Endodontic Surgery

Dr. Körmöczi Kinga
Surgical methods of preserving the teeth

- Apicoectomy (root-end resection)
- Retrograde root canal filling
- Transdental fixation
- Tooth replantation
- Tooth transplantation
The changes of the surgical profile of the Oral Surgery Department

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2004</th>
<th>2008</th>
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<tbody>
<tr>
<td>Surgical tooth removal</td>
<td>4427</td>
<td>4728</td>
<td>5354</td>
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<tr>
<td>Tooth removal of impacted wisdom</td>
<td>1197</td>
<td>1400</td>
<td>2042</td>
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<tr>
<td>Apicoectomy</td>
<td>566</td>
<td>469</td>
<td>331</td>
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<tr>
<td>Retrograde root canal filling</td>
<td>104</td>
<td>93</td>
<td>33</td>
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<tr>
<td>Implantation</td>
<td>263</td>
<td>398</td>
<td>532</td>
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<tr>
<td>Bone grafting</td>
<td>75</td>
<td>103</td>
<td>133</td>
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The history of the use of microscope in surgery

- In 1953 Carl-Zeiss company made the first binocular operating microscope.

- In 1981 Apotheker and Jakob planned and started to sell the first operating microscope for dentistry with the name Dentiscope.

- In March 1993 the first symposium of endodontic surgery was organized at the dentistry department of Pennsylvanian University.
Operating microscope

The benefits of usage of operating microscope in endodontics:

- Accurate localization of the root apex
- Smaller „bone window” necessary during the operation
- The resection angle is smaller, than 10°
- Ability to inspect, prepare and seal the isthmus area
- More accurate preparation
- Precise retrograde root filling
Microsurgical instruments for endodontics

- The range of magnification from 2.5X to 8X allows a better evaluation of the root position.

- Magnification of 10X to 16X is used for operating. This is the so called „working magnification” in endodontic surgery.

- The highest magnification (20X to 30X) is used only to examine fine details.
Microsurgical instruments for endodontics
Microsurgical instruments for endodontics
Microsurgical instruments for endodontics
ultrasonic preparation instrument
Microsurgical instruments for endodontics
ultrasonic preparation instrument

- Works with 30-40 Hz frequency, induced by quartz or ceramic piezoelectric crystals.
- The multiple curves of the ultrasonic tips ensure easier access to the smaller bone crypts.
- Makes the preparation easier in the long access of the canal.
- The active head is straight and 3mm long
- Grooves on the root surface
Indications of apicoectomy (root-end resection):

- Anatomical difficulty (canal is not negotiable, bent root)
- Periapical inflammation (*periodontitis apicalis chronica*, radicular cyst)
- Focal infection
- The root canal cannot be dried properly
- Root canal “overfill”
- Broken endodontic instruments
- “Via falsa” in the apical third of the root
- The apex is exposed during an operation
- Wide apical foramen
Contraindications of apicoectomy:

- Acute purulent inflammation
- General surgical contraindications
- Teeth with a weakened periodontium
Instruments used for apicoectomy
The surgical method of apicectomy

- Root-canal filling (before and during the operation)
- Anesthesia
- Flap preparation
- Soft tissue shifting
- Localization and exposure of the root apex
- Root apex removal - amputation
- Cleaning out the inflamed tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Wound closure
- Follow-up
The surgical method of apicoectomy

- Anesthesia
- Flap preparation
- Reflection of the flap
- Localization and exposure of the root apex
- Root apex removal - amputation
- Removal of the inflammatory tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Flap repositioning and closure
- Follow-up

- In case upper teeth, application of anesthesia buccally and palatally
- Ensure enough time for the anesthetic to diffuse in the bone tissue
The surgical method of apicectomy

- Anesthesia
- Flap preparation
- Soft tissue shifting
- Localization and exposure of the root apex
- Root apex removal - amputation
- Cleaning out the inflammatory tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Wound closure
- Follow-up
The flap must have good blood supply

Adequate exposure necessary

Apply mucoperiostal flap

The flap must be extendable

Tension-free closure should be ensured

The sutures should always lie on bony basis

Avoid damage of the important anatomical structures
Surgical methods of preserving the teeth with operating microscope

Flap preparation:

- Partsch, Pichler incision
- Reinmöller incision
- L-shaped incision
- Trapezoid-shaped incision
- Ochsenbein-Luebke (submarginalis) incision
Types of flaps
Reflection of the flap
The surgical method of apicectomy

- Anesthesia
- Flap preparation
- Soft tissue shifting
- Localization and exposure of the root apex
- Root apex removal - amputation
- Cleaning out the inflammatory tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Wound closure
- Follow-up
Localization and exposure of the root apex - Osteotomy
Case presentation
The surgical method of apicectomy

- Anesthesia
- Flap preparation
- Soft tissue shifting
- Localization and exposure of the root apex
- Root apex removal - amputation
- Cleaning out the inflammatory tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Wound closure
- Follow-up
Case presentation
Root apex removal - amputation

In case of apicoectomy minimum **3 mm** maximum **1/3 length** of the root has to be removed.

<table>
<thead>
<tr>
<th></th>
<th>1 mm</th>
<th>2 mm</th>
<th>3 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ramificatio</strong></td>
<td>52%</td>
<td>78%</td>
<td>98%</td>
</tr>
<tr>
<td><strong>Accessory canals</strong></td>
<td>40%</td>
<td>86%</td>
<td>93%</td>
</tr>
</tbody>
</table>
Angle of the resection

- Using micro handpiece the resection angle is: 30-45°
- In case using ultrasonic tips (Piezo) the resection angle depends on the anatomy
Removal of the inflamed tissues
The surgical method of apicectomy

- Anesthesia
- Flap preparation
- Flap reflection
- Localization and exposure of the root apex
- Root apex removal - amputation
- Removal of the inflammatory tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Wound closure
- Follow-up
Isthmus

- Narrow band connecting two canals
- Contains pulp tissue
- The mesiobuccal root of the maxillary first molar, when there are two root canals, 100% in cases a complete isthmus can be found*

RETROGRADE CAVITY PREPARATION

- Preparation of cavity of appropriate size.
- The walls are parallel with the long axis of the root.
- The cavity must be in the central position compared to the cross-section of the root.
- Proper cavity depth for the retrograde filling.
RETROGRADE CAVITY PREPARATION

- **Micro handpiece**:  
  - larger size  
  - difficult visualization  
  - steeper tilt  
  - the exposure of the isthmus is harder  
  - the retrograde closure is inaccurate

- **Piezo**:  
  - smaller size  
  - better visualization  
  - smaller tilt  
  - the exposure of the isthmus is easier  
  - the retrograde closure is accurate
Isolation - hemostasis

Hemostasis

- adrenalin
- iron-sulphate
- calcium-phosphate
- bone wax
- mechanical
- collagens
The surgical method of apicectomy

- Anesthesia
- Flap preparation
- Flap reflection
- Localization and exposure of the root apex
- Root apex removal - amputation
- Removal of the inflammatory tissues
- Cavity preparation
- Isolation - hemostasis
- Retrograde root filling
- Wound closure
- Follow-up
Retrograde root canal filling
Requirements for the retrograde filling materials

- biocompatibility
- not toxic
- should be easily shaped, worked with. Should ensure an excellent apical closure and fit precisely to the walls of the root canal
- non corroding
- bacteriostatic, bactericidal effect
- insoluble in the tissues
- electrochemically inert
- easy process
- adequate setting time
- radiopaque
- shouldn't cause discoloration of the tooth and surrounding tissues
- availability, accessibility, inexpensive
Materials used for retrograde root canal filling

- Amalgam
- Glass-ionomer cement
- ZOE – Zinc Oxid-Eugenol Cement
- Temporary fillings
- IRM – Intermediate Restorative Material
- AlO₂-ceramic stift
- Super EBA – Super Ethoxybenzoic Acid
- MTA – Mineral Trioxide Aggregate
- Biodentine
Glass-ionomer Cement

- **powder:**
  - polyethylene- polycarboxyl-acid 20%,
  - glass dust, oxides, chemical materials 80%

- **fluid:**
  - tartaric-acid 20%

**Benefits:**
- easy handling
- biocompatibility
- radiopaque
- cheap

**Disadvantage:**
- Sensitivity to wetness
MTA - Mineral Trioxide Aggregate

- Portland cement (75%)
- Bizmuth-oxid (20%)
- Plaster (5%)
- pH: 12,5

Benefits:
- less toxic
- excellent biocompatibility
- radiopaque
- bacteriostatic
- hydrophilic
- stimulating effect to hard tissue formation

Disadvantages:
- hard to process
- long setting time
- expensive


Biodentin

- Tricalcium-silicate powder
- Calcium-chloride
- Biocompatibility
- Radiopaque
- Physical properties similar to dentin
- Other applications:
  - pulp capping,
  - restore root perforations
Case presentation
Case presentation
Procedural steps of root-end resection:

- Root canal filling (before or during the operation)
- Anaesthesia
- Flap preparation
- Separating soft tissues
- Locating and exposing the apex
- Sectioning of the apex
- Removal of inflammatory tissues
- Wound closure
- Postoperative care
Postoperative care

- Cooling
- Proper oral hygiene (Corsodyl, camomilla)
- Removal of sutures on the 7.-8. day
- Antibiotics, pain killers if necessary
- Controll periapical X-ray (immediately after operation, 6, 12 month later)
Case presentation
Postoperative complications:

- Pain
- Swelling
- Inflammation
- Bleeding
- Intraoral haematome
- Soft tissue injury
- Foreign body in the operated area
Possible outcomes of apicoectomy

**Complete healing**

- Regeneration of the periapical area is complete
- The width of the periodontal ligament space is smaller than twice the initial space
- No bone defect in the surgical site
- There is a continuity between periodontal ligament space and a sound bone.

**Complete bone regeneration**

Possible outcomes of apicoectomy

**Partial healing (scar tissue)**

- Partial regeneration of the periapical space
- The width of the periodontal ligament twice as large as the initial one
- Irregular borders of previous surgical site are visible on the X-Ray.
- There is a transition zone of connective tissue (scar tissue) between periodontal ligament space and surrounding bone.
- The bone regeneration in the central part of the surgical site is not complete.

Possible outcomes of apicoectomy

**Uncertain healing**

- Partial regeneration of the periapical space.
- The width of the periodontal ligament space is twice the size of the initial one.
- The surgical site gives round shape shadow on an X-Ray.
- The cone shape bone defect around resected root is visible.
- The bone regeneration in the center of the surgical site is absent

Possible success forms after apicoectomy surgery (classification):

**Unsuccessful healing**

- No regeneration of the periapical space
  - The width of the periodontal ligament space is twice the size of the initial one.
- The surgical site gives round shape shadow on an X-Ray.
- The cone shaped bone defect is visible around resected root.
- Possibly there is no bone regeneration in the surgical site.

## Succes rates of apicoectomy (literature overview):

<table>
<thead>
<tr>
<th>Study</th>
<th>Complete healing</th>
<th>Partial healing</th>
<th>Uncertain healing</th>
<th>Unsuccessful healing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rud et al.-1972</td>
<td>78%</td>
<td>11%</td>
<td>2%</td>
<td>9%</td>
</tr>
<tr>
<td>Persson et al.-1982</td>
<td>73%</td>
<td>15%</td>
<td>3%</td>
<td>9%</td>
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<td>Molven et al.-1991</td>
<td>60%</td>
<td>12%</td>
<td>10%</td>
<td>18%</td>
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<tr>
<td>Kvist et Reit-1999</td>
<td>81%</td>
<td>4%</td>
<td>4%</td>
<td>11%</td>
</tr>
<tr>
<td>Von Arx et mtsai-2001</td>
<td>88%</td>
<td>2%</td>
<td>1%</td>
<td>9%</td>
</tr>
</tbody>
</table>
The success rate of apicoectomy when using operating microscope (literature review):

<table>
<thead>
<tr>
<th>Study</th>
<th>Complete healing</th>
<th>Retrograde root canal filling material</th>
<th>Time</th>
<th>Case number (root canal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rud et al-1997</td>
<td>81%</td>
<td>Retroplast</td>
<td>2-4 years</td>
<td>153</td>
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<tr>
<td>Von Arx et al-1999</td>
<td>82%</td>
<td>SuperEBA</td>
<td>12 months</td>
<td>43</td>
</tr>
<tr>
<td>Rubinstein and Kim- 2002</td>
<td>96%</td>
<td>SuperEBA</td>
<td>5-7 years</td>
<td>94</td>
</tr>
<tr>
<td>Maddalone et al- 2003</td>
<td>92%</td>
<td>MTA Pro Root</td>
<td>3 years</td>
<td>120</td>
</tr>
<tr>
<td>Chong et al-2003</td>
<td>98%</td>
<td>MTA Pro Root</td>
<td>2 years</td>
<td>194</td>
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</table>
color atlas of MICROSURGERY IN ENDODONTICS

Syngcuk Kim
with Gabriele Pecora and Richard A. Rubinstein

Endodontic Microsurgery
Surgical Methods of the Conservative Treatment of Teeth

- Apicoectomy (root-end resection)
- Retrograde root canal filling
- Transdental fixation
- Tooth replantation
- Tooth transplantation
Surgical Methods of the Conservative Treatment of Teeth

- Apicoectomy (root-end resection)
- Retrograde root canal filling
- Transdental fixation
- Tooth replantation
- Tooth transplantation
Tooth replantation
21 years old patient. She had had several times endodontic treatment on the 47, but still complained
After making the retrograde cavity, we used Vitremer® material for the filling
Surgical Methods of the Conservative Treatment of Teeth

- Apicoectomy (root-end resection)
- Retrograde root canal filling
- Transdental fixation
- Tooth replantation
- Tooth transplantation
Tooth transplantation

- Good oral hygiene, non-smoker patient
- Cooperation and subscription of the patient, parents
- The rootgrowth of the wisdom has not finished
- The apical foramen should be open at least 2 mm
- Usually we transplant the wisdom teeth at the place of the first molars
- The recipient place have to be bigger than the donor place
Loose splinting (2-6 weeks)

It is not necessary to give antibiotics

We don’t have to take the tooth in infraocclusion, but early contact is not recommended
Thank You for your attention