Principles of endodontic surgery

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Endodontic surgery is the management of periradicular disease by a surgical approach. In general, this includes abscess drainage, periapical surgery, corrective surgery, intentional replantation, and root removal.

Conventional endodontic treatment, also known as orthograde endodontics, is generally a successful procedure; however, in 10% to 15% of cases symptoms can persist or recur spontaneously. Findings as a draining fistula, pain on mastication, or the incidental finding of a radiolucency increasing in size indicate problems with the initial endodontic procedure. Many endodontic failures occur 1 year or more after the initial root canal treatment, often complicating a situation because a definitive restoration may have already been placed. This creates a higher "value" for the tooth because it now may be supporting a fixed partial denture.

Factors Associated With Success in Periapical Surgery

- Dense orthograde fill
- Healthy periodontal status:

• No dehiscence
• Adequate crown-root ratio

- Radiolucent defect isolated to apical one-third of the tooth
- Tooth treated:

• Maxillary incisor
• Mesiobuccal root of maxillary molars

- Postoperative factors:

• Radiographic evidence of bone fill following surgery
• Resolution of pain and symptoms
• Absence of sinus tract

- Decrease in tooth mobility

Factors Associated With Failure in Periapical Surgery

- Clinical or radiographic evidence of fracture
- Poor or lack of orthograde filling
- Marginal leakage of crown or post
- Poor preoperative periodontal condition
- Radiographic evidence of post perforation
- Tooth treated:

• Mandibular incisor

- Postoperative factors:

• Lack of bone repair following surgery
• Lack of resolution of pain
• Fistula does not resolve or returns

Categories of Endodontic Surgery

1. Abscess drainage
2. Periapical surgery
3. Hemisection or root amputation
4. Intentional replantation
5. Corrective surgery

Abscess drainage

Drainage releases purulent or hemorrhagic transudates and exudates from a focus of liquefaction necrosis (i.e., abscess). Draining an abscess relieves pain, increases circulation, and removes a potent irritant. The abscess may be confined to bone or may have eroded through bone and the periosteum to invade soft tissue. Managing these intraoral or extraoral swellings by incision. Draining the infection does not eliminate the cause of the infection, so definitive treatment of the tooth is still needed.

An abscess in bone resulting from an infected tooth may be drained by two methods: (1) opening into the offending tooth coronally to obtain drainage through the pulp chamber and canal or (2) a formal incision and drainage (I&D), with or without placement of a drain.

Periapical Surgery (apicectomy or apicoectomy)

Periapical (i.e., periradicular) surgery includes a series of procedures performed to eliminate symptoms. Periapical surgery includes the following:

1. Appropriate exposure of the root and the apical region
2. Exploration of the root surface for fractures or other pathologic conditions
3. Curettage of the apical tissues
4. Resection of the root apex
5. Retrograde preparation with the ultrasonic tips
6. Placement of the retrograde filling material
7. Appropriate flap closure to permit healing and minimize gingival recession

❖ Indications for Periapical Surgery

1. Anatomic problems preventing complete debridement or obturation
2. Restorative considerations that compromise treatment
3. Horizontal root fracture with apical necrosis
4. Irretrievable material preventing canal treatment or retreatment
5. Procedural errors during treatment
6. Large periapical lesions that do not resolve with root canal treatment

1. Anatomic Problems

Calcifications or other blockages, severe root curvatures, or constricted canals may compromise root canal treatment (e.g., prevent instrumentation, obturation, or both). A nonobturated and cleaned canal may lead to failure because of continued apical leakage.

It is preferable to attempt conventional root canal treatment or retreatment before apical surgery. If this is not possible, removing or resecting the uninstrumented and unfilled portion of the root and placing a root end filling may be necessary.

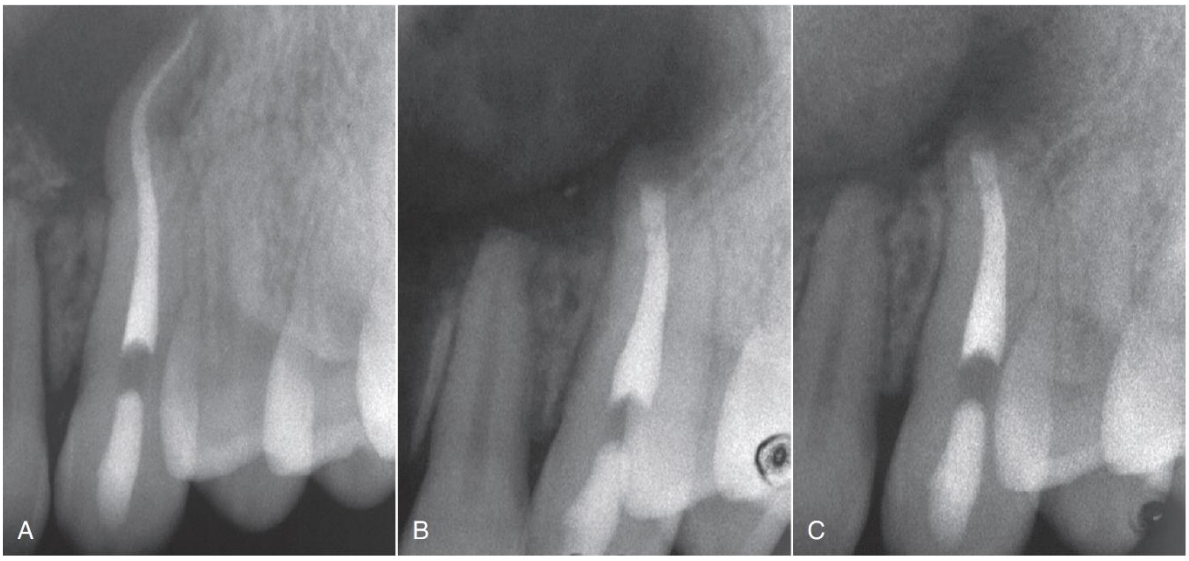

Fig. 1 (A) Anatomic problem of a severe root curvature, for which surgery is indicated. (B) Apical resection and root end retrograde mineral trioxide aggregate the seal. (C) An image taken 4 months after surgery shows regeneration of bone.

2. Restorative Considerations

Root canal retreatment may be risky because of problems that may occur from attempting access through a restoration such as a crown on a mandibular incisor. An opening could compromise retention of the restoration or perforate the root.

Rather than attempt the root canal retreatment, root resection and root end filling may successfully eliminate the symptoms associated with the tooth.

A common indication for surgery is failed treatment on a tooth that has been restored with a post and core. Many posts are difficult to remove or may cause root fracture if an attempt at removal is made to retreat the tooth.

Fig.2 Irretrievable posts and apical pathosis. Root end resection and filling with amalgam to seal in irritants, likely from coronal leakage.

3. Horizontal Root Fracture

Occasionally, after a traumatic root fracture, the apical segment undergoes pulpal necrosis. Because pulpal necrosis cannot be predictably treated from a coronal approach, the apical segment is removed surgically after root canal treatment of the coronal portion.

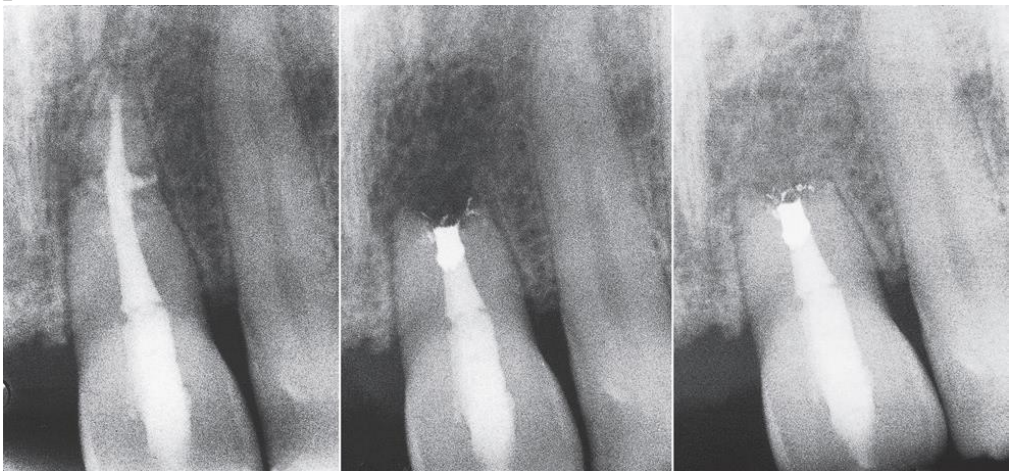

Fig.3 (A) Horizontal root fracture *(arrow)*, with failed attempt to treat both segments. (B) The apical segment is removed surgically, and retrograde amalgam is placed. (C) Healing is complete after 1 year.

4. Irretrievable Material in the Canal

Canals are occasionally blocked by objects such as broken instruments, restorative materials, segments of posts, or other foreign objects. If evidence of apical pathosis is found, those materials can be removed surgically, usually with a portion of the root. A broken file can be left in the root canal system if the tooth remains asymptomatic and is not itself an indication for apical surgery.

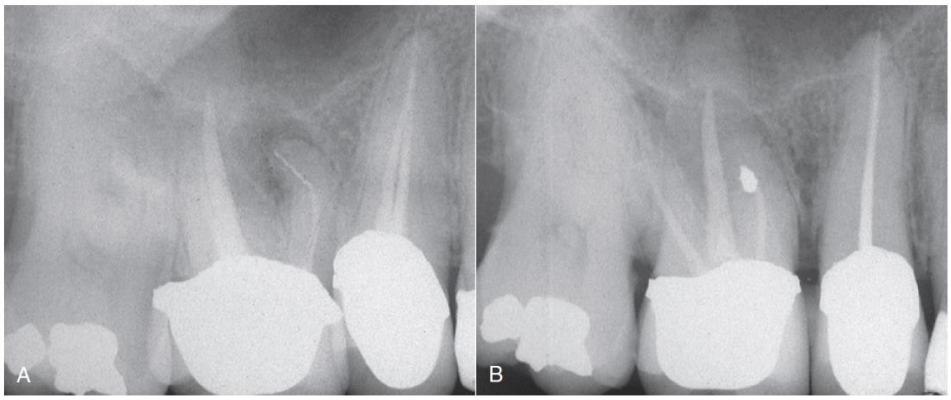

Fig. 4 (A) Irretrievable separated instruments in mesial-buccal canal. A separated instrument requires surgical intervention only if the tooth becomes symptomatic. (B) Following resection of root with fractured instrument and placement of amalgam seal.

5. Procedural Error

Broken instruments, ledging, gross overfills, and perforations may result in failure. Although overfilling is not itself an indication for removal of the material, surgical correction is beneficial in these situations if the tooth becomes symptomatic.

Because the obturation of the canal is often dense in these situations, surgical treatment has an excellent prognosis.

Fig. 5 (A) Overfill of injected obturating material has resulted in pain and paresthesia as a result of damage to inferior alveolar nerve. (B) Corrected by retreatment, apicectomy, curettage, and a root end amalgam fill.

6. Large, Unresolved Lesions After Root Canal Treatment

Occasionally, very large periradicular lesions may enlarge after adequate debridement and obturation. These lesions are generally best resolved with decompression and limited curettage to avoid damaging adjacent structures such as the mandibular nerve. The continued apical leakage is the nidus for this expanding lesion, and root resection with the placement of an apical seal often resolves the lesion.

Fig 6 Decompression of large lesion. (A) Extensive periradicular lesion that has failed to resolve. Coronal leakage in either treated tooth is possible. (B) A surgical opening to defect is created; a polyethylene tube extends into the lesion to promote drainage. (C) After partial resolution, root end resection and filling with amalgam are performed.

Contraindications (or Cautions) for Periapical Surgery

1. Unidentified cause of root canal treatment failure
2. When conventional root canal treatment is possible
3. Combined coronal treatment and apical surgery
4. When retreatment of a treatment failure is possible
5. Anatomic structures (e.g., adjacent nerves and vessels) are in jeopardy
6. Structures interfere with access and visibility
7. Compromise of crown-root ratio
8. Systemic complications (e.g., bleeding disorders)

➢ *Unidentified Cause of Treatment Failure*

An important consideration is to (1) identify the cause of failure and (2) design an appropriate corrective treatment plan. Orthograde retreatment is often indicated and offers the best chance of success. Surgery to correct a treatment failure for which the cause cannot be identified is often unsuccessful.

➢ *When Conventional Endodontic Treatment Is Possible*

In most situations, orthograde conventional endodontic treatment is preferred.

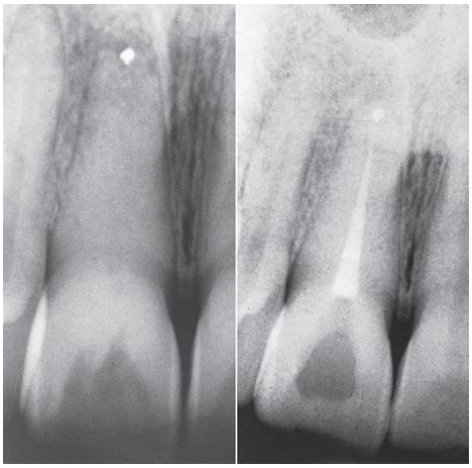

Fig. 7 (A) Inadequate root end resection and root end filling have failed to seal the apex. (B) Root canal treatment is readily accomplished, with good chance of success.

➢ *Simultaneous Root Canal Treatment and Apical Surgery*

Few situations occur in which simultaneous root canal therapy and apical surgery are indicated. An approach that includes both of these as a single procedure typically has no advantages. In some patients the conventional root canal procedure is ineffective at eliminating and purulent exudate from the tooth or a vestibular swelling is still present. A combined orthograde obturation with a simultaneous periapical surgery to curette the apical region and seal the tooth can be successfully coordinated and the symptoms resolved.

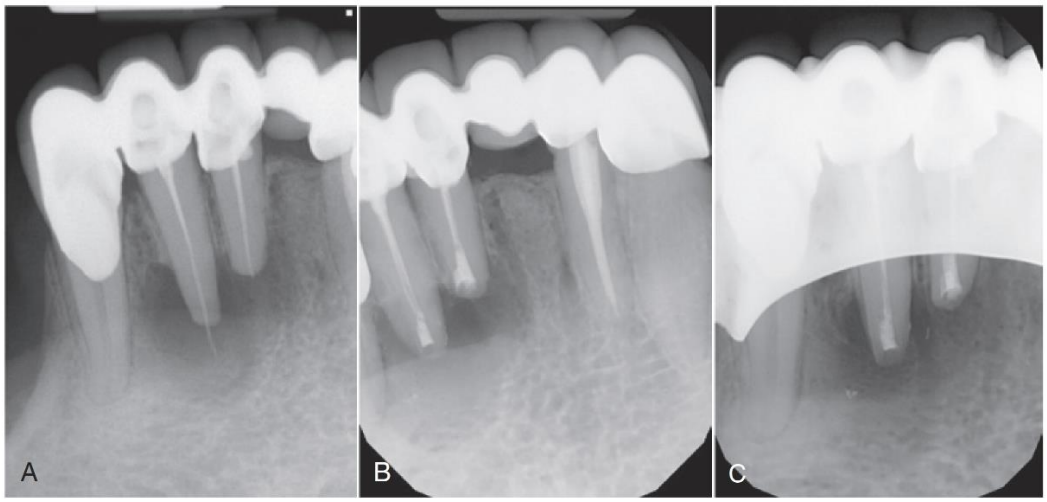

Fig.8 (A) Lower incisors with persistent symptoms despite reinstrumentation. The canals are densely filled and a slight overfill is inconsequential as the patient will see the surgeon the same day for apical surgery. (B) At the completion of the apical surgery with placement of a mineral trioxide aggregate retrograde seal. (C) Six months later the bony defect is nearly completely healed without the use of any graft.

➢ *Anatomic Considerations*

Expertise in operating around a structure such as the **maxillary sinus or the mental nerve region** is imperative before undertaking surgery in these regions. Exposure of the maxillary sinus, which occurs in most molar apical surgeries, is itself not a complication but a known consequence of the surgery. Creating a sinus opening is neither unusual nor dangerous. However, caution is necessary not to introduce foreign objects into the opening and to remind the patient not to exert pressure by forcibly blowing the nose until the surgical wound has healed (for 2 weeks). Correct flap design is also crucial to prevent the development of an oral-antral communication.

Surgical procedures around the mental foramen require caution to avoid stretch injury or direct damage to the nerve. Exposure of the mental nerve is safer than attempting to estimate its position. Once identified, staying a safe distance above, anteriorly, or both is crucial to preventing an injury. Important to note is that the nerve may have an anterior loop of 2 to 4 mm, so that distance should be accounted for anteriorly.

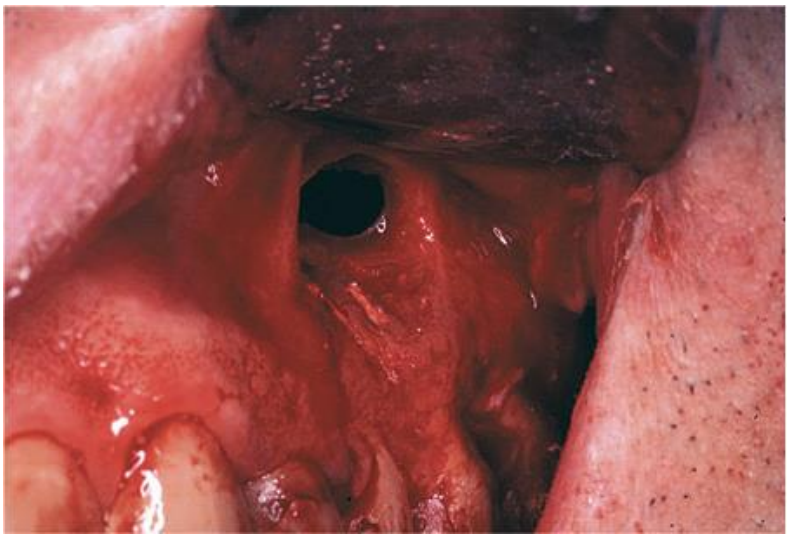

Fig. 9 Sinus communication during root apical surgery of an upper molar. The closure with the sulcular incision is far away and unlikely to lead to an oral-antral communication.

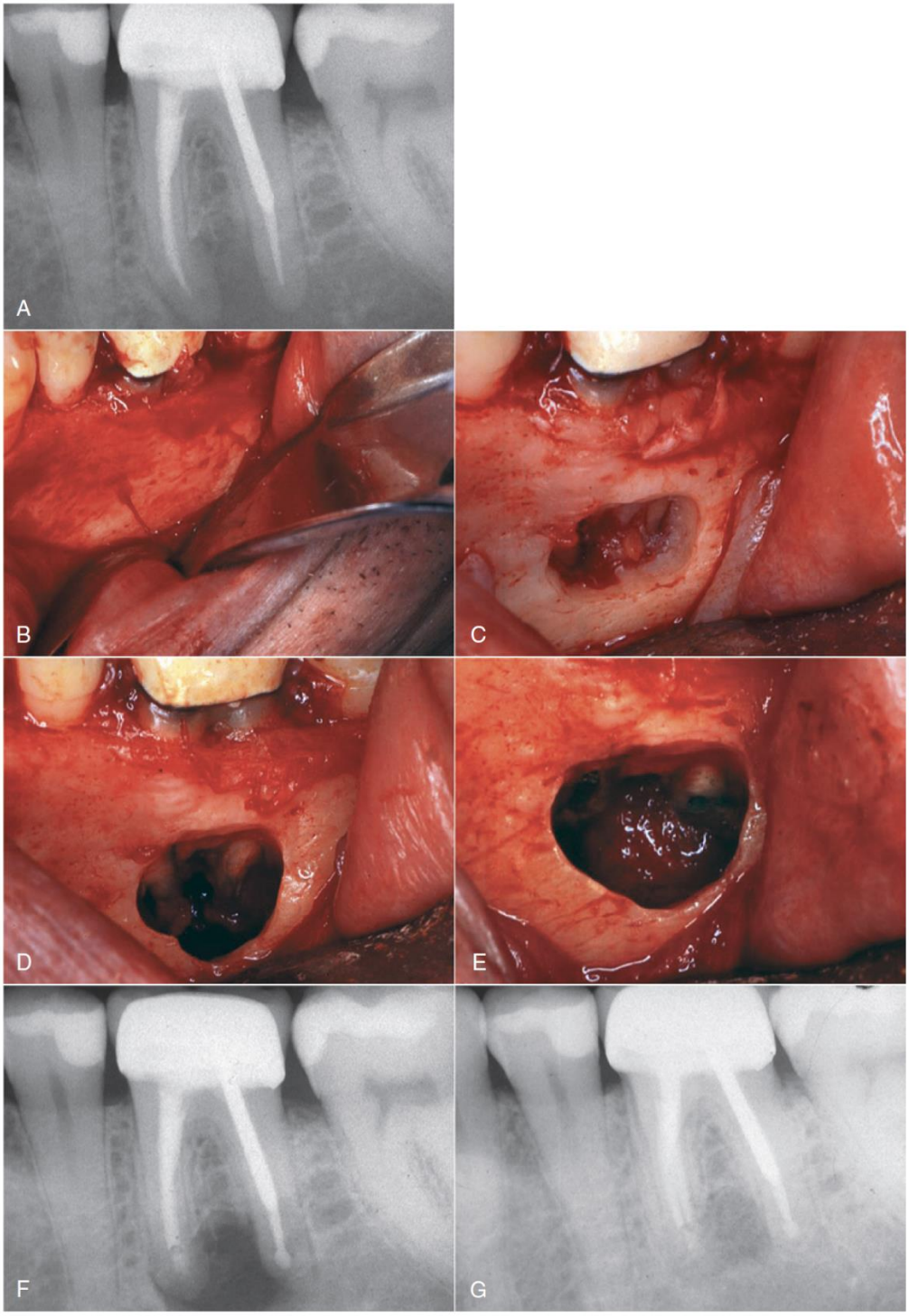

Fig. 10 (A) A preoperative radiograph showing the periapical pathologic condition amenable to apical surgery. (B) Full-thickness mucoperiosteal flap to expose lateral border of mandible. As is typical, no obvious bony perforation exists. (C) Careful removal of the thick buccal bone to expose the apical portion. (D) Apical one-third exposed before resection of root. (E) Both roots resected and mineral trioxide aggregate seal placed following ultrasonic preparation. (F) Immediate postoperative radiograph with mineral trioxide aggregate seal visible. (G) Five months after surgery, bone fill is evident.

➢ *Poor Crown-Root Ratio*

Teeth with very short roots have compromised bony support and are poor candidates for surgery; root end resection in such cases may compromise stability. However, shorter roots may support a relatively long crown if the surrounding cervical periodontium is healthy. Fig.3

➢ *Medical (Systemic) Complications*

The general health and condition of the patient are always essential considerations. Contraindications for endodontic surgery are like those for other types of oral surgery.

❖ Surgical Procedure

➢ *Antibiotics*

Almost without exception, periapical surgery is performed in an area with mixed acute and chronic infection. Because of the nature of the surgery and the potential for the spread of infection into adjacent spaces, preoperative prophylactic administration of antibiotics should be considered. Risk for infection of the hematoma exists because of the amount of edema expected after the procedure. In addition, inadvertent opening of adjacent structures such as the maxillary sinus is expected to occur with molar surgeries. Antibiotic prophylaxis are that antibiotics are to be administered before surgery to have any protective benefit. The surgeon should consider a preoperative dose of penicillin (2 g) or clindamycin (600 mg) one hour before surgery. The need for postoperative dosing has not been clearly defined and may not be of benefit to the patient. Perioperative administration of corticosteroids, may reduce edema and speed recovery. However, the use of corticosteroids may increase the risk of infection, so prophylactic antibiotics may be necessary.

➢ *Flap Design*

Surgical access is a compromise between the need for visibility of the surgical site and the potential damage to adjacent structures. A properly designed and carefully reflected flap results in good access and uncomplicated healing. The basic principles of flap design should be followed (as in mentioned in pervious lecture). Although several possibilities exist, the three most common incisions are (1) semilunar, (2) submarginal, and (3) full mucoperiosteal (i.e., sulcular). The submarginal and full mucoperiosteal incisions have either a three corner (i.e., triangular) design or a four-corner (i.e., rectangular) design.

Semilunar Incision

Slightly curved half-moon horizontal incision in the alveolar mucosa Although the location allows **straightforward reflection and quick access to the periradicular structures**, it limits the clinician in providing full evaluation of the root surface. If a fracture is noted, performing a root resection through this incision or extracting the tooth is impractical. The incision is based primarily in the unattached or alveolar mucosa, which heals more slowly with a greater chance of dehiscence than a flap based primarily in attached or keratinized tissue. In addition, the flap design carries the flap over the inflamed surgical site, and this inflamed mucosa is at a high risk of breakdown.

Other disadvantages to this incision include excessive hemorrhage, delayed healing, and scarring; therefore this design is contraindicated for most endodontic surgery.

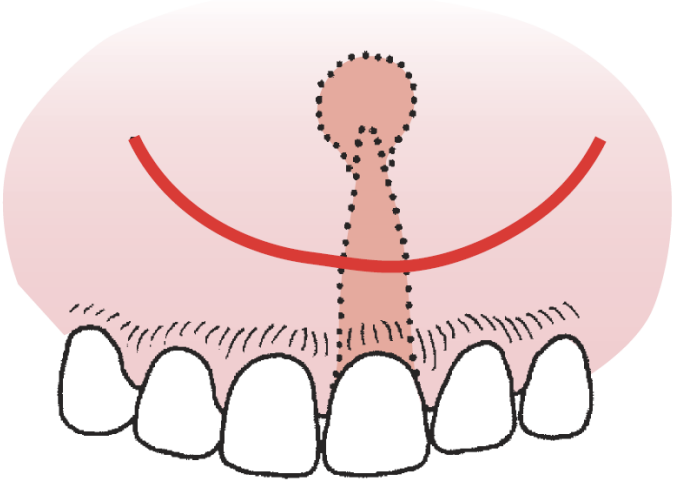

Fig.11 Semilunar flap incision, primarily horizontal and in alveolar mucosa. Because of limitations of access and poorer healing, this design is contraindicated.

Submarginal Incision

The horizontal component of the submarginal incision is in attached gingiva with one or two accompanying vertical incisions. In general, the incision is scalloped in the horizontal line, with obtuse angles at the corners. The incision is used most successfully in the maxillary anterior region or, occasionally, with maxillary premolars with crowns. Because of the design, prerequisites are at least 4 mm of attached gingiva and good periodontal health.

The major advantage of this type of incision is **esthetics**. Leaving the gingiva intact around the margins of crowns is less likely to result in bone resorption with tissue recession and crown margin exposure. Compared with the semilunar incision, the submarginal incision provides **less risk of incising over a bony defect and provides better access and visibility.** Disadvantages include hemorrhage along the cut margins into the surgical site and occasional healing by scarring compared with the full mucoperiosteal sulcular incision.
The incision also provides limited access should a fracture be noted or other situation in which extraction or root resection is indicated.

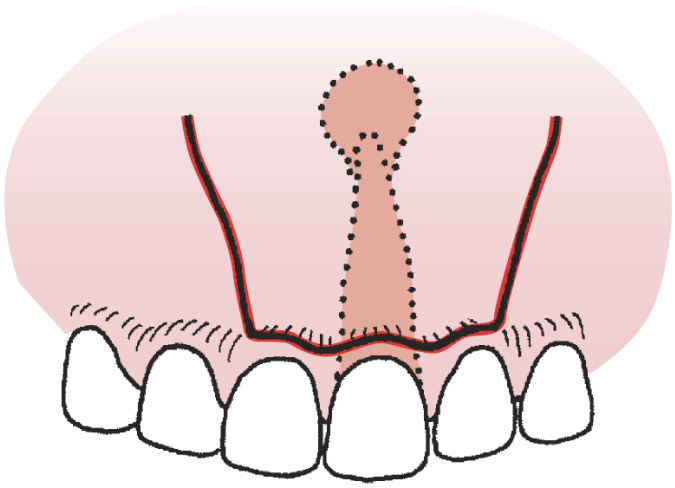

Fig.12 Submarginal incision is a scalloped horizontal line in attached gingiva, with one or two vertical components. This incision is usually confined to the anterior maxillary region.

Full Mucoperiosteal Incision

The full mucoperiosteal incision is made into the gingival sulcus, extending to the gingival crest. This procedure includes elevation of interdental papilla, free gingival margin, attached gingiva, and alveolar mucosa. One or two vertical relaxing incisions may be used, creating a triangular or rectangular design. The full mucoperiosteal design is preferred over the other two techniques. The advantages include **maximum** access and visibility, **not incising over the lesion or bony defect**, **lower risk for hemorrhage**, **complete visibility of the root, allowance of root planning and bone contouring, and reduced likelihood of healing with scar** formation. The disadvantages are that the flap is more difficult to replace and to suture; in addition, gingival recession can develop if the flap is not reapproximated well, exposing crown margins or cervical root surfaces (or both).

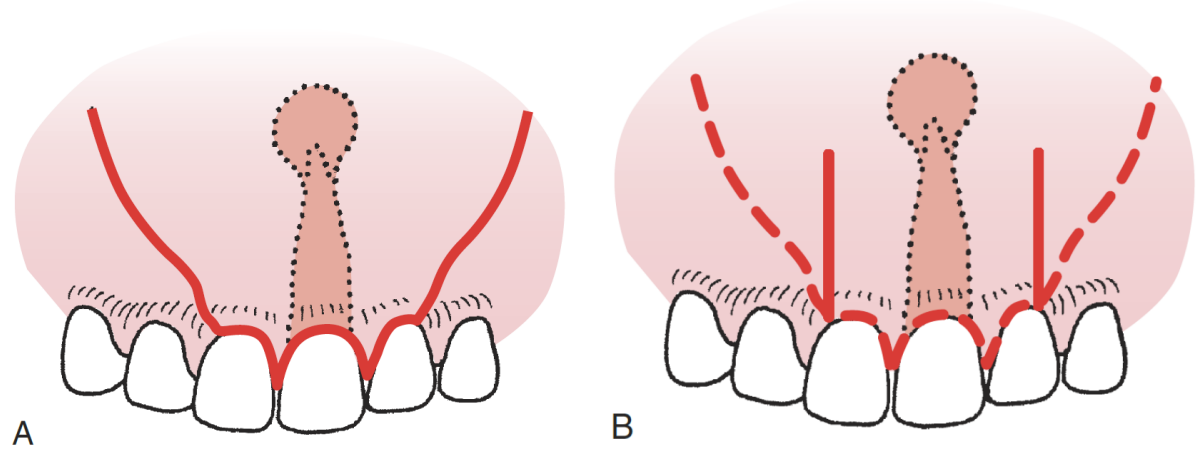

Fig.13 (A) Full mucoperiosteal (i.e., sulcular) incision. The horizontal incision is into the sulcus, accompanied by one (i.e., three-corner) or two (i.e., four-corner) vertical components. This represents the classic trapezoidal flap with the base broader rather than the peripheral edge. (B) In comparison, by making the vertical-releasing incision(s) along the long axis of adjacent teeth, the length of the flap in nonkeratinized tissue is decreased, which reduces pain and accelerates the healing.

➢ *Anesthesia*

For most surgical procedures, anesthetic approaches are conventional. In most mandibular regions, a block is administered; then local infiltration of an anesthetic with epinephrine is given to enhance hemostasis. Frequently, the patient is sensitive to curettage of the inflammatory tissue, particularly toward the lingual aspect. Some of the sensitivity may be decreased by a preemptive periodontal ligament or intraosseous injection, using a device specifically designed for this purpose. Placing a cotton pellet soaked with local anesthetic solution can also reduce this discomfort. A long-acting anesthetic agent such as bupivacaine is recommended for the inferior alveolar nerve block. Bupivacaine 0.5% with epinephrine 1 : 200,000 has been shown to give long-lasting anesthesia and, later, provide a lingering analgesia. Long-acting local anesthetic agents such as bupivacaine do not diffuse well through tissue because they are highly protein bound, which limits their effectiveness for an infiltration-type injection.

Some patients request sedation because of their concern about having a surgical procedure. If active infection is present in the region, profound local anesthesia may not be possible to achieve, and these patients may be candidates for intravenous sedation or general anesthesia.

➢ *Incision and Reflection*

A firm incision should be made through the periosteum to bone. Incision and reflection of a full-thickness flap is important to minimize hemorrhage and to prevent tearing of the tissue. Reflection is with a sharp periosteal elevator beginning in the vertical incisions and then raising the horizontal component. To reflect the periosteum, the elevator must firmly contact bone while the tissue is raised. Reflection is to an apical level adequate for access to the surgical site, although still allowing a retractor to have contact with bone. Enough width and vertical release of the flap must be included to prevent the flap from being stretched, which can lead to tearing and slower healing.

Postsurgical recession, especially around teeth in the esthetic zone, is a concern. Recession may be exacerbated in cases where preexisting full coverage crowns are present.

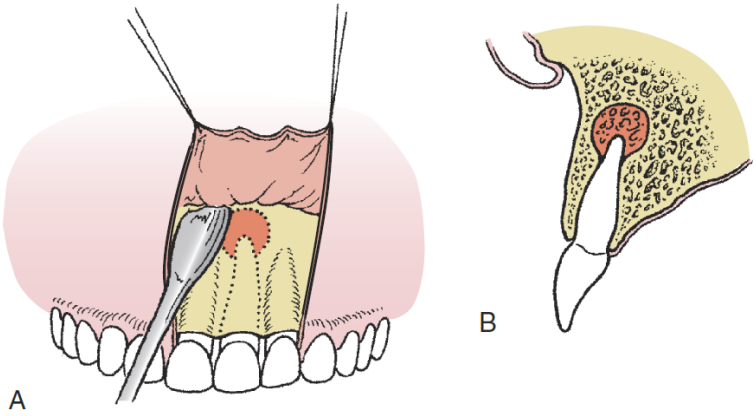

Fig. 14 Full-thickness flap is raised with sharp elevator in firm contact with bone. Enough tissue is raised to allow access and visibility to apical area. (A) Frontal view. (B) Cross-section.

➢ *Periapical Exposure*

Frequently, cortical bone overlying the apex has been resorbed, exposing a soft tissue lesion. If the opening is small, it is enlarged using a large surgical round burr until approximately half the root and the lesion are visible. With a limited bony opening, radiographs are used in conjunction with root and bone topography to locate the apex. A measurement may be made with a periodontal probe on the radiograph and then transferred to the surgical site to determine the apex location.

To avoid air emphysema, handpieces that direct pressurized air, water, and abrasive particles (or combinations) into the surgical site must not be used.

Copious irrigation should be performed with a syringe or through the handpiece with sterile saline solution. Enough overlying bone should be removed to expose the area around the apex and at least half the length of the root. Good access and visibility are important; the bony window must be adequate. The clinician should not be concerned about the bone removal because once the infection resolves, bone will reform.

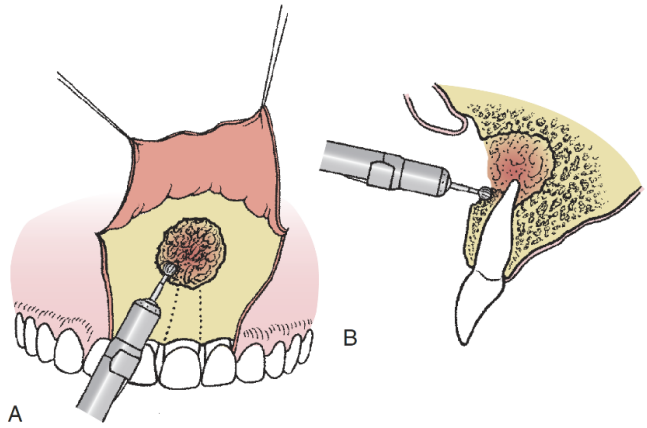

Fig. 15 Apical exposure. A large round burr is used to "paint" the bony window. Enough bone is removed to give good visibility and access to lesion and apex. (A) Frontal view. (B) Cross-section.

➢ *Curettage*

Most of the granulomatous, inflamed tissue surrounding the apex should be removed to gain access and visibility of the apex, to obtain a biopsy for histologic examination (when indicated), and to minimize hemorrhage.

If possible, tissue should be enucleated with a suitably sized sharp curette, although total lesion removal usually does not occur.

Often, extensive debris may have been forced out the apex of the tooth during the initial endodontic therapy. Cleaning out this debris removes what may have been the nidus for the acute or chronic infection. Tissue removal should not jeopardize the blood supply to an adjacent tooth. It is better to leave a small portion of this tissue than to damage the inferior alveolar nerve and this wouldn't compromising healing.

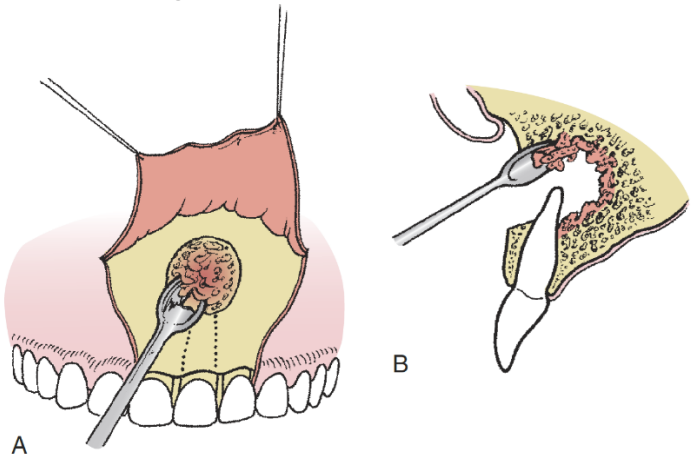

Fig.16 Curettage. Much of lesion that is accessible is removed with large curettes. Usually, remnants of tissue remain, which is not a problem. (A) Frontal view. (B) Cross-section.

➢ *Root End Resection*

Root end resection is indicated because it removes the region that most likely had the **poorest obturation** because of the distance from the coronal portion of the tooth. The presence of **accessory canals** increases at the apex as well, which may have not been initially cleaned and debrided, thus leaving a source of continued infection.

The resection is done with the tapered fissure burr. Depending on the location, a bevel of varying degrees is made in a faciolingual direction. With the use of ultrasonic instruments to prepare the apex, a minimal bevel is needed, especially in anterior maxillary teeth.

The amount of root removed depends on the reason for performing the resection. Sufficient root apex must be removed to provide a larger surface and to expose additional canals. In general, approximately **2 to 3 mm** of the root is resected—more, if necessary, for apical access or if an instrument is lodged in the apical region; less if too much removal would further compromise stability of an already short root.

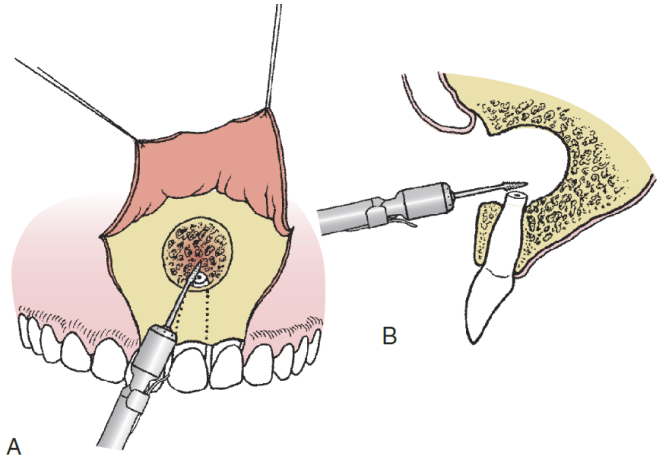

Fig.17 Root end resection. Approximately one third of apex is removed with tapered burr. Amount removed and degree of bevel varies according to situation. (A) Frontal view. (B) Cross-section.

➢ *Root End Preparation and Restoration*

A retrograde filling should be placed unless technical aspects prohibit it. The filling seals the canal system, preventing further leakage.

The depth of the preparation must be at least 1 mm deeper than the length of the bevel to seal the apex adequately. Root end preparation was done by slow-speed, specially designed microhandpieces. Contemporary apical preparation uses ultrasonic tips.

Ultrasonic instruments offer the advantages of **control and ease of use**; they also permit **less apical root removal** in certain situations. Another advantage of the ultrasonic tips, particularly when diamond coated, is the formation of **cleaner, better-shaped preparation**. Evidence suggests that success rates are significantly improved with ultrasonic preparation.

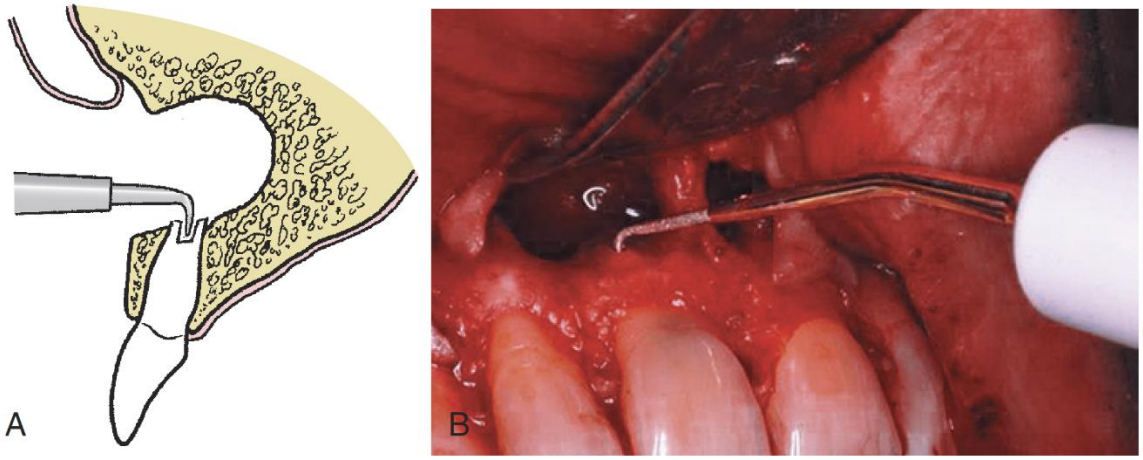

Fig.18 (A) Ultrasonic tips are good alternative for root end preparation. (B) These tips permit preparation with better control and less root removal and the need for less bevel, which exposes fewer dentinal tubules.

➢ *Root End–Filling Materials*

The root end–filling material is placed into the cavity preparation. These materials should seal well and should be tissue tolerant, easily inserted, minimally affected by moisture, and visible radiographically. Importantly, the root end–filling material must be stable and nonresorbable indefinitely.

Amalgam (preferably zinc free), intermediate restorative material, and super ethoxybenzoic acid cement have been commonly used materials. Gutta-percha, composite resin, glass ionomer cement, intermediate restorative material, and different luting cements have also been recommended; these materials have less clinical documentation of success. **Mineral trioxide aggregate (MTA)** has favorable biologic and physical properties and ease of handling; it has become a widely used material. MTA has been shown to be conducive to bone growth over the apical region. MTA is a hydrophilic material, similar to Portland cement. MTA has a working time of approximately 10 minutes, although it takes 2 to 3 hours to reach final set, which is not an issue because the root apex is not a load-bearing region, at least not until bone fills in the defect.

The surgeon must be careful not to irrigate MTA out after placement, so irrigation is done before placing the filling, and any excess is wiped with a just-dampened cotton pellet.

MTA, with its properties, may be placed in a field in which some hemorrhage has occurred; the final set is not adversely affected by blood contamination.

➢ *Irrigation*

The surgical site is flushed with copious amounts of sterile saline to remove soft and hard tissue debris, hemorrhage, blood clots, and excess root end–filling material.

➢ *Radiographic Verification*

Before suturing, a radiograph is obtained to verify that the surgical objectives are satisfactory. If corrections are needed, these are made before suturing.

➢ *Flap Replacement and Suturing*

Cervical region of the exposed teeth is gently scaled to remove any debris, preexisting calculus, and granulation tissue. This speeds the reattachment and reduces greatly the chance for recession. The flap is returned to its original position and is held with moderate digital pressure and moistened gauze.

A sling suture is ideal in the esthetic zone to avoid gingival recession. After suturing, the flap should again be compressed digitally with moistened gauze for several minutes to express more hemorrhage. This limits postoperative swelling and promotes more rapid healing.

➢ *Postoperative Instructions*

Oral and written information should be supplied in simple, straightforward language. Instructing the patient about normal postoperative sequelae (e.g., swelling, discomfort, possible discoloration, and some oozing of blood) and the ways in which these sequelae can be prevented, managed, or both, this would minimize anxiety arising from. The surgical site should not be disturbed, and pressure should be maintained (cold packs over the surgical area until bedtime).

Oral hygiene procedures are indicated everywhere except the surgical site; careful brushing and flossing may begin after 24 hours. Proper nutrition and fluid intake are important but should not traumatize the area.

A chlorhexidine rinse, twice daily, reduces bacterial count at the surgical site. This may minimize inflammation and enhances soft tissue healing.

Analgesics are recommended, although pain is frequently minimal; strong analgesics are usually not required.

The patient is instructed to call if excessive swelling or pain is experienced. Again, antibiotics are not indicated; palliative or corrective treatment usually suffices.

➢ *Suture Removal and Evaluation*

Sutures ordinarily are removed in 5 to 7 days, with shorter periods being preferred to enhance healing. After 3 days, swelling and discomfort should be decreasing.

❖ To Perform a Biopsy or Not

A clinical controversy has ensued over the consideration as to whether all periapical lesions treated surgically should have soft tissue removed and submitted for histologic evaluation. Some organizations, such as the American Association of Endodontists, submit all the soft tissue recovered from the apical surgery for pathologic evaluation.

Guidelines on which to determine that submission of tissue is not indicated. These guidelines are:

- Was there evidence of preendodontic pulpal necrosis?
- Is the characteristic of the radiolucency "classic"?
- Will the patient return for follow-up radiographs?

If all of these criteria are met, the surgeon may decide to not submit routinely collected periapical tissue.

❖ Light and Magnification Devices

Surgical Microscope

The microscope has been adapted and used for surgery, as well as for other diagnostic and treatment procedures in endodontics. Advantages of the microscope include **magnification and in-line illumination**. Microscopes also can be adapted for **videotaping and to transmit the image to a television** monitor for direct viewing or recording. These adaptations enhance the view of the surgical field, help identify previously undetected structures, and facilitate surgical procedures.

Fiberoptics

A new system, known as endoscopy, is available that uses a very small, flexible fiber bundle that contains a light and an optic system. The optics are connected to a monitor that permits visualization of precise details of the surgical site. This system also gives the clinician the option of videotaping and recording the procedures.