessary, the CBCT scan should be of limited volume and high resolution.

Recent systematic reviews indicate that prophylactic administration of oral antimicrobials to prevent systematic disease is not always in the patient's best interest.[14,29]Likewise, prophylactic administration to prevent postoperativeinfection (in patients not requiring prophylacticantibiotics for medical conditions) has not beenshown to be beneficial.[15,30]

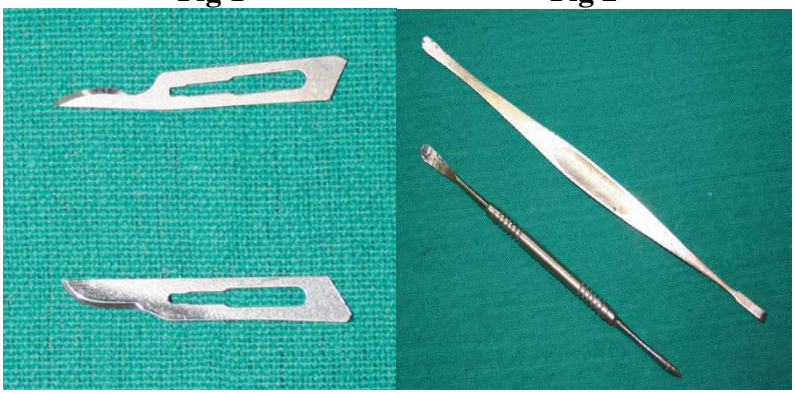
ANESTHESIA AND HEMOSTASIS

Conventional nerve blocks are augmented by local infiltration. Of equal momentousness is the preference for the vasoconstrictor. Adrenaline in concentrations ranging from 1:50,000, 1:100,000, and 1:200,000 have performed commendably.Haemostasis is of benefit at the surgical site, which is more easily achieved when a local anaesthetic containing a vasoconstrictor is used.[16-17,31]

ARMAMENTARIUM

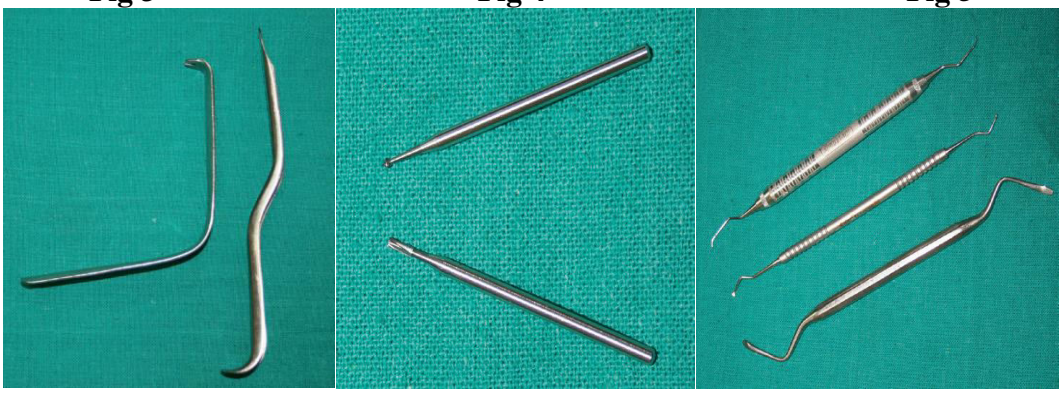
Incisions can be placed with no.11, no. 12, no 15, or no. 15-C blades (Fig.1). Sharp, blunt dissection and elevation of the mucoperiosteal flap are accomplished by a Molts' or Howarths' periosteal elevator (Fig.2)

Fig 1 **Fig 2**



Endodontic tissue retractors like Austin, Seldon, or Minnesota should be judiciously selected in order to minimize trauma to the mucoperiosteal flap and neurovascular bundles (Fig.3).Overlying bone is cut with No.4/6/8 round burs or 701/702 fissure burs (Fig.4). These can be used to resect the root apex as well. Surgical handpiece with 45 ° angle head and rear air exhaust is advocated. Sharp surgical curettes like Lucas curette, angled periodontal curettes, and spoon excavators help to remove the inflamed soft tissue from the bony cavity (Fig.5).

Fig 3 **Fig 4** **Fig 5**



The advantages of lasers include greater patient comfort, decreased vibrations, lesser surgical site contamination, andminimal trauma to the juxtaposed tissues.
Ultrasonic microsurgical tips are invaluable for root endpreparation. Earlier, hand files and rotary burs were used. Teflonsleeves, pluggers, and Messing gun-type syringes can be used toplace various root-end filling materials like MTA (Fig.6).Review of literature validates the superiority of microsurgicaltechniques over conventional surgery (97% to 59%)[18,32]. Thedental operating microscope, ultrasonic tips, and diamondcoated micromirrors (Fig.7) have found their niche in thesurgeon's armamentarium. Micromirrors (Fig.8) can beused to inspect the buccal and lingual walls of the retrocavity.Microsurgical scalpels are useful for incising the intrasulculareareas and dissection of the interproximal papillae.

Fig 6

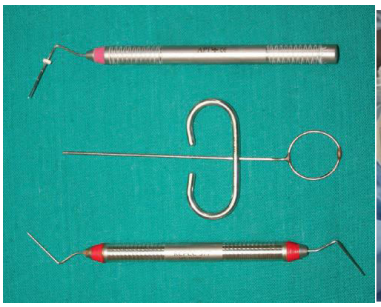
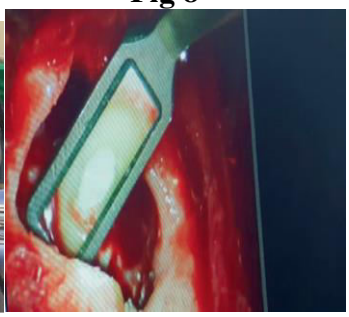


Fig 7

Fig 8



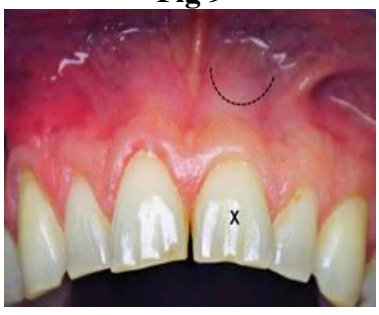
FLAP DESIGN

There are many different flap designs that have been used in endodontics.[19,33] The flap design chosen will usually and mainly be dependent on the surgical access required; however, it will also affect the post-surgical probing depth, gingival margin level and clinical attachment.[20.34] Regardless of the design chosen, it should always follow the basic principles of ensuring that there is an adequate blood supply, and these days preservation or avoidance of the interdental papilla is preferred.

SEMI-LUNAR FLAP

The semi-lunar flap design (Fig.9) is inadequate in terms of providing good surgical access and is also associated with many post-operative complications including pain, swelling and scarring. Therefore, the semi-lunar flap is contra-indicated for use in periradicular surgery.[21,35]

Fig 9



FULL THICKNESS MARGINAL FLAP

A primary incision is made in the gingival sulcus and follows the contours of the teeth. Relieving incisions crossing any bony defects should be avoided as this may hinder healing. The relieving incision is made with firm pressure starting at the gingival margin and extended through the attached gingiva in as vertical direction as possible to avoid severing supra-periosteal vessels and collagen fibres; this will reduce bleeding and improve healing. Extension deep into the sulcus is not normally required and can lead to increased bleeding

into the operative site. One relieving incision (triangular flap) may provide sufficient visibility. However, two relieving incisions (rectangular flap) (Fig.10) will provide greater surgical access. Healing is normally by primary intention and provided there is good oral hygiene, post-operative complications are rare.[22,36]

Fig 10

SUBMARGINAL (LUEBKE-OCHSENBEIN) FLAP

The submarginal flap (Fig. 11) is useful in the anterior maxilla especially if preservation of the gingival contours adjacent to crowned teeth is needed.[23] The horizontal, scalloped incision is made approximately three mm from, and follows, the contours of the gingival margin, with one or two relieving incisions.[24,37] Disadvantages of this flap design include the risk of flap shrinkage, delayed healing and scarring; it is also not suitable for use in the mandible.

Fig 11

FLAP ELEVATION

The horizontal element of a full mucoperiosteal flap commences in the gingival sulcus and severs the gingival attachment fibers to the crestal bone. The interdental papilla should be incised at the midcol level. While incising a limited flap, the horizontal component must conform to the contour of the marginal gingiva and should be 2 mm apical to the depth of the gingival sulcus. The vertical incision should begin in thealveolar mucosa and proceed toward the crown till it abutsthe horizontal incision. To achieve the above objectivesfresh, sharp blades should be opted for. Hemostasis and healing are enhanced if the entire mucoperiosteal flap is elevated as a single unit, due to adherence of the flap with its microvasculature. The broad end of the elevator can be maneuvered beneath the vertical incision, a few millimeters from the junction of the horizontal and vertical incision in the attached gingiva. This preserves the supracrestal root-attached fibers. This is followed by coronal dissection, and forces are directed toward the periosteum and bone. This technique is termed undermining elevation and should be continued throughout the length of the horizontal incision and apically to the alveolar mucosa.[25]

POSTOPERATIVE COMPLICATIONS

1. Flap necrosis and breakdown, due to poor design and careless handling
2. Transient paresthesia of mental and inferior alveolar nerves

3. Exposure of the maxillary sinus, which heals in a majority of cases
4. Perforation or Fracture of tooth roots
5. Gingival recession and Scar tissue formation
6. Staining of gingival tissues due to retrofilling materials like amalgam

OUTCOMES OF SURGICAL ENDODONTIC INTERVENTION

An initial review appointment is required to remove sutures and assess early healing. Thereafter, regular review appointments should be made to assess healing using criteria based upon clinical and radiological examination.

Radiological examination should be conducted at annual intervals until healing is observed.[26-27]Periapical radiographs should be taken, endeavouring to achieve the same angulation as the pre-operative view to allow accurate comparison.

Outcomes may be classed as successful, incomplete, uncertain and unsuccessful. Outcomes must be defined and quantified to enable audit to establish best practice, as there is a shortage of reliable clinical data. A range of 37–91% has been reported for healing following surgical endodontics.[28,37]

CONCLUSIONS

There was also limited understanding ofendodontic disease and the causes of treatment failure. The concept that it is possibleto confine microbes within the root canal system purely by placement of an apicalplug, which led to poor case selection and the unquestioned practice of performingendodontic surgery first, is obsolete. The development of newer surgicalarmamentarium, the implementation of microsurgical techniques, the use ofenhanced illumination and magnification, and the advent of newer root-end fillingmaterials have revolutionised endodontic surgery and improved surgicaloutcome.

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