

ENDODONTIC SURGERY

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SURGICAL METHODS OF PRESERVING THE TEETH

- Ambulant dentoalveolar procedures
- Surgical rehabilitation of the tooth after unsuccessful restorative, surgical, periodontological and orthodontic dental treatment.
- Primary aim is the preservation of the tooth
- Apicectomy-resection of the root apex
- Retrograde filling
- Transdental fixation
- Replantation
- Transplantation



MAKING OPERATION PLAN

- An accurate patient examination is essential before most of the operative interventions! (anamnesis, physical, supplementary and radiological examinations)
The indications and contraindications need to be assessed carefully during the making of the operative plan.
- Detailed documentation and informing the patient !
- Radiological findings:
 - Periapical X-ray: length of the root, curvature, distance from the other teeth
 - OPT:
 - In case of distal teeth: their relation to the mandibular canal and to the maxillary sinus or other pathological lesions
 - Occlusal X-ray:
in case of palatally curving roots



ENDODONTIC SURGERY, PERIAPICAL SURGERY

- Endodontic surgery, periapical surgery includes dentoalveolar surgical procedures
- Following the completion of endodontics, the tooth may lead to recommendation for periapical/endodontic surgery.
- These results the correct closure of the apex, and the healing of the periapical lesions.
- The surgery completes the root canal treatment BUT does not substitute it!

ENDODONTIC SURGERY, PERIAPICAL SURGERY

- Root canal filling
- Expectations:
- apex length RCF, it has to fill the canal completely, the closure of the periapical region from the root canal.
- length, density, and taper- The root canal filling was considered acceptable if it had an adequate length with no voids and consistent taper from the orifice to the apex.

APICECTOMY- RESECTION

- Apicectomy – more expressive
- The most frequently used endodontic surgical intervention.
- Removal of the pathological periapical parts and the apex of the tooth to make a correct RCF.
- Surgical finishing of the root canal filling

INDICATIONS

- **1. Anatomic or pathologic problems preventing complete débridement or obturation of the root canal**
- constricted canal, severe root curvatures
- delta apicalis
- calcification or other blockages
- **2. Periodontitis apicalis chronica**
- relative: orthograde conventional endodontic treatment is preferred, surgery is not indicated
- absolute: in case of focal disease

INDICATIONS

- **3. Apical leakage**
- Periapical cyst
- Chronic apical osteitis
- Fistule and drainage
- **4. Procedural errors**
- Broken instruments
- Perforation of the root
- Overfilling - curettage of the apical tissue
- Ledging

INDICATIONS

- **5. Horizontal root fracture in the apical third**
- **The apical segment is removed surgically after root canal treatment of the coronal portion**
- **6. Exposure of the apex in connection with other operations**
- **Operations of huge cysts or the maxillary sinus**

CONTRAINDICATIONS

General surgical contraindications

- General condition, age
- Cardiovascular diseases
- Haematological disorders
- Pregnancy in 1th and 3rd trimester
- Cachexia
- Diabetes mellitus
- Untreated systemic diseases

CONTRAINDICATIONS

- **Local contraindications**
- **Conventional root canal treatment is possible**
- **Periodontally weakened/mobile teeth**
- **Acute purulent inflammation**
- **Anatomical structures in the region of the planned operation**
- **Short root/ compromise of crown-root ratio**
- **Extended defect**
- **Alveolar atrophy**
- **Stomatitis (relative)**

SURGICAL PROCEDURE

- Preparation of the tooth (root canal filling)
- Local anaesthesia
- Creating a flap
- Periapical exposure, resection of the apex, curettage
- Irrigation
- Flap replacement and suturing

PREPARING THE TOOTH

Root canal filling!

Before the operation- preoperative

During the operation- intraoperative

It is preferable to attempt conventional root canal treatment

In surgical aspect it is more advantageous to perform it preoperatively

„Too early” acute exacerbation of periapical inflammation could develop

„Too late”- bonding time!!

In case of failed surgical treatment, orthograde re-treatment is indicated before the repeated surgery



PREPARING THE TOOTH

Preoperative: The criteria of this method is the correct preparation-desiccation and filling of the root canal to the possible line of apicectomy. The main advantage is the shortened operation time and we can control it before the operation

Intraoperative: Making The RCF under direct visual control. Advantages: better desiccability, higher possibility to make a correct RCF after apicectomy and the removing of the apex and the delta. Usually used when the desiccation is unsuccessful preoperatively.

The perfect closure of the root canal can be achieved. The proper isolation is very important. The root filling material has to be catching into the canal at the apex like an inlay.

Disadvantage: makes the operation time longer



FLAPS

- The basic principles of flap design should be followed
- To provide adequate exposure and promote proper healing the flap must be correctly designed
- Mucoperiosteal flap-properly designed, carefully reflected flap- good access and uncomplicated healing
- The flap should be designed to avoid injury of local vital structures in the area of surgery.
- The incisions that outline the flap must be made over intact bone that will be present after the surgical procedure is complete.
- Variety of intraoral tissue flaps can be used.



FLAPS

- **Sulcular/ Envelope flap**
- Indication: neck resorption, perforation, periodontal intervention
- Advantages: there is no vertical incision, easy to reconstruct the original stage
- Disadvantages: small explored area, worse visibility, hard to retract the flap, stretching tissues, traumatisation of the gingival adhesion

- **Partsch**



- **Semilunar**

- Indication: limited amount of access necessary, approach to the root apex
- Advantages: simple incision, designed to avoid attached gingiva, there won't be bone loss on the alveolar ridge
- Disadvantages: provides limited access, runs through the protrusion of the roots (juga alveolaria), danger of ruption of the flap, delayed healing, bleeding

- **Pichler**



FLAPS

- **Three-cornered flap , L-shaped flap**
- **Indication:** perforation of the root in the medial third, greater access is necessary in an apical direction, especially in the posterior aspect of the mouth
- **Advantages:** maximum access and visibility with a shorter circular incision, easy to modify in two directions, easy reconstruction except vertical releasing incision, not incising over the lesion
- **Disadvantages:** in case of long roots the visibility is worse, stretching during the retraction, the vertical incision affects the alveolar mucosa , gingival recession could develop



FLAPS

- **Rectangular flap, Trapezoid shape flap:**
- **Indications:** periapical surgery of more than 1 tooth , huge lesion, short or long roots, access the whole lengths of the root
- **Advantages:** good visibility, flap stretching is minimal
- **Disadvantages:** damages the flaps blood supply, longer exploration time, damages the gingival adhesion, gingival recession can develop, bone loss from alveolar ridge, difficulty in suturing

FLAPS

- **Submarginal incision**
- **Horizontal component is in the attached gingiva**
- **Frenulum can be saved in upper front region**
- **Advantage: esthetic, avoid the attached gingiva, less likely to result recession, bone resorption and crown margin exposure**
- **Disadvantage: hemorrhage, scar formation**

Reinmüller incision

ANAESTHESIA

- In most mandibular regions an inferior alveolar nerve block is administered
- In maxillary region terminal anaesthesia of the tooth, palatal anaesthesia!
- Frequently patients are sensitive to curettage of the inflammatory tissue- intraligamental injection using a device specifically designed for this purpose or placing a cotton pellet soaked with local anesthetic solution can reduce this discomfort

PERIAPICAL EXPOSURE

- Localization of root apex, periapical region
- Cortical bone overlying the apex has been resorbed frequently
- Overfilling can be seen
- Jugum alveolare
- X-ray- is used in conjunction with root and bone topography to locate the apex or correlate the length of crown to the length of the root
- Length of the instruments used for root canal treatment

ROOT END RESECTION

- Bone trepanation- large surgical round bur approximately half of the root and the lesion are visible
- Root end resection- fissure bur
- Copious irrigation should be performed with sterile saline solution
- Root end resection because it removes the region that most likely had the poorest obturation

ROOT END RESECTION

- 2-3mm of the root , <one third of the root
- The plane of the resection is perpendicular to the axis of the root (not 45°)
- Tilted surface: more dentin tubes opened during oblique preparation, which worsening the chance of healing, So the perpendicular preparation plain to the tooth's axis is advised. We prepare the plain in 45 degree when the retrograd RCF is necessary

SURGICAL MICROSCOP

- 2005. endodontial methodological recommendation in Hungary
- Rate of success ↑
- Advantage: more accurate localization of the apex, smaller bony window in size, angel of resection plain $>10^\circ$, more precise retrograde filling
- Disadvantage: cost of purchasing, special small instruments, longer operation time

- **The granulomatous, inflammed tissue surrounding the apex shold be removed: (Volkman, Kerpel, excavator)**
- **Intraoperative root canal filling if it necessary**
- **Irrigation: the surgical site is flushed with copious amounts of sterile saline to remove soft and hard tissue debris, haemorrhage, blood clots and excess root end filling material**
- **Flap replacement and suturing: the flap is returned to its original position, sling suture (circumdental) is recommended**

SPECIAL ASPECTS IN CASE OF INDIVIDUAL TOOTH

- **Upper incisors**
- Most frequent
- Frenulum labii superior
- Perforation of the nasal musosa
- The apex of the lateral incisor is located more palatinally
- **Upper canine**
- To localize the apex is easy
- Thick, srtong root
- Opening of the nasal cavity or the maxillary sinus is a rare complication

SPECIAL ASPECTS IN CASE OF INDIVIDUAL TOOTH

- **Upper premolars**
- Vicinity of the maxillary sinus and the anatomical variation of the tooth can cause difficulty
- Accurate planing of incision (possible sinusplasty)
- Finding the palatinal root is more difficult
- **Upper molars**
- We resectate only the first molar in practice
- Buccal roots
- To remove the whole buccal roots (dissection)

SPECIAL ASPECTS IN CASE OF INDIVIDUAL TOOTH

- **Lower incisors**
- Thick buccal cortical plate
- Thin, gracile tooth
- Very small space
- Increased danger of the injury of the adjacent teeth

- **Lower canine**
- Long root
- The operation does not cause any particular difficulty



SPECIAL ASPECTS IN CASE OF INDIVIDUAL TOOTH

- **Lower premolars**
- **Danger of injury of the mental nerve**
- **Appropriate incision and exposure**

- **Lower molar**
- **Apicectomy is generally not performed on the lower molars**
- **Dissection**
- **Modified version of resection**



DISSECTION

- **Conditions:**
- **It is performed for teeth at the end of the dental arch which are intended to be used subsequently as a bridge pillars**
- **One of the roots of the tooth (generally the distal one) without any periapical lesion and can be filled**
- **Healthy periodontium**
- **Wide interradicular sept**
- **Root canal filling**
- **Sulsular incision**
- **Approach of bifurcation**
- **Dissection of the roots with bur**
- **Extraction of the root**



RETROGRADE FILLING

- **Accesorial periapical surgical method , the filling seals the canal system, preventing further leakage.**
- **Indication:**
- **RCF which can not be corrected in the orthograd way and it is associated with a periapical lesion (root tapped tooth)**
- **Insufficient apical closure, which recognised during the apicectomy**
- **denticulus, stenosis, fractured tools or needles**

RETROGRADE FILLING

- A retrograde filling should be placed after the preparation of the retentional cavity, removal of the apical part of the root canal filling
- Plane of resection 45°
- Rotary instruments-slow speed specially designed microhandpieces, depth: 3mm
- Ultrasonic instruments- success rate better, cleaner, better shaped preparation
- The root end filling material is placed into the cavity preparation

RETROGRADE FILLING

- The root canal filling material should seal well and should be tissue tolerant, easily inserted, minimally affected by moisture and visible radiographically.
- No single , allpurpose, superior root end-filling material exists.
- Glass-ionomer, Bio-dentin , MTA
- Mineral trioxide aggregate has shown favorable biologic and physical properties- widely used
- Conductive to bone grows in periapical region

COMMON ERRORS, COMPLICATIONS

- Incorrect diagnosis
- Inadequate preoperative planning
- Inadequate anaesthesia
- Poorly positioned incision
- Collapse of the flap
- Difficulties of the periapical region's identification
- Insufficient apex removing
- inadequate retention of the retrograde RCF
- Filling material parts that left behind
- Failed flap reposition

COMMON ERRORS, COMPLICATIONS

- Injury of the adjacent teeth, soft tissues, nerves, blood vessels
- Opening the nasal cavity or the sinus
- bleeding
- failure
- haematoma
- wound healing disorder
- inflammation
- tooth mobility
- recidive lesion



POSTOPERATIVE INSTRUCTIONS

- Oral and written information should be supplied
- Cold packs over the surgical area
- Surgical site should not be disturbed
- Oral hygiene procedures are indicated, careful brushing may begin after 24h at the surgical site
- Proper nutrition and fluid intake- soft diet
- Chlorhexidine rinse
- Analgesics
- Antibiotics in special cases- normally are not indicated

TRANSIDENTAL FIXATION

- The stabilisation of the tooth which has a weakened support structure with a special stick. This stick is guided through the root and prolonged in the alveolar bone. It is made of biomaterial titanium or aluminium oxide ceramics.
- Indication:
- Tooth suffered from trauma which has a root fracture in the medial third
- Huge periapical bone loss, unstable tooth
- Resorption of the root
- Marginal periodontitis

TRANSIDENTAL FIXATION

- **Surgical techniques:**
- **Apically open method combined with apicectomy. In case of closed method the proper position setting of the stick is hardened**
- **Dilatation of the root canal to correspond to the thickness of the fixation stick**
- **The stick should be in the bone 1 cm long**

REPLANTATION

- Replacing the tooth into its own socket
- Indication: Luxation because of trauma , wrong extraction
- Conditions: intact socket, alveolar bone, time factor (12h), wet environment
- Replantation of the extracted or luxated tooth after it has dried cannot be successfully accomplished.

REPLANTATION

- The factors most important for determining how successful treatment measures will be are the length of time the tooth has been out of the socket, the state of the tooth and periodontal tissues, and the manner in which the tooth was preserved before replantation
- The tooth should be rinsed gently
- The tooth should be placed back or should be kept in the patient's mouth or placed into an appropriate medium (water, physiologic saline, milk, special tooth box-save a tooth)

REPLANTATION

- Anaesthesia
- Cleaning the socket and the tooth with 0.9 % saline solution.
- Avoid the curettage- root surface and tooth socket should never be scraped or manipulated because it can destroy viable periodontal ligaments
- Replantation
- Sem-rigid fixation- rigid fixation could predispose ankylosis and external root resorption
- Acid etched composite system- composite with wire or arch bar
- The duration of stabilization- as short a time as necessary for the tooth to become reattached (7-10-14 days)

REPLANTATION

- Soft tissue injuries caring
- Antibiotics, Tetanus prophylaxis, liquid soft diet, rinse with CHX, if necessary analgesia
- If the apical foramen is wide open, pulp may survive and revascularize (3-4 weeks splinting)
- Mature tooth should be root canal treated and filled
- After 2-4 weeks temporary filling with CaOH₂-al
- After 6 months permanent filling
- Observation!

TRANSPLANTATION

- We transplanting the patients own healthy tooth into the place of the extracted or missing one.
- Very strict conditions and indications!
- Young patient in puberty
- Excellent oral hygiene, cooperation
- Biological conditions: healthy periodontium and alveolar bone of the donor and recipient site
- Revascularisation and reinnervation- development of the root is not complete, foramen apicale > 2mm, bifurcation of molars totally developed
- Most often transplanted teeth: wisdom teeth, premolars, deciduous canine



TRANSPLANTATION

Local anaesthesia- donor and recipient region

Atraumatic extraction of the tooth

Preparation of the alveolar bone of the recipient site

1-2 mm wider, essential for wound healing and clot formation

The transplanting tooth should be placed in tetracyclin solution

Insertion of the tooth, infraocclusion does not need, suitable direkt antagonist contact

TRANSPLANTATION

- Fixing with sutures and splinting
- Semi-rigid fixation- rigid fixation can lead to ankylosis
- Duration time of fixation 2-6 weeks
- Rinsing with CHX, antibiotics
- Observation!
- composite rekonstruction, crown
- Foramen apicale < 2mm, ROOT CANAL TREATMENT kell- pre-, intraop.
- MTA
- Helps bony regeneration
- Biocompatible



LITERATURE

- **Cotemporary Oral and Maxillofacial Surgery- chapter 18, Principles of endodontic surgery, in chapter 24 Avulsion (page 483-487)**
- **Oral and maxillofacial surgery , edited by György Szabó: Chapter 4. – Surgical methods of preserving the teeth**
- **LECTURE!**

The pictures in the lecture are the own property of University of Debrecen, Oral and Maxillofacial Department of the Faculty of Dentistry .

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