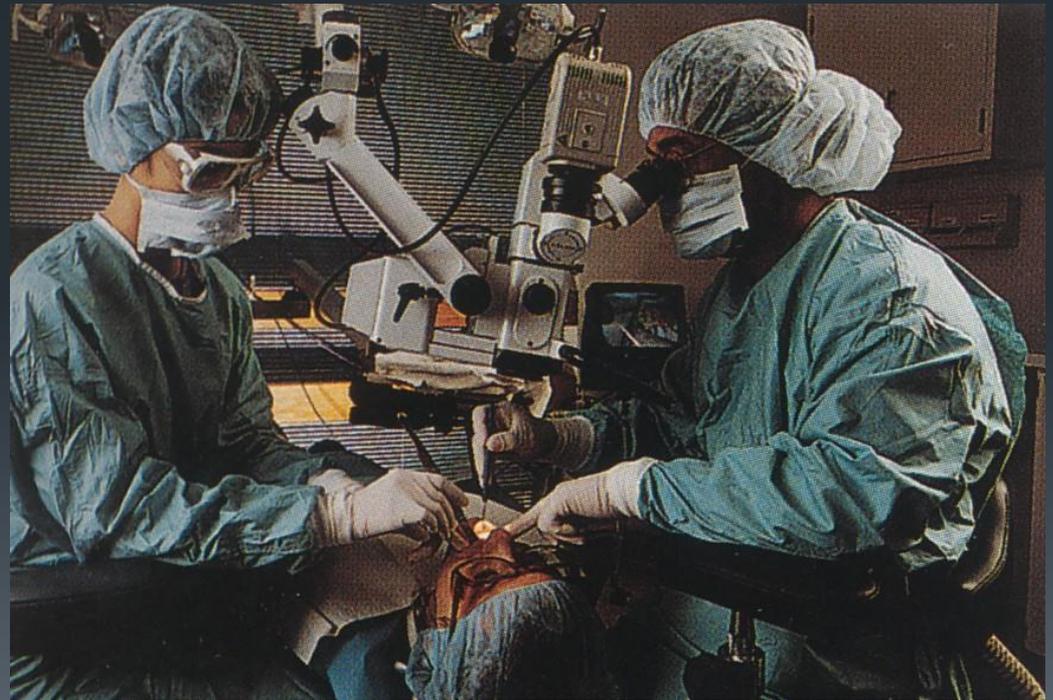
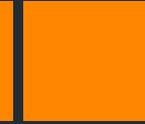


# Endodontic Surgery



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

	1999	2004	2008
Surgical tooth removal	4427	4728	5354
Tooth removal of impacted wisdom	1197	1400	2042
Apicoectomy	566	469	331
Retrograde root canal filling	104	93	33
Implantation	263	398	532
Bone grafting	75	103	133

# The history of the use of microscope in surgery

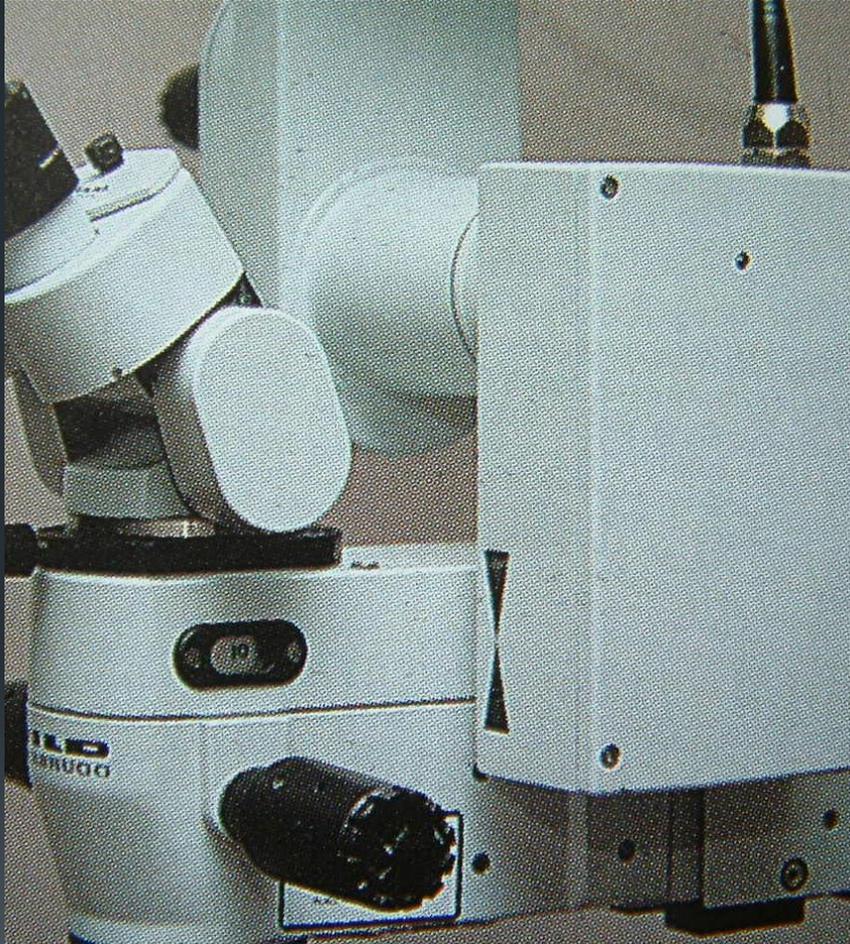
- In 1953 Carl-Zeiss company made the first binocular operating microscope
- In 1981 Apothecker and Jakob planned and started to sell the first operating microscope for dentistry with the name Dentiscope
- In March 1993 the first symposium of endodontic surgery was organized at the dentistry department of Pennsylvanian University

# Operating microscope

## The benefits of usage of operating microscope in endodontics:

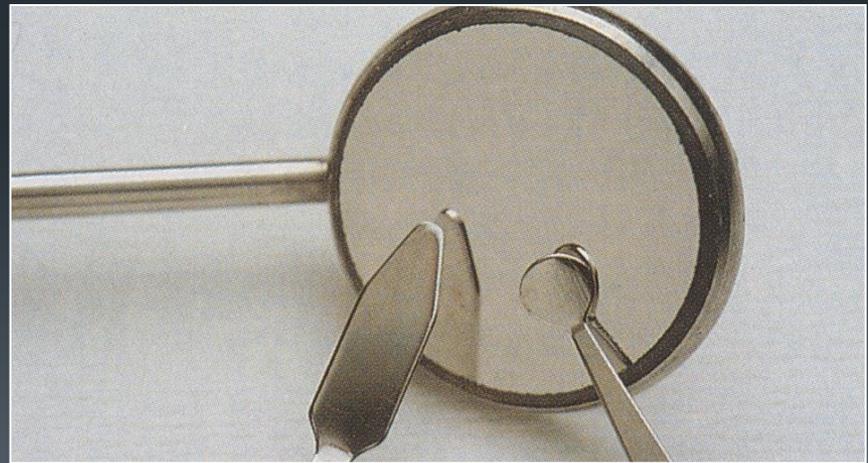
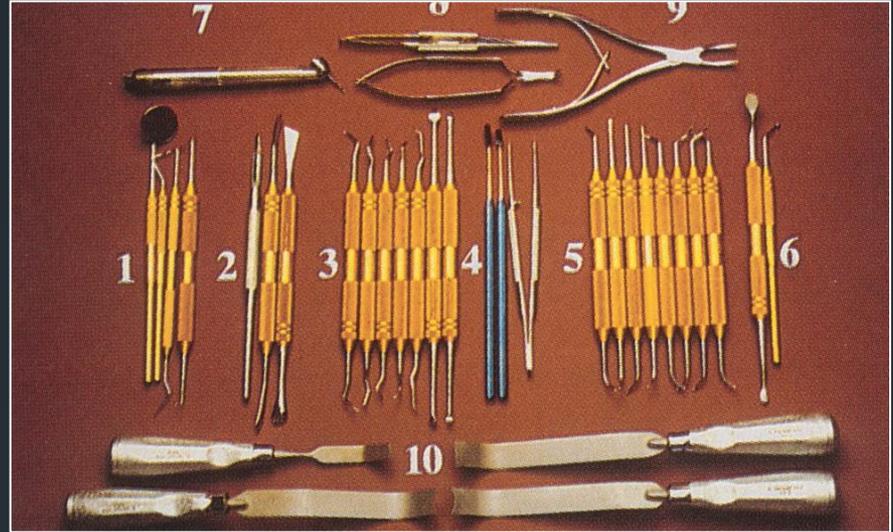
- Accurate localization of the root apex
- Smaller „bone window” necessary during the operation
- The resection angle is smaller, than  $10^{\circ}$
- Ability to inspect, prepare and seal the isthmus area
- More accurate preparation
- Precise retrograde root filling
-

# Microsurgical instruments for endodontics

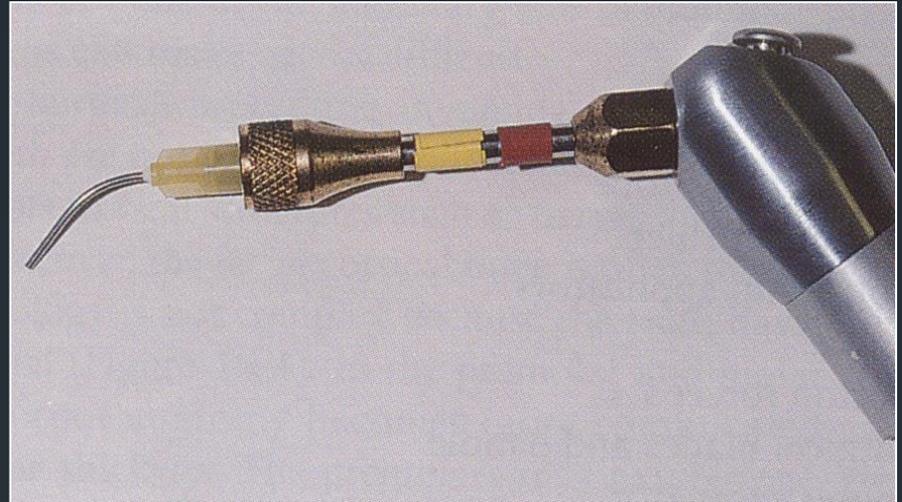
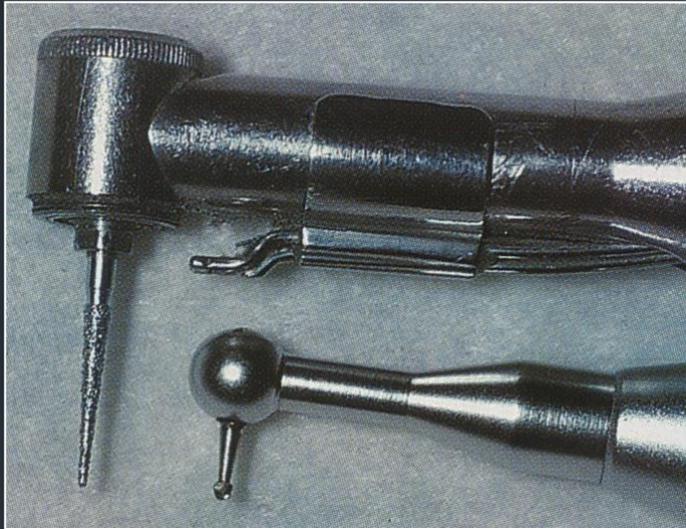


- The range of magnification from 2,5X to 8X allows a better evaluation of the root position.
- Magnification of 10X to 16X is used for operating. This is the so called „working magnification” in endodontic surgery
- The highest magnification (20X to 30X) is used only to examine fine details.

# Microsurgical instruments for endodontics

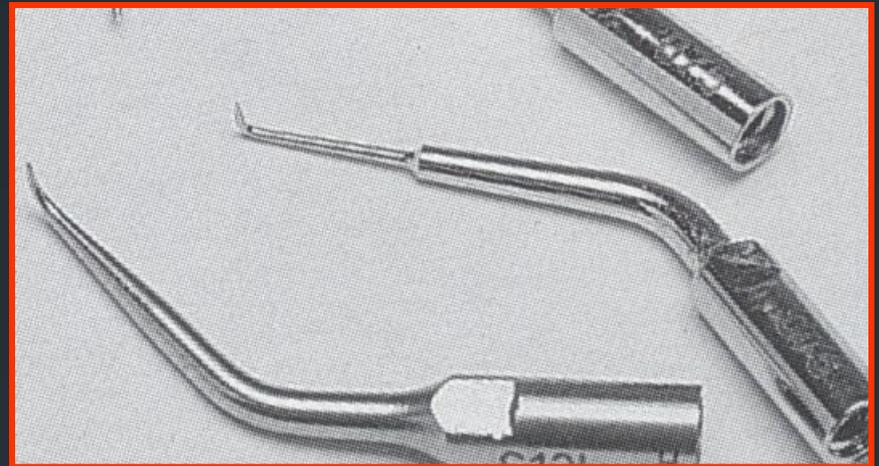
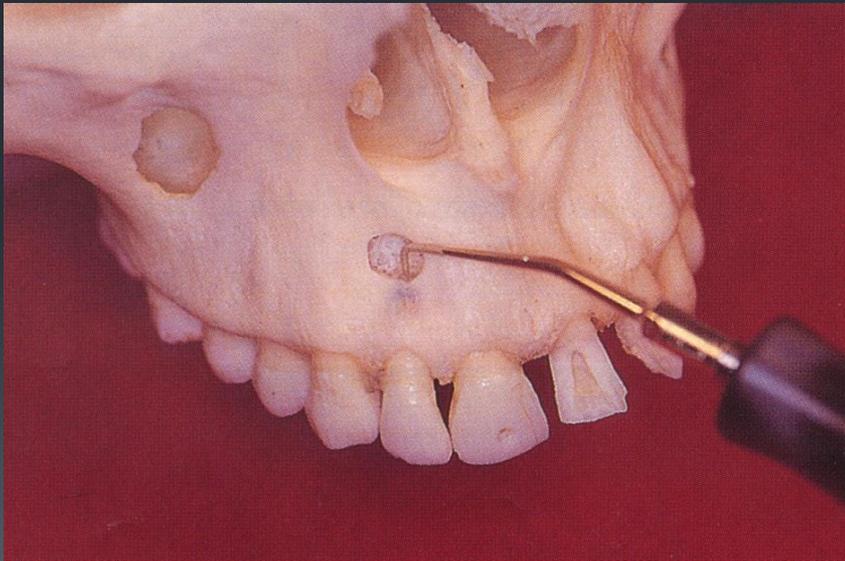


# Microsurgical instruments for endodontics



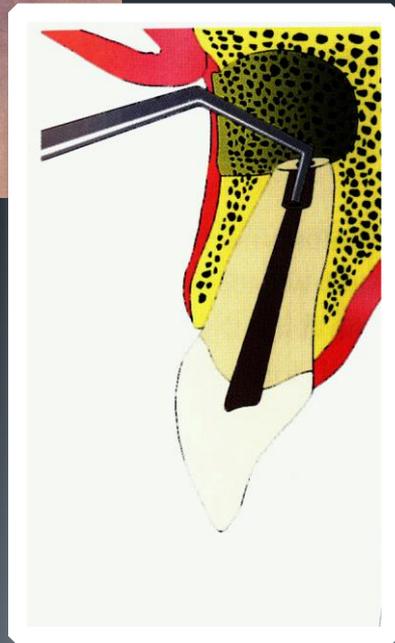
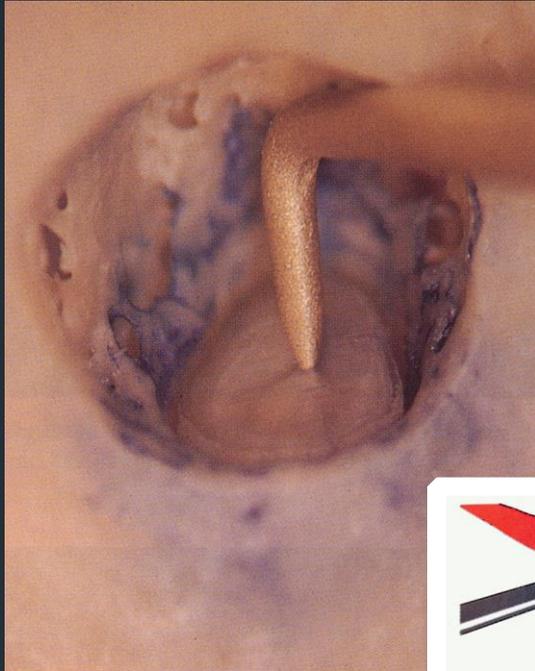
# Microsurgical instruments for endodontics

## ultrasonic preparation instrument



# Microsurgical instruments for endodontics

## ultrasonic preparation instrument



- ⑩ Works with 30-40 Hz frequency, induced by quartz or ceramic piezoelectric crystals.
- ⑩ The multiple curves of the ultrasonic tips ensure easier access to the smaller bone crypts.
- ⑩ Makes the preparation easier in the long access of the canal.
- ⑩ The active head is straight and 3mm long
- ⑩ 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 “overflow”
- 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

- ⑩ Root-canal filling ( before and during the operation )
- ⑩ Anesthesia
- ⑩ Flap preparation
- ⑩ Soft tissue shifting
- ⑩ Localization and exposure of the root apex
- ⑩ Root apex removal- amputation
- ⑩ Cleaning out the inflamed tissues
- ⑩ Cavity preparation
- ⑩ Isolation - hemostasis
- ⑩ Retrograde root filling
- ⑩ Wound closure
- ⑩ Follow-up

# The surgical method of apicoectomy

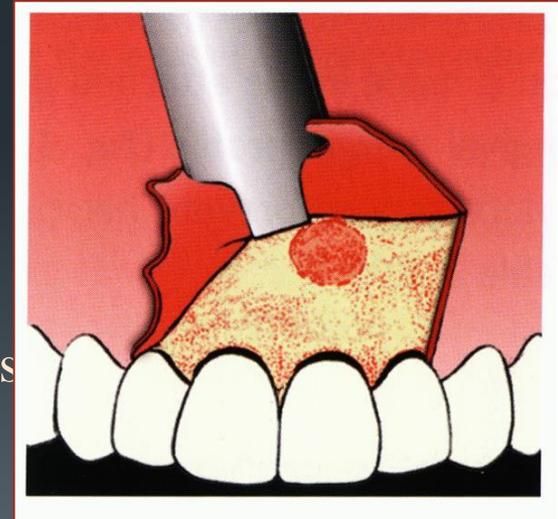
- ⑩ Anesthesia
  - ⑩ Flap preparation
  - ⑩ Reflection of the flap
  - ⑩ Localization and exposure of the root apex
  - ⑩ Root apex removal- amputation
  - ⑩ Removal of the inflammatory tissues
  - ⑩ Cavity preparation
  - ⑩ Isolation - hemostasis
  - ⑩ Retrograde root filling
  - ⑩ Flap repositioning and closure
  - ⑩ Follow-up
- 
- ⑩ In case upper teeth application of anesthesia buccally and palatally
  - ⑩ Ensure enough time for the anesthetic to diffuse in the bone tissue

# The surgical method of apicectomy

- ⑩ Anesthesia
- ⑩ Flap preparation
- ⑩ Soft tissue shifting
- ⑩ Localization and exposure of the root apex
- ⑩ Root apex removal- amputation
- ⑩ Cleaning out the inflammatory tissues
- ⑩ Cavity preparation
- ⑩ Isolation - hemostasis
- ⑩ Retrograde root filling
- ⑩ Wound closure
- ⑩ Follow-up

# General rules of flap preparation

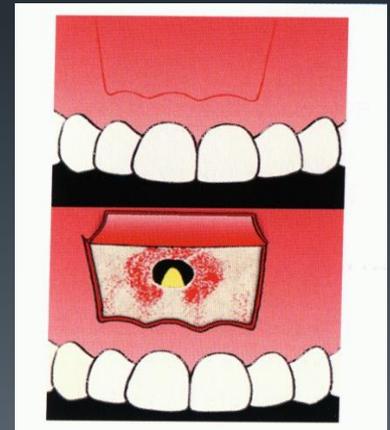
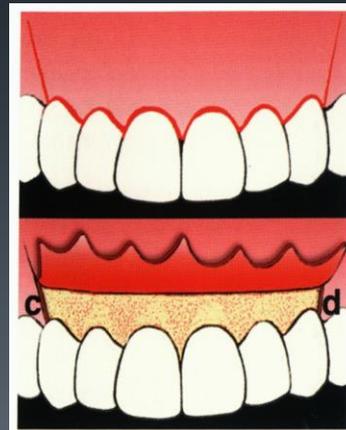
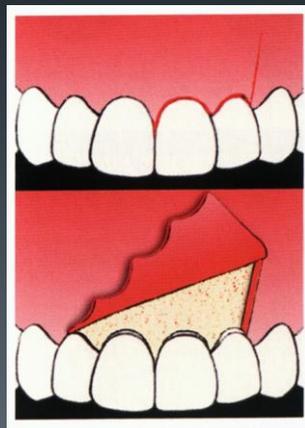
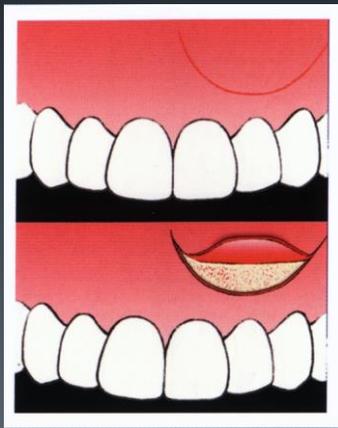
- ⑩ The flap must have good blood supply
- ⑩ Adequate exposure necessary
- ⑩ Apply mucoperiosteal flap
- ⑩ The flap must be extendable
- ⑩ Tension-free closure should be ensured
- ⑩ The sutures should always lie on bony basis
- ⑩ Avoid damage of the important anatomical structures



# Surgical methods of preserving the teeth with operating microscope

## ⑩ Flap preparation:

- ⑩ Partsch, Pichler incision
- ⑩ Reinmöller incision
- ⑩ L-shaped incision
- ⑩ Trapezoid-shaped incision
- ⑩ Ochsenbein-Luebke (submarginalis) incision



# Types of flaps



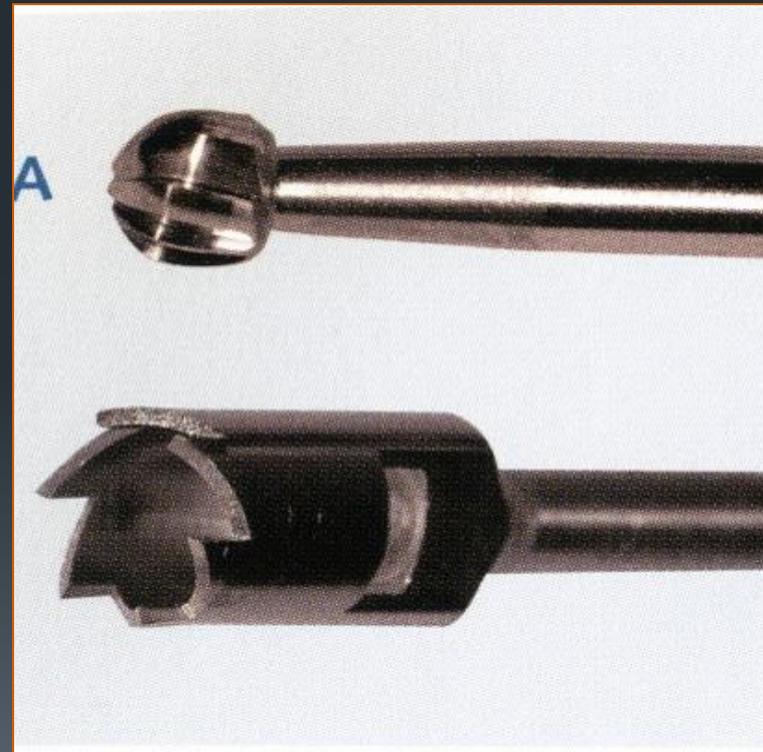
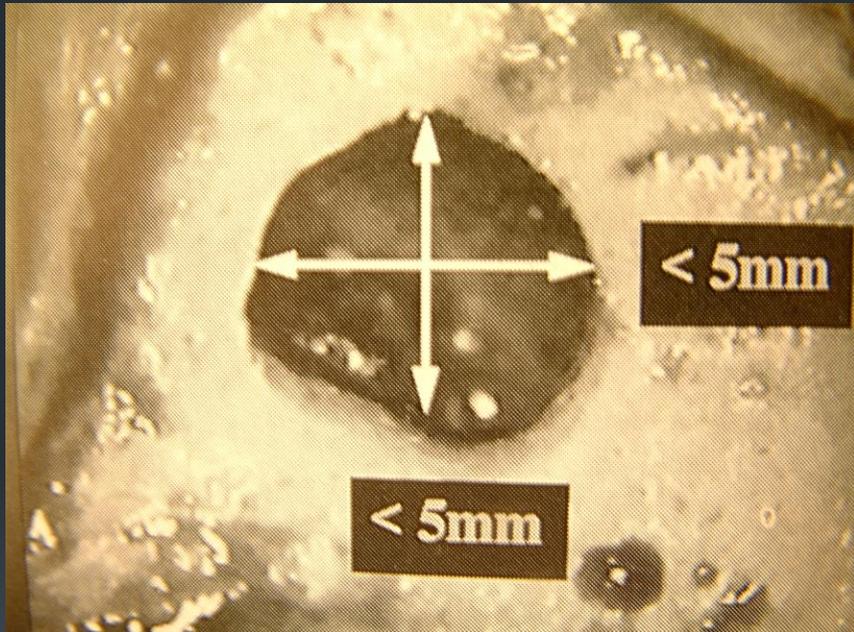
# Reflection of the flap



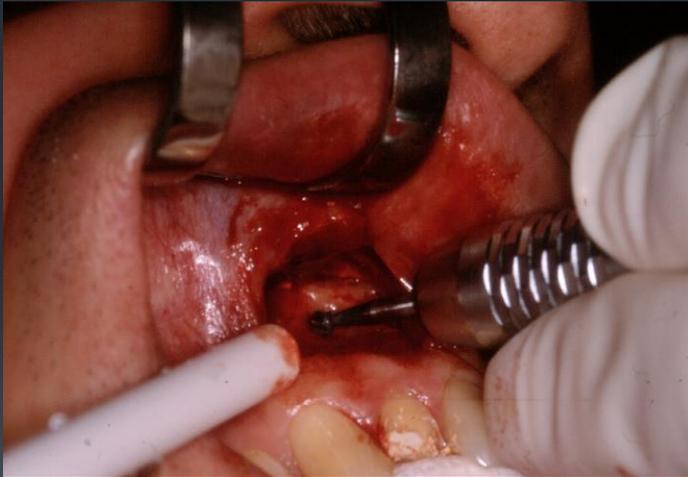
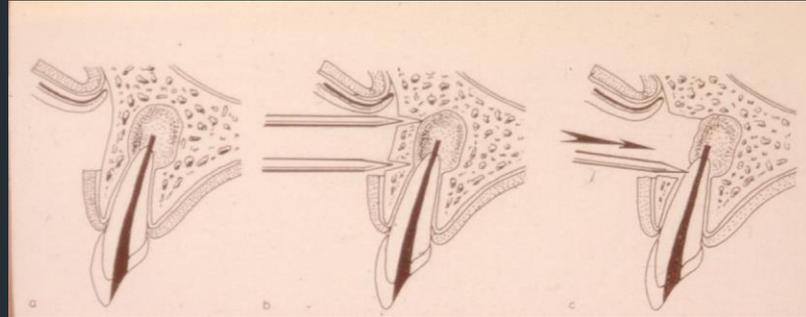
# The surgical method of apicectomy

- ⑩ Anesthesia
- ⑩ Flap preparation
- ⑩ Soft tissue shifting
- ⑩ Localization and exposure of the root apex
- ⑩ Root apex removal- amputation
- ⑩ Cleaning out the inflammatory tissues
- ⑩ Cavity preparation
- ⑩ Isolation - hemostasis
- ⑩ Retrograde root filling
- ⑩ Wound closure
- ⑩ Follow-up

# Localization and exposure of the root apex - Osteotomy



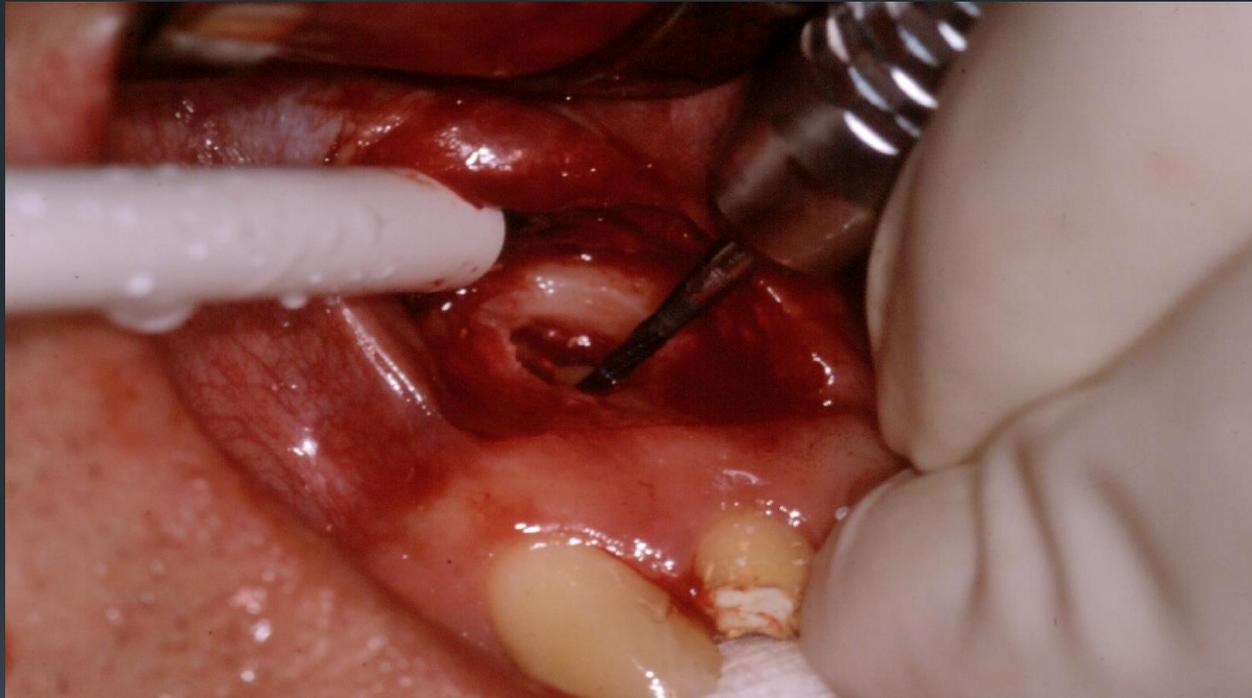
# Case presentation



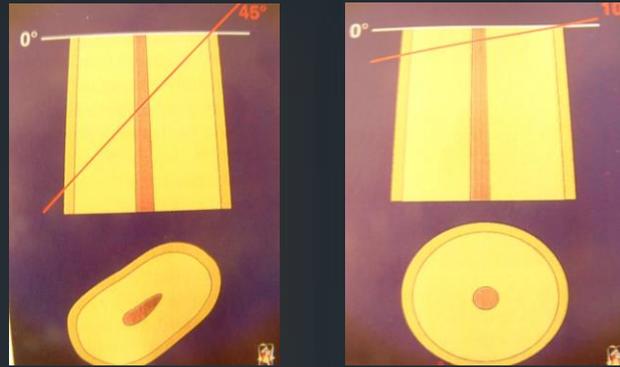
# The surgical method of apicectomy

- ⑩ Anesthesia
- ⑩ Flap preparation
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# Case presentation

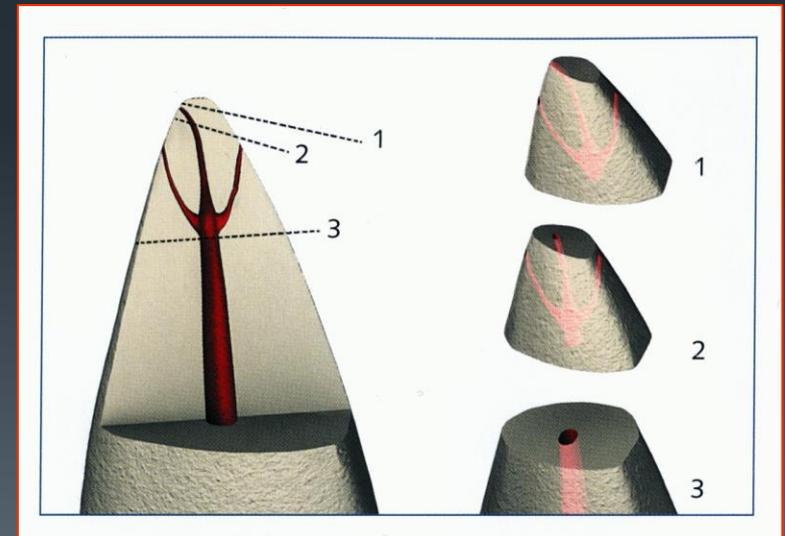


# Root apex removal- amputation

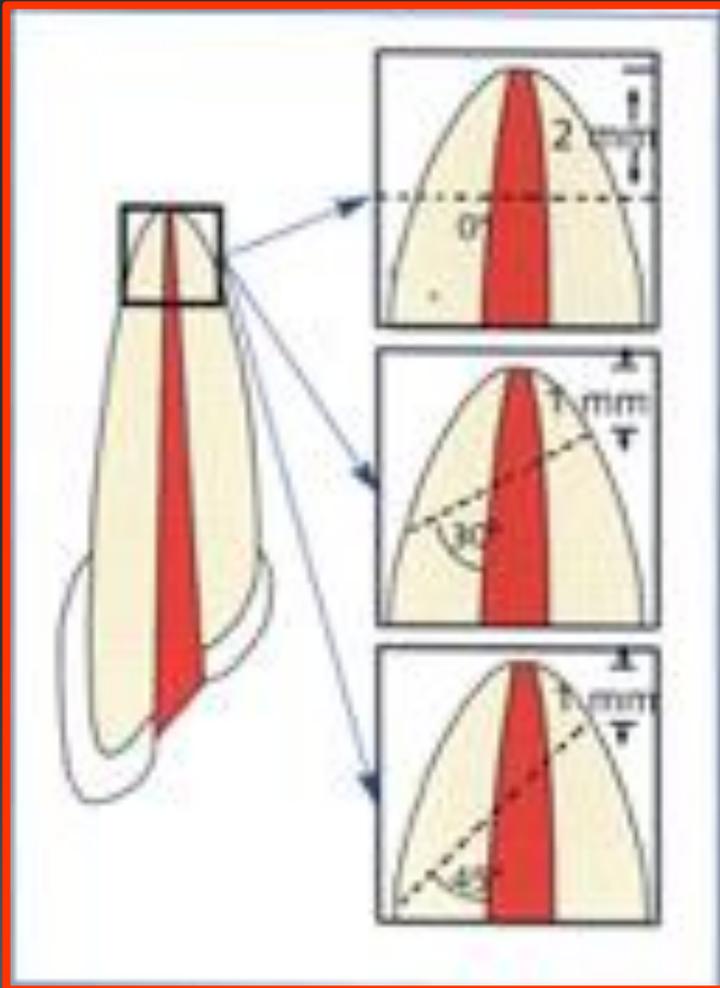


In case of apicoectomy minimum **3 mm** maximum **1/3 length** of the root has to be removed.

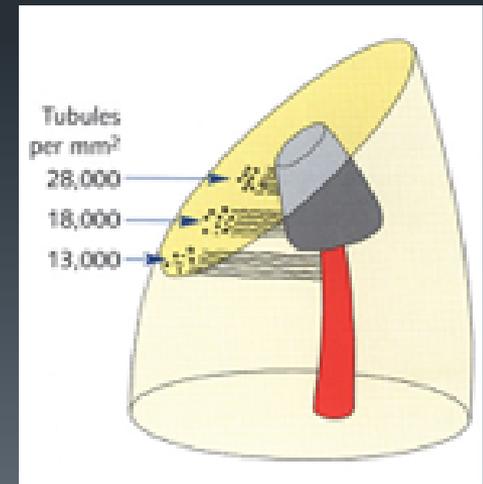
	1 mm	2 mm	3 mm
Ramificatio	52%	78%	98%
Accessory canals	40%	86%	93%



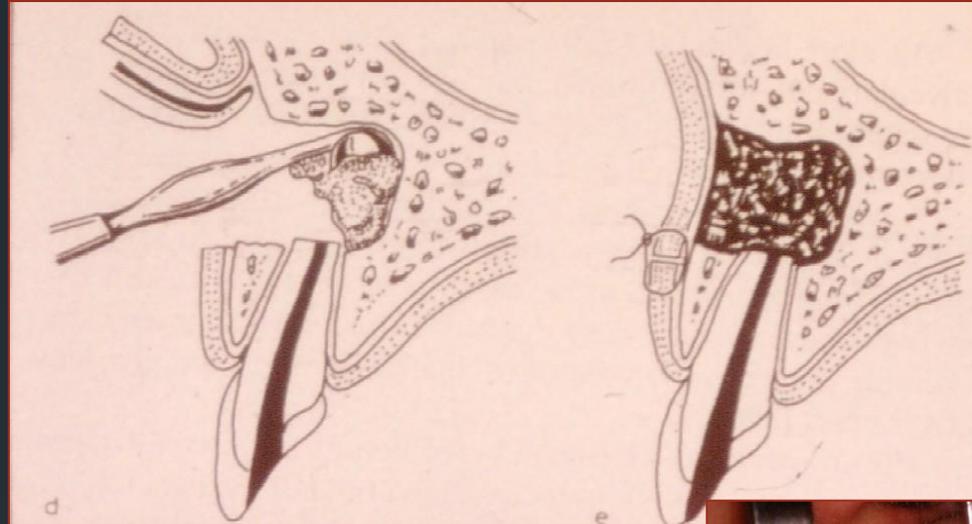
# Angle of the resection



- Using micro handpiece the resection angle is: 30-45°
- In case using ultrasonic tips (Piezo) the resection angle depends on the anatomy

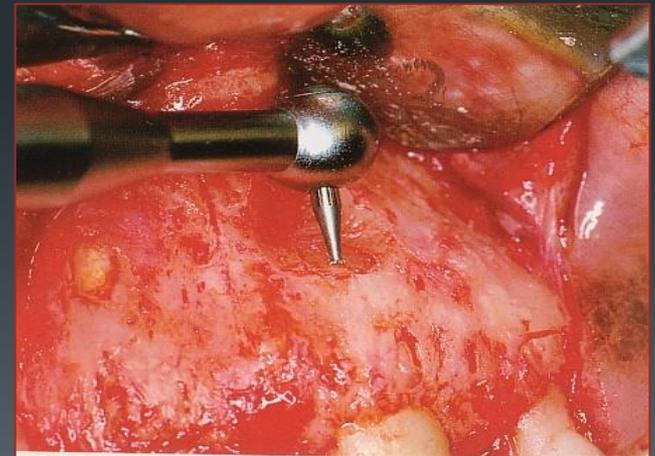
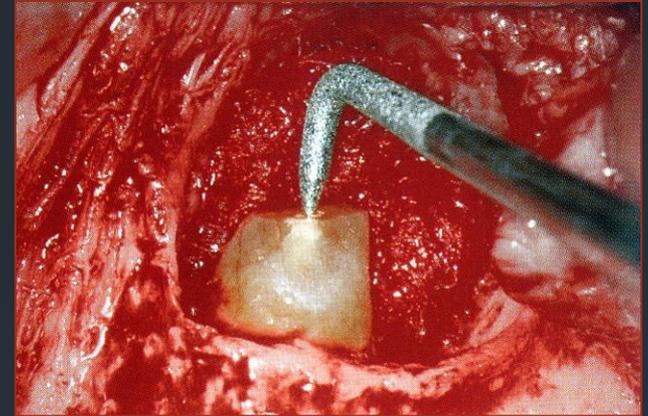


# Removal of the inflamed tissues



# The surgical method of apicectomy

- ⑩ Anesthesia
- ⑩ Flap preparation
- ⑩ Flap reflection
- ⑩ Localization and exposure of the root apex
- ⑩ Root apex removal- amputation
- ⑩ Removal of the inflammatory tissues
- ⑩ Cavity preparation
- ⑩ Isolation - hemostasis
- ⑩ Retrograde root filling
- ⑩ Wound closure
- ⑩ 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\*



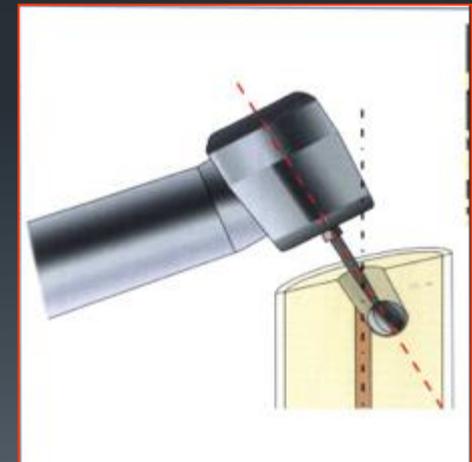
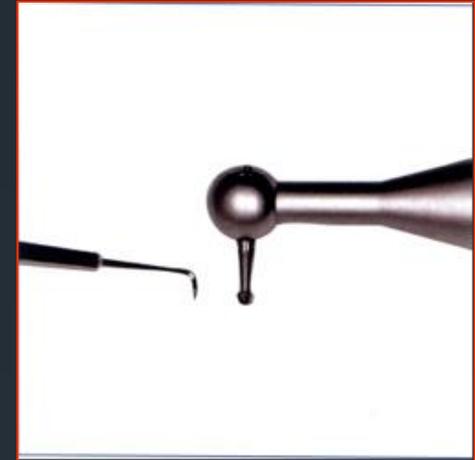
\*Weller RN, Niemczyk SP, Kim S: The incidence and position of the canal isthmus mesiobuccal root of the maxillary first molar. J Endod, 1995;21:380-383.

# 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

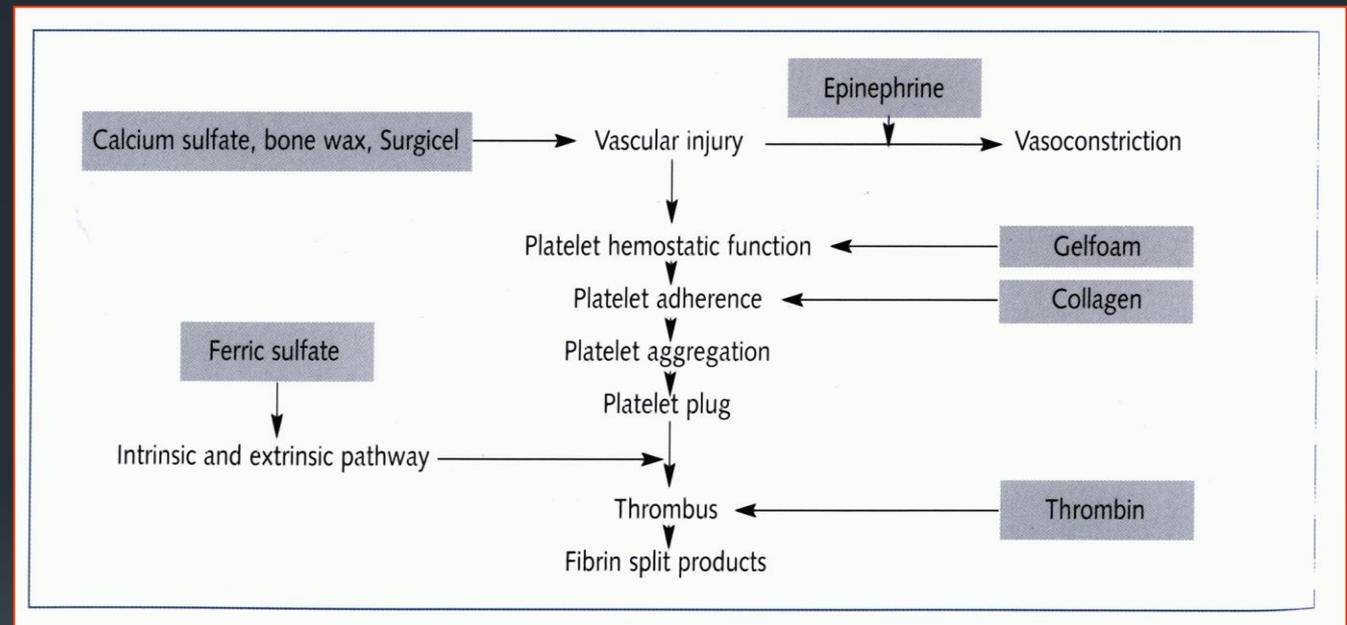
- **Micro handpiece :**
  - -larger size
  - -difficult visualization
  - -steeper tilt
  - -the exposure of the isthmus is harder
  - -the retrograde closure is inaccurate
- **Piezo:**
  - -smaller size
  - -better visualization
  - -smaller tilt
  - -the exposure of the isthmus is easier
  - - the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



# Isolation - hemostasis

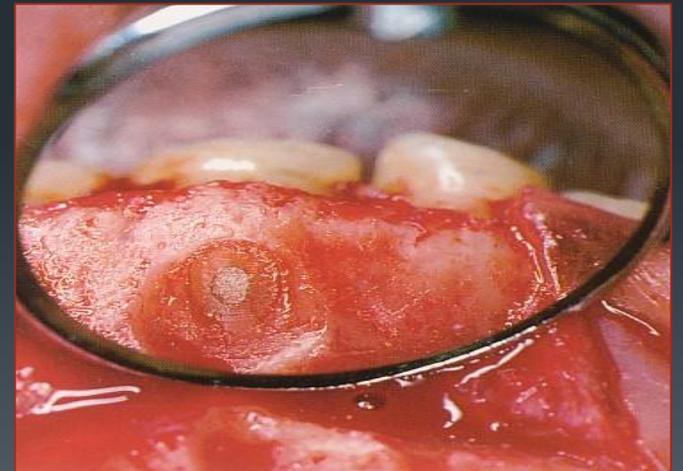
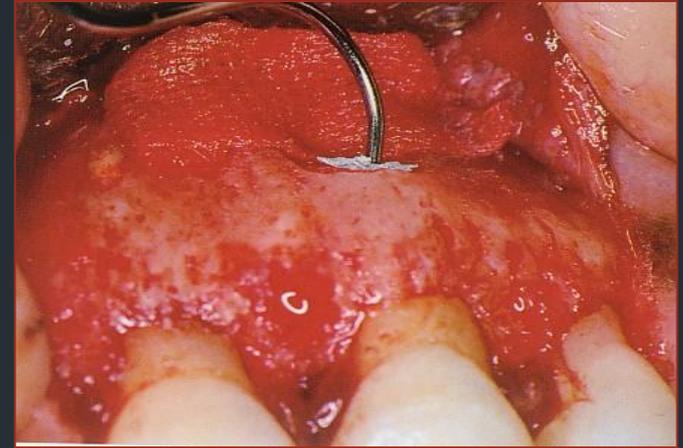
## Hemostasis

- ⑩ adrenalin
- ⑩ iron-sulphate
- ⑩ calcium-phosphate
- ⑩ bone wax
- ⑩ mechanical
- ⑩ collagens

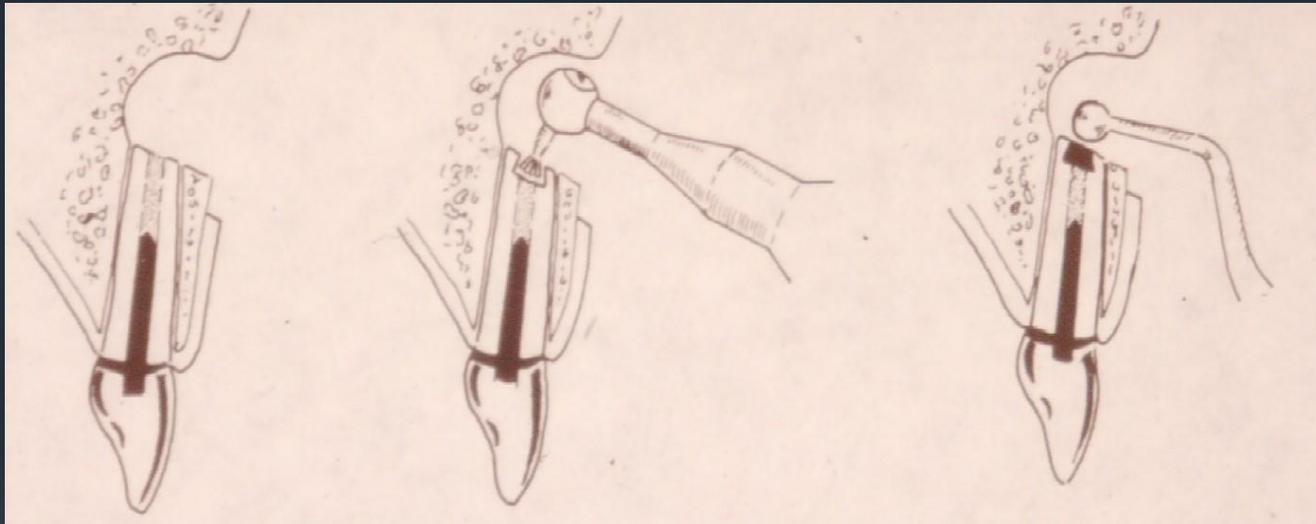


# The surgical method of apicectomy

- ⑩ Anesthesia
- ⑩ Flap preparation
- ⑩ Flap reflection
- ⑩ Localization and exposure of the root apex
- ⑩ Root apex removal- amputation
- ⑩ Removal of the inflammatory tissues
- ⑩ Cavity preparation
- ⑩ Isolation - hemostasis
- ⑩ Retrograde root filling
- ⑩ Wound closure
- ⑩ Follow-up



# Retrograde root canal filling



# Requirements for the retrograde filling materials

- ⑩ biocompatibility
- ⑩ not toxic
- ⑩ should be easily shaped, worked with. Should ensure an excellent apical closure and fit precisely to the walls of the root canal
- ⑩ non corroding
- ⑩ bacteriostatic, bactericidal effect
- ⑩ insoluble in the tissues
- ⑩ electrochemically inert
- ⑩ easy process
- ⑩ adequate setting time
- ⑩ radiopaque
- ⑩ shouldn't cause discoloration of the tooth and surrounding tissues
- ⑩ 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**
- $AlO_2$ -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

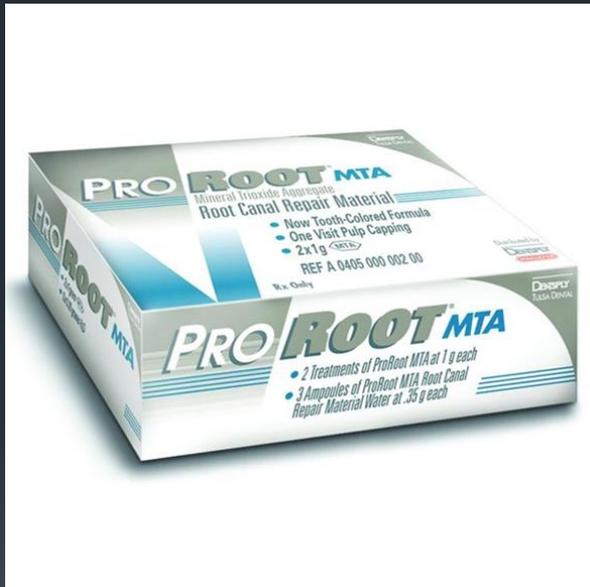
## Disadvantage:

- Sensitivity to wetness



# MTA - Mineral Trioxide Aggregate

- Portland cement (75%)
- Bismuth-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

Apaydin ES, Shabahang S, Torabinejad M: Hard tissue healing after application of fresh or set MTA as root-end filling material. J Endod 2004;30:21.

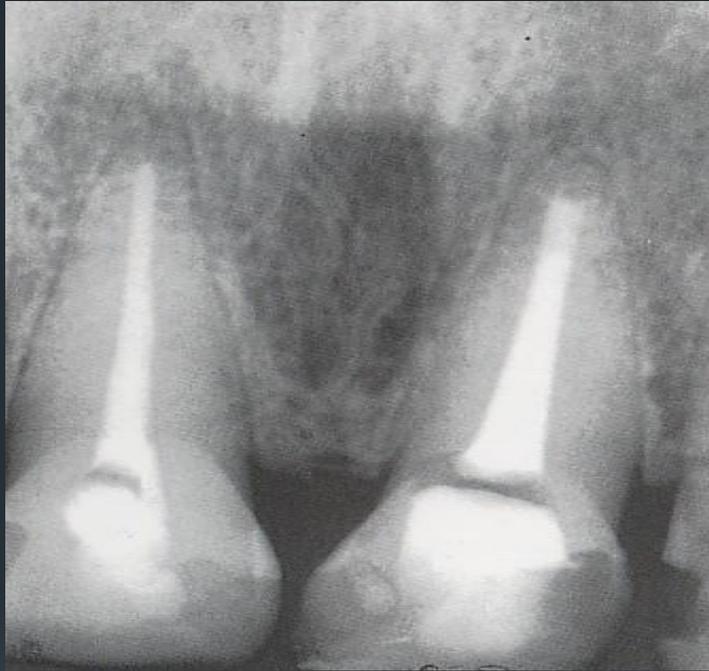
Thomson TS, Berry JE, Somerman MJ, Kirkwood KL: Cementoblasts maintain expression of osteocalcin in the presence of mineral trioxide aggregate. J Endod 1999;25:728.

# Biodentine

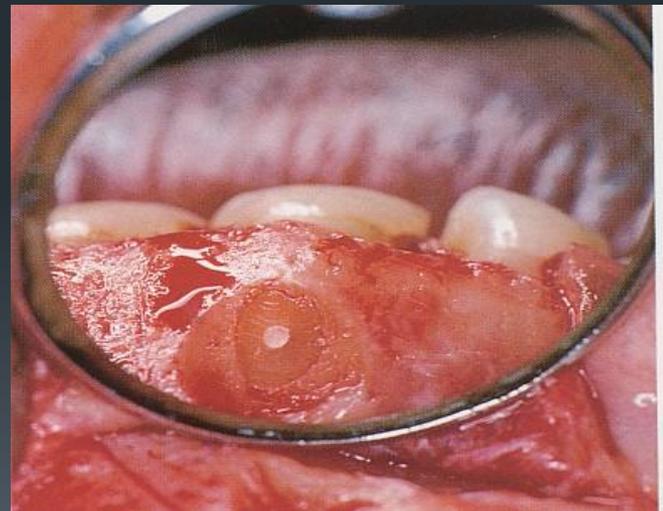
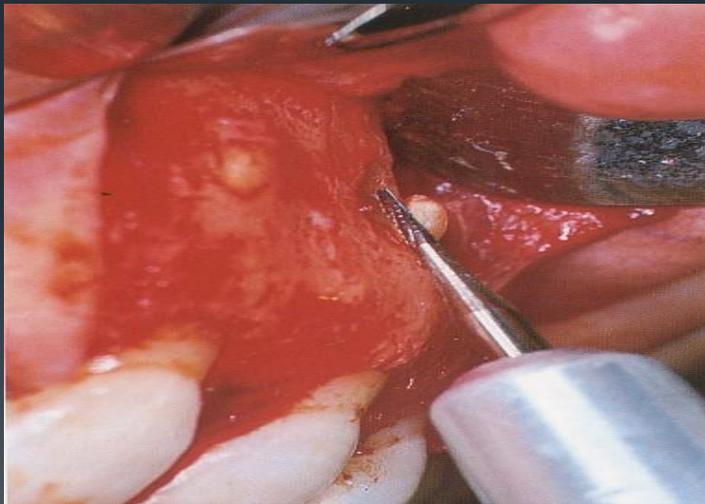
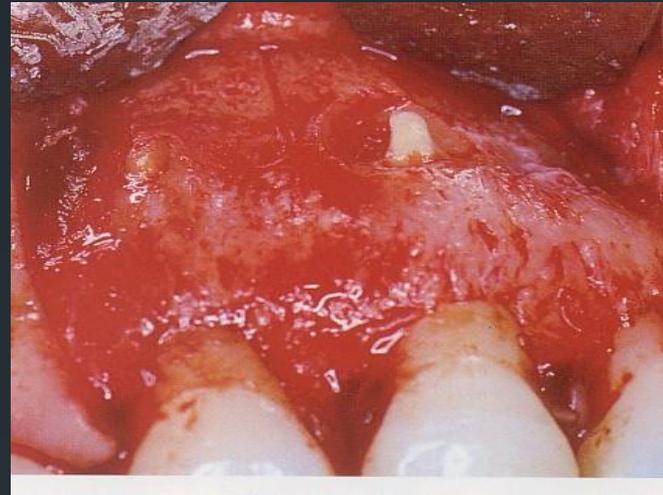
- Tricalcium-silicate powder
- Calcium-chloride
- Biocompatibility
- Radiopaque
- Physical properties similar to dentin
- Other applications:
  - pulp capping,
  - restore root perforations

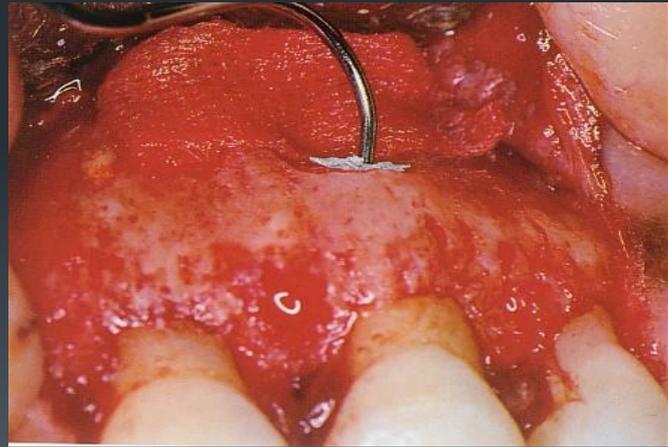
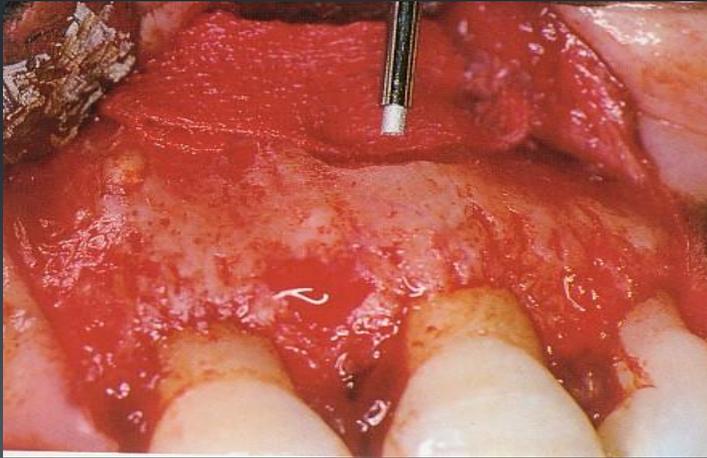
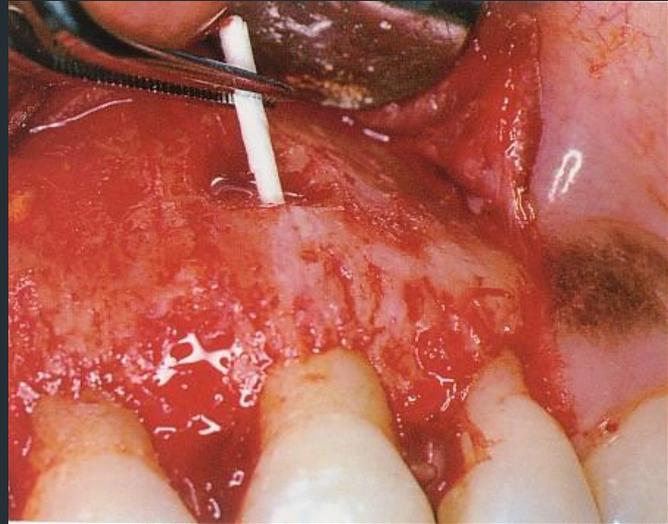
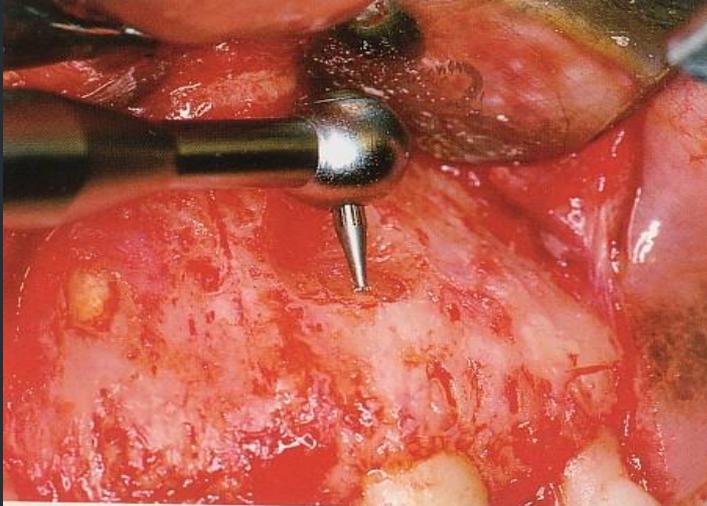


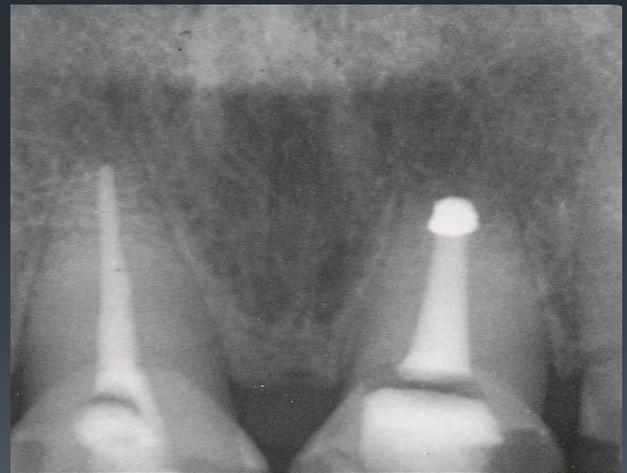
# Case presentation



# 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





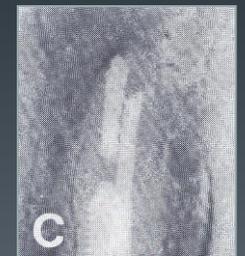
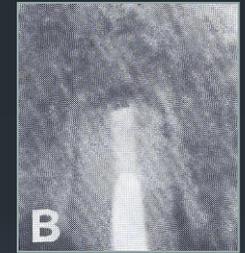
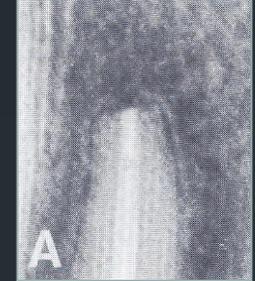
# Postoperative complications:

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

# Possible outcomes of apicoectomy

## Complete healing

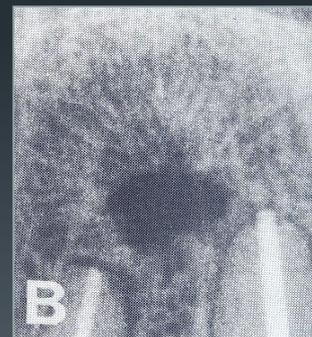
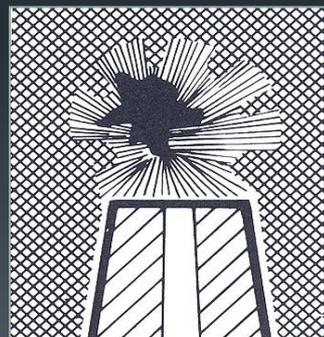
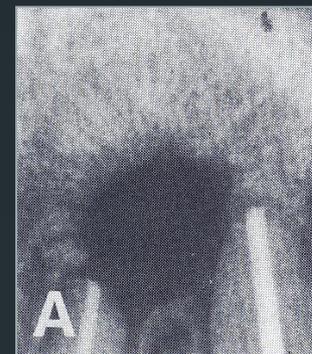
- ⑩ Regeneration of the periapical area is complete
- ⑩ The width of the periodontal ligament space is smaller than twice the initial space
- ⑩ No bone defect in the surgical site
- ⑩ There is a continuity between periodontal ligament space and a sound bone.
- ⑩ Complete bone regeneration



# Possible outcomes of apicoectomy

## Partial healing ( scar tissue )

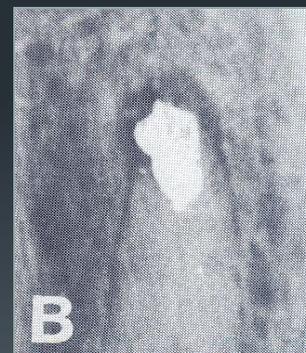
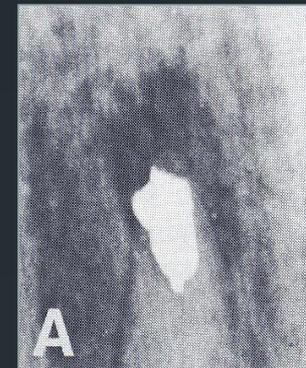
- ⑩ Partial regeneration of the periapical space
- ⑩ The width of the periodontal ligament twice as large as the initial one
- ⑩ Irregular borders of previous surgical site are visible on the X- Ray.
- ⑩ There is a transition zone of connective tissue ( scar tissue ) between periodontal ligament space and surrounding bone.
- ⑩ The bone regeneration in the central part of the surgical site is not complete.



# Possible outcomes of apicoectomy

## Uncertain healing

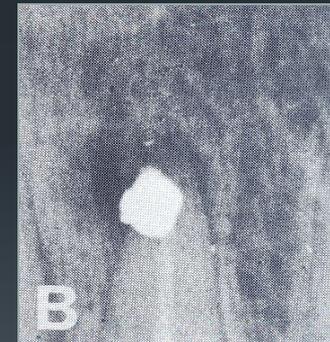
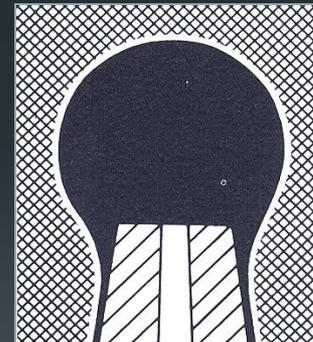
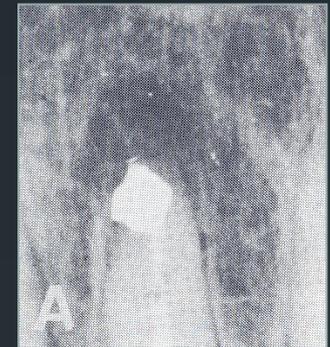
- ⑩ Partial regeneration of the periapical space.
- ⑩ The width of the periodontal ligament space is twice the size of the initial one.
- ⑩ The surgical site gives round shape shadow on an X-Ray.
- ⑩ The cone shape bone defect around resected root is visible.
- ⑩ The bone regeneration in the center of the surgical site is absent



# Possible success forms after apicoectomy surgery (classification):

## Unsuccessful healing

- ⑩ No regeneration of the periapical space
  - ⑩ The width of the periodontal ligament space is twice the size of the initial one.
- ⑩ The surgical site gives round shape shadow on an X-Ray.
  
- ⑩ The cone shaped bone defect is visible around resected root.
- ⑩ Possibly there is no bone regeneration in the surgical site.





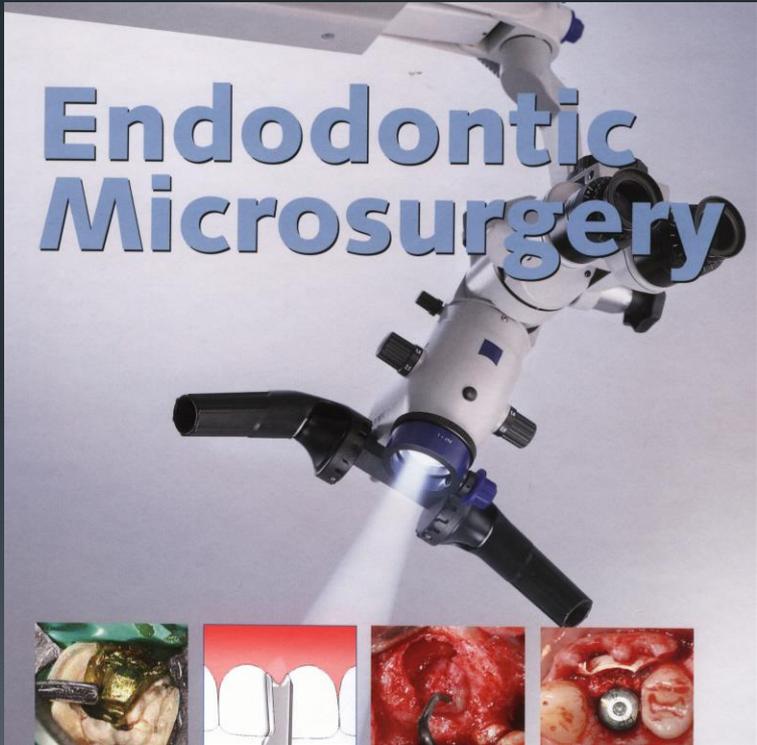
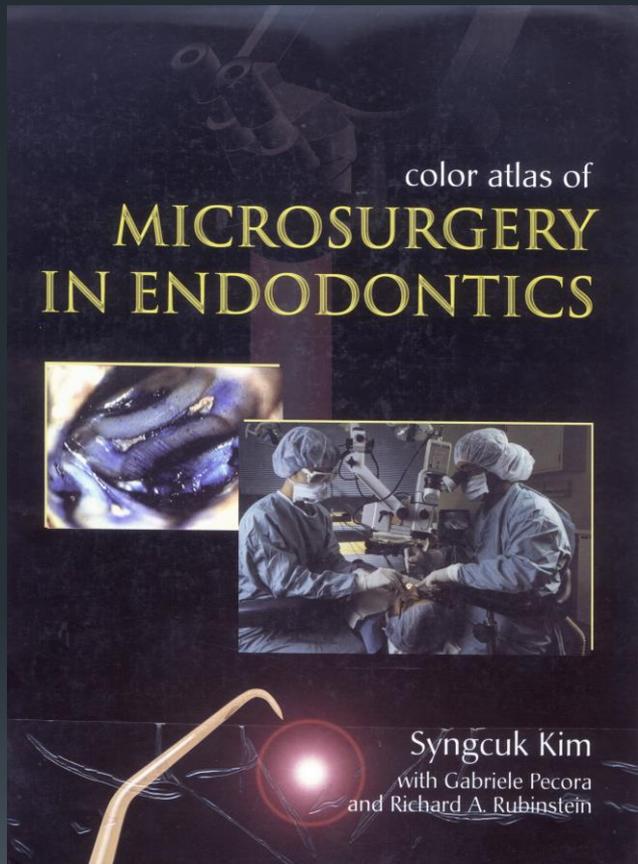
# Success rates of apicoectomy (literature overview):

Rud et al.-1972
Persson et al.-1982
Molven et al.-1991
Kvist et Reit-1999
Von Arx et mtsai-2001

Complete healing	Partial healing	Uncertain healing	Unsuccessful healing
78%	11%	2%	9%
73%	15%	3%	9%
60%	12%	10%	18%
81%	4%	4%	11%
88%	2%	1%	9%

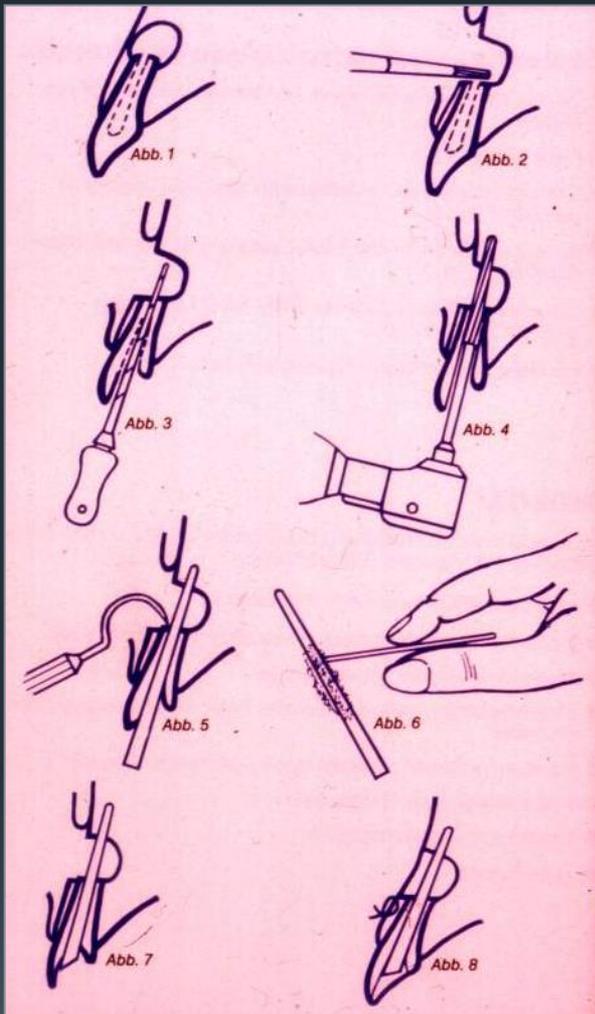
## The succes rate of apicoectomy when using operating microscope(literature review):

	Complete healing	Retrograde root canal filling material	Time	Case number (root canal)
Rud et al-1997	81%	Retroplast	2-4 years	153
Von Arx et al-1999	82%	SuperEBA	12 months	43
Rubinstein and Kim- 2002	96%	SuperEBA	5-7 yerars	94
Maddalone et al- 2003	92%	MTA Pro Root	3 years	120
Chong et al-2003	98%	MTA Pro Root	2 years	194



# Surgical Methods of the Conservative Treatment of Teeth

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

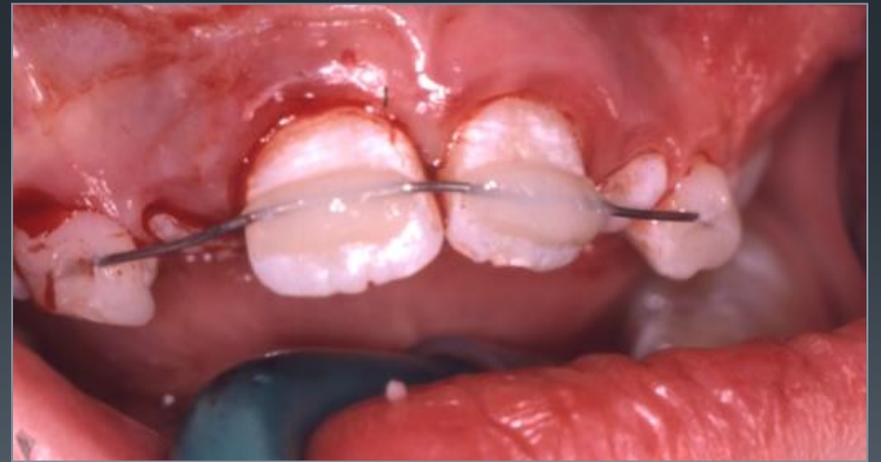
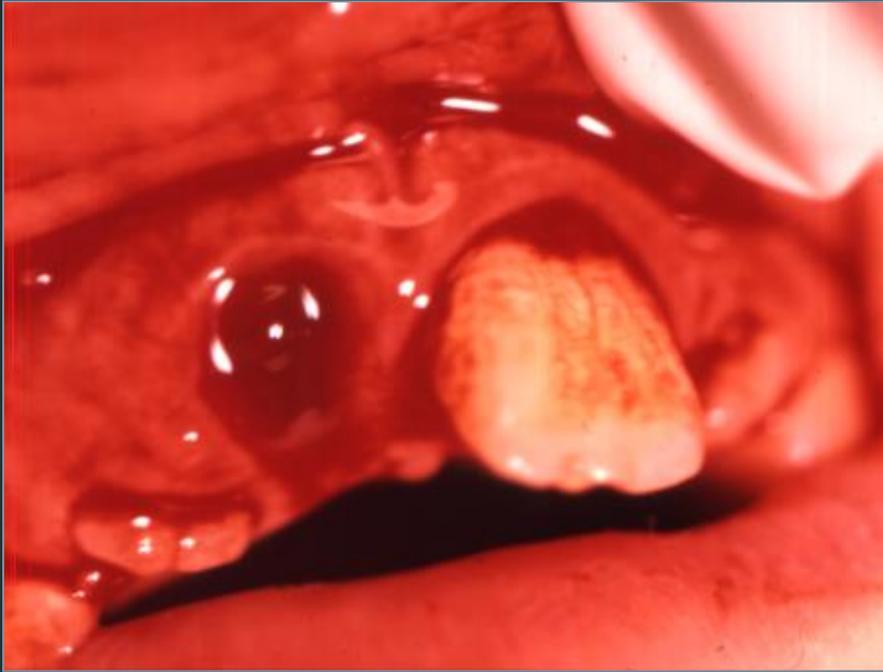




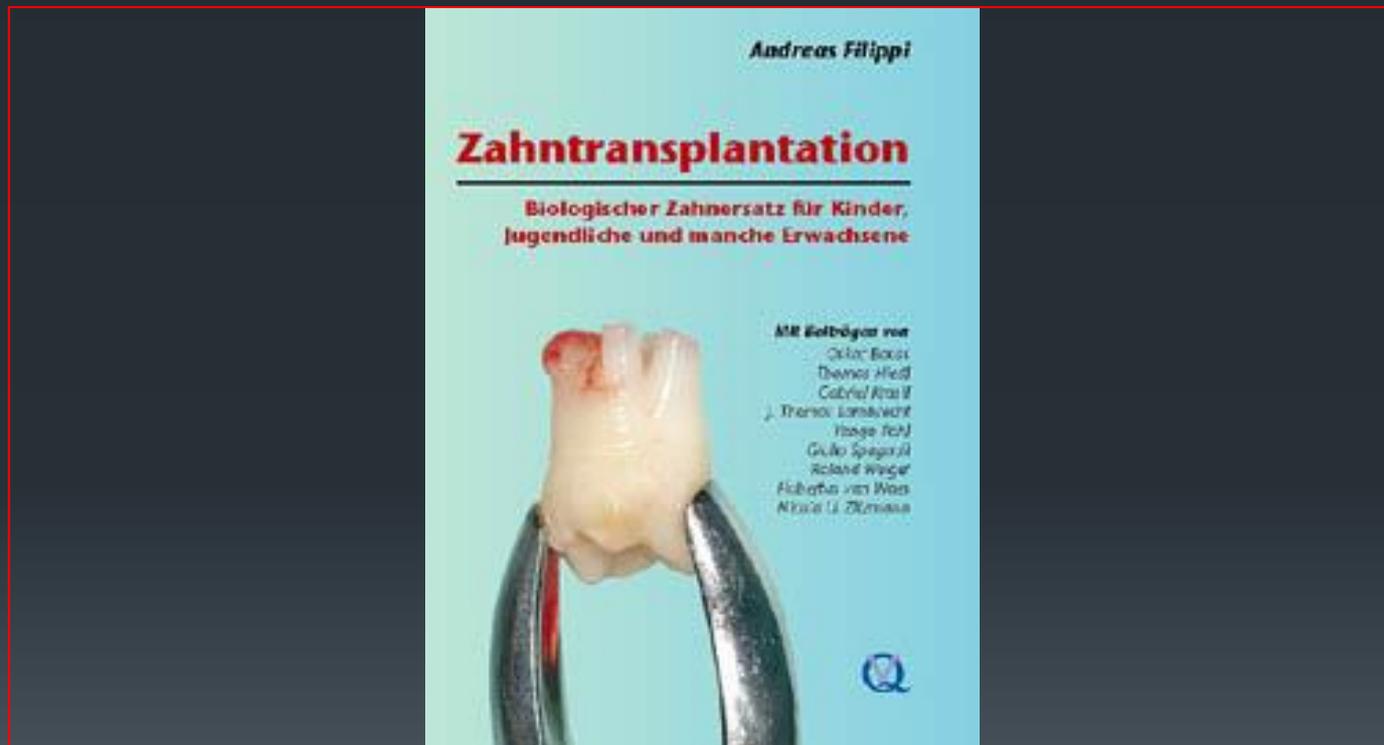
# Surgical Methods of the Conservative Treatment of Teeth

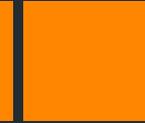
- Apicoectomy (root-end resection)
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# Tooth replantation

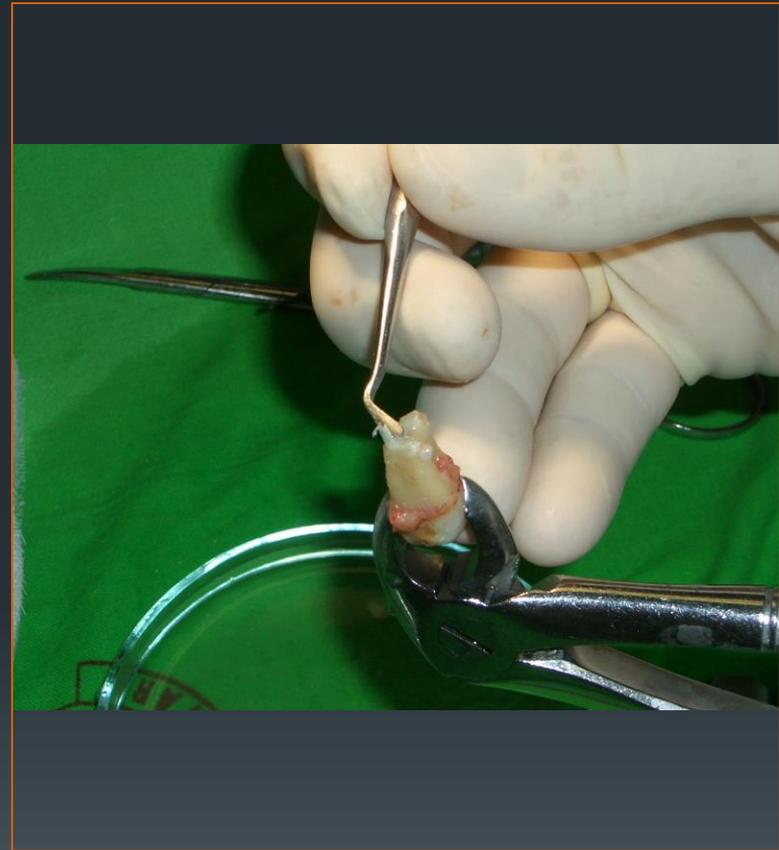


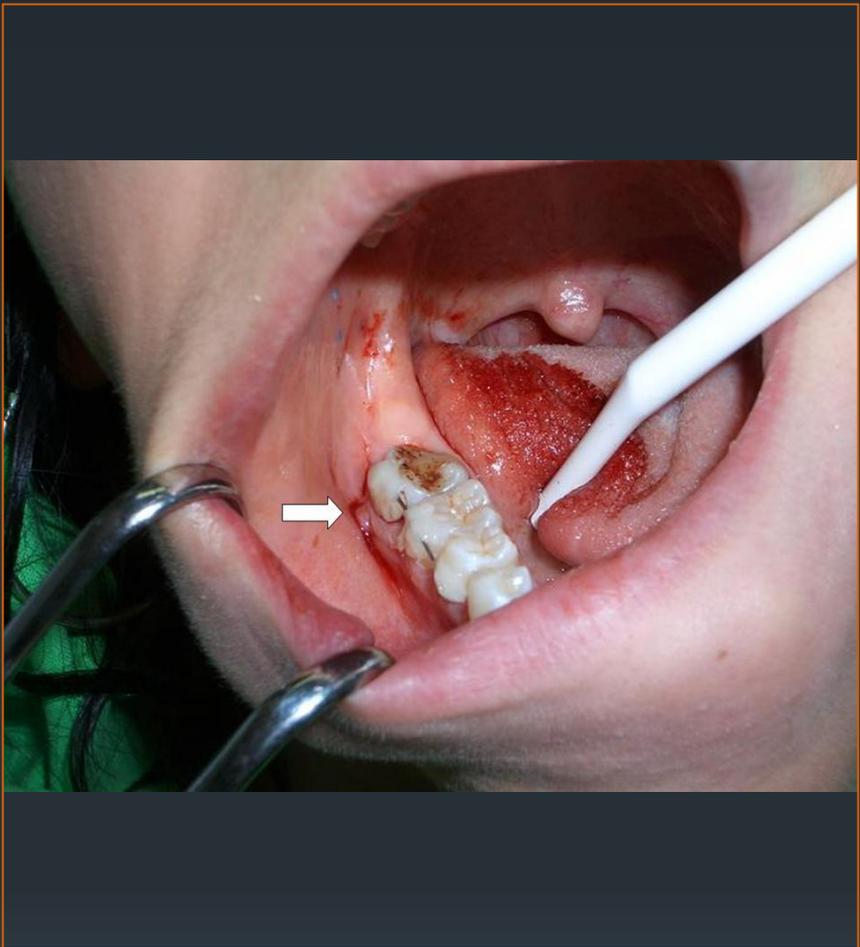


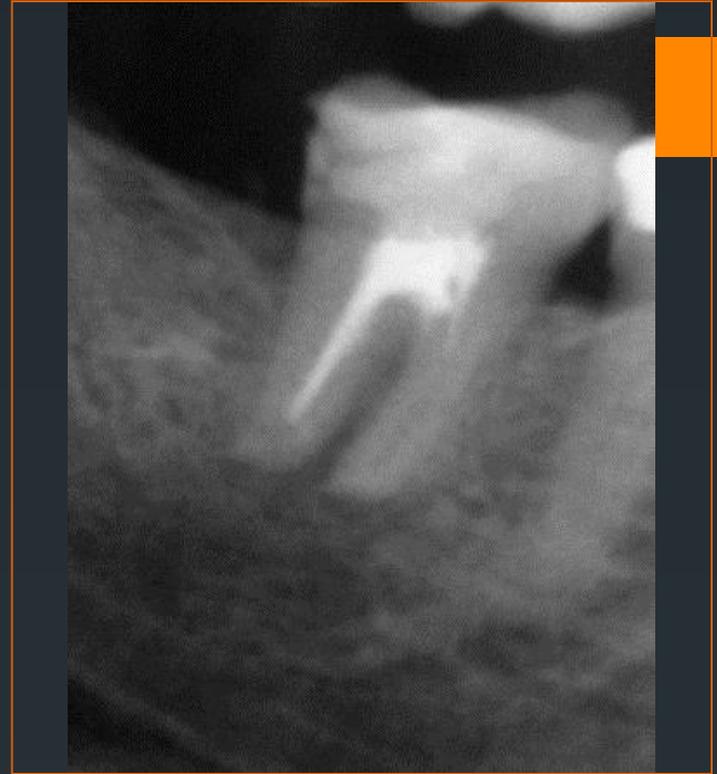
21 years old patient. She had had several times endodontic treatment on the 47, but still complained



After making the retrograde cavity, we used Vitremer® material for the filling







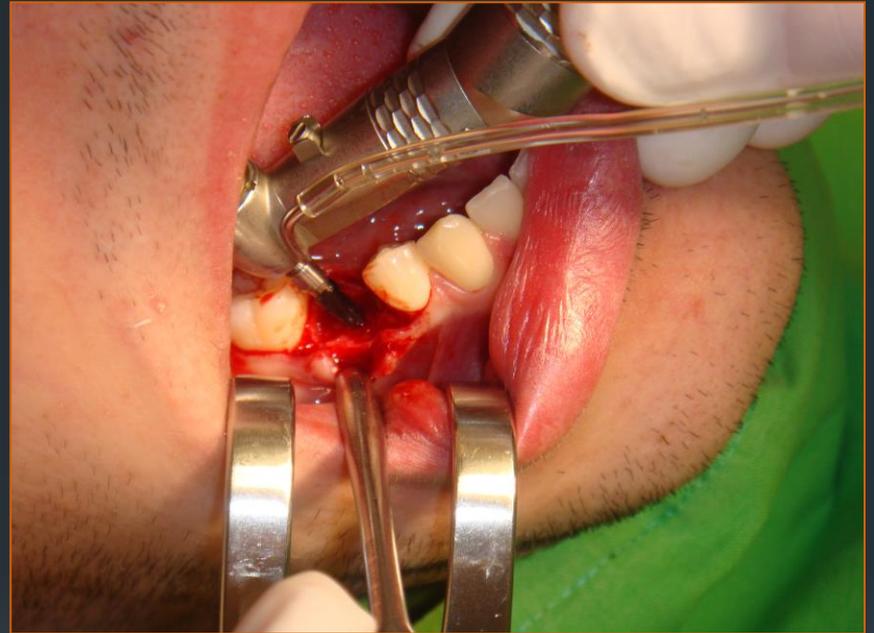
# Surgical Methods of the Conservative Treatment of Teeth

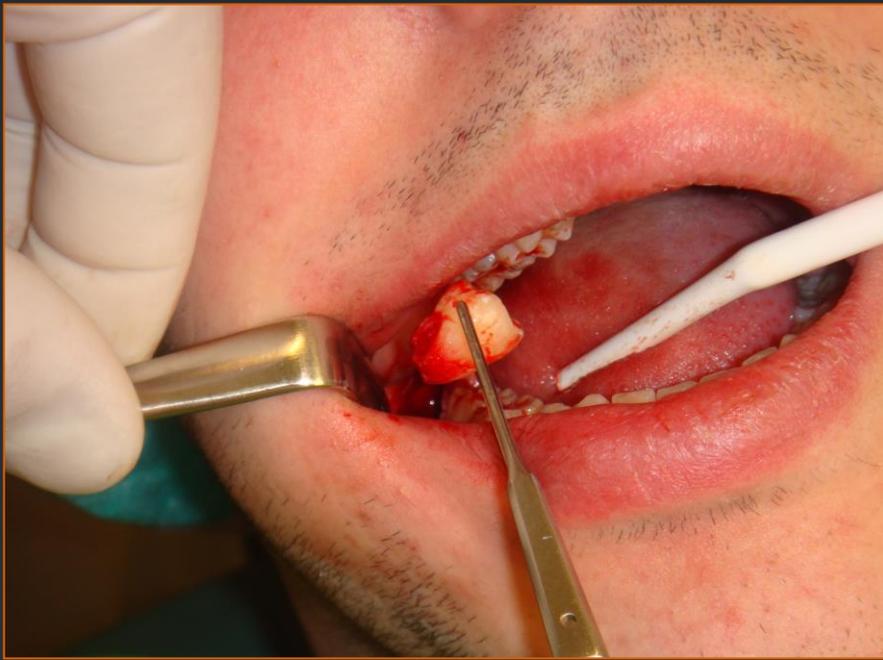
- Apicoectomy (root-end resection)
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# Tooth transplantation

- 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 wisdomteeth 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