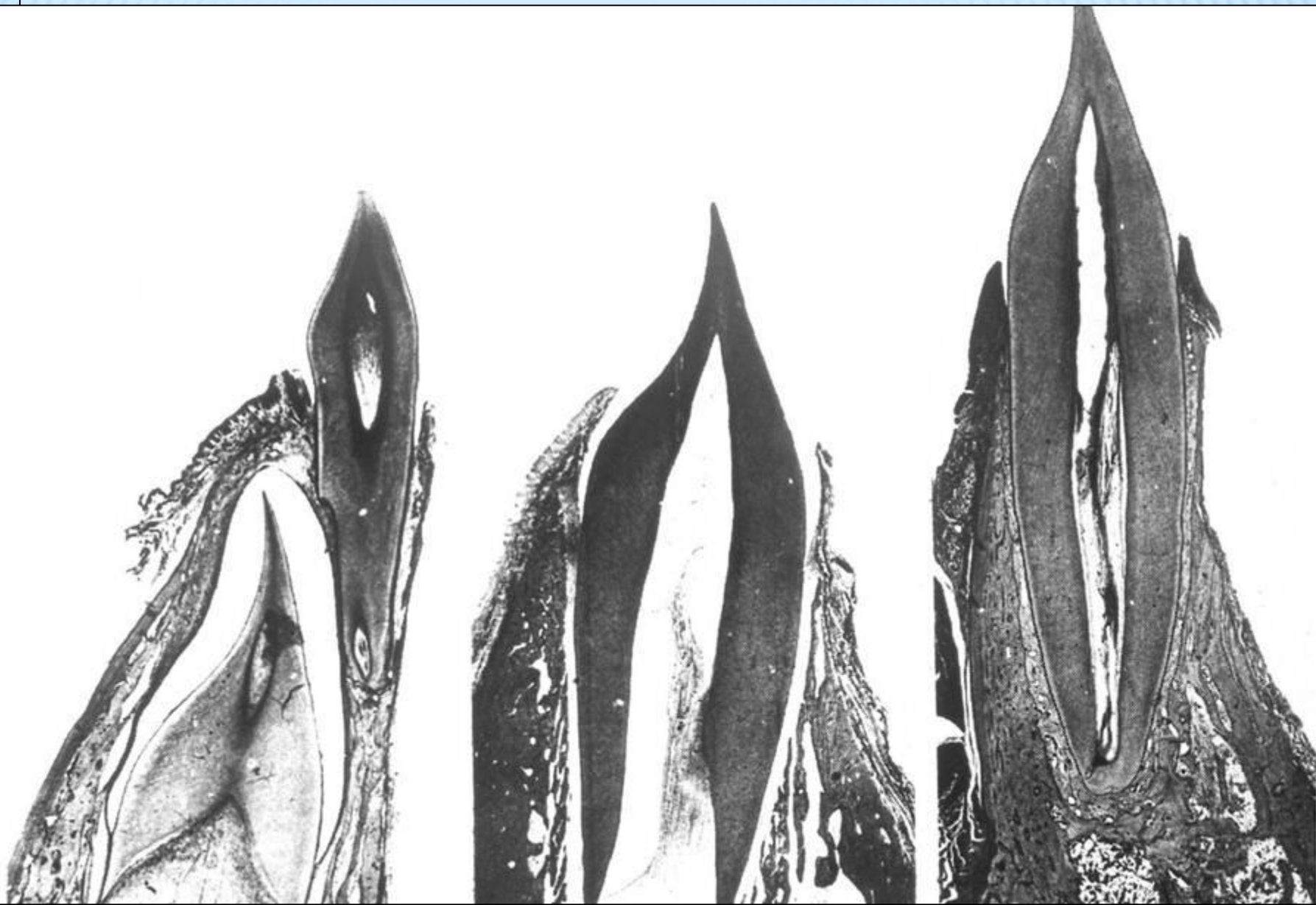
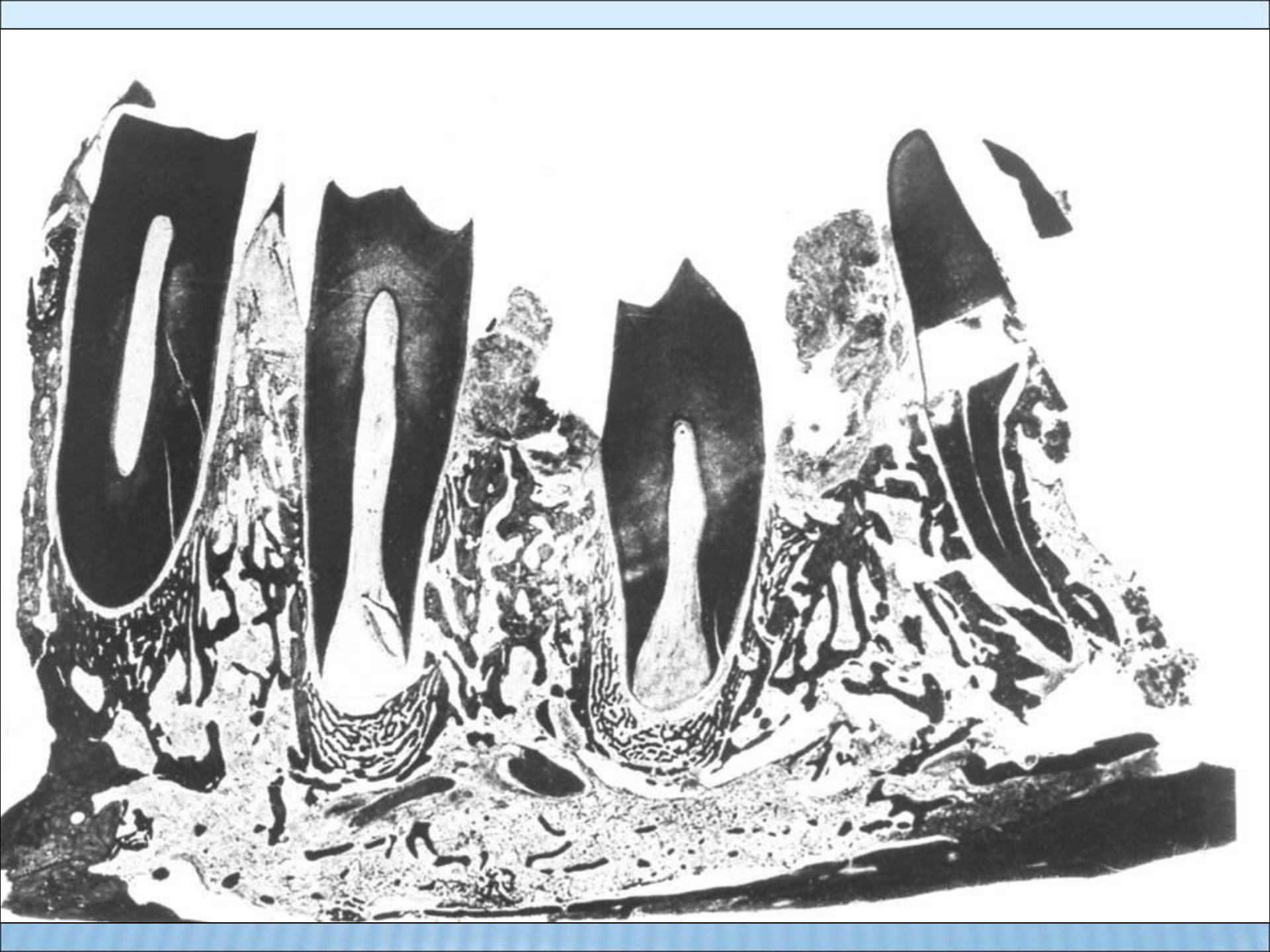
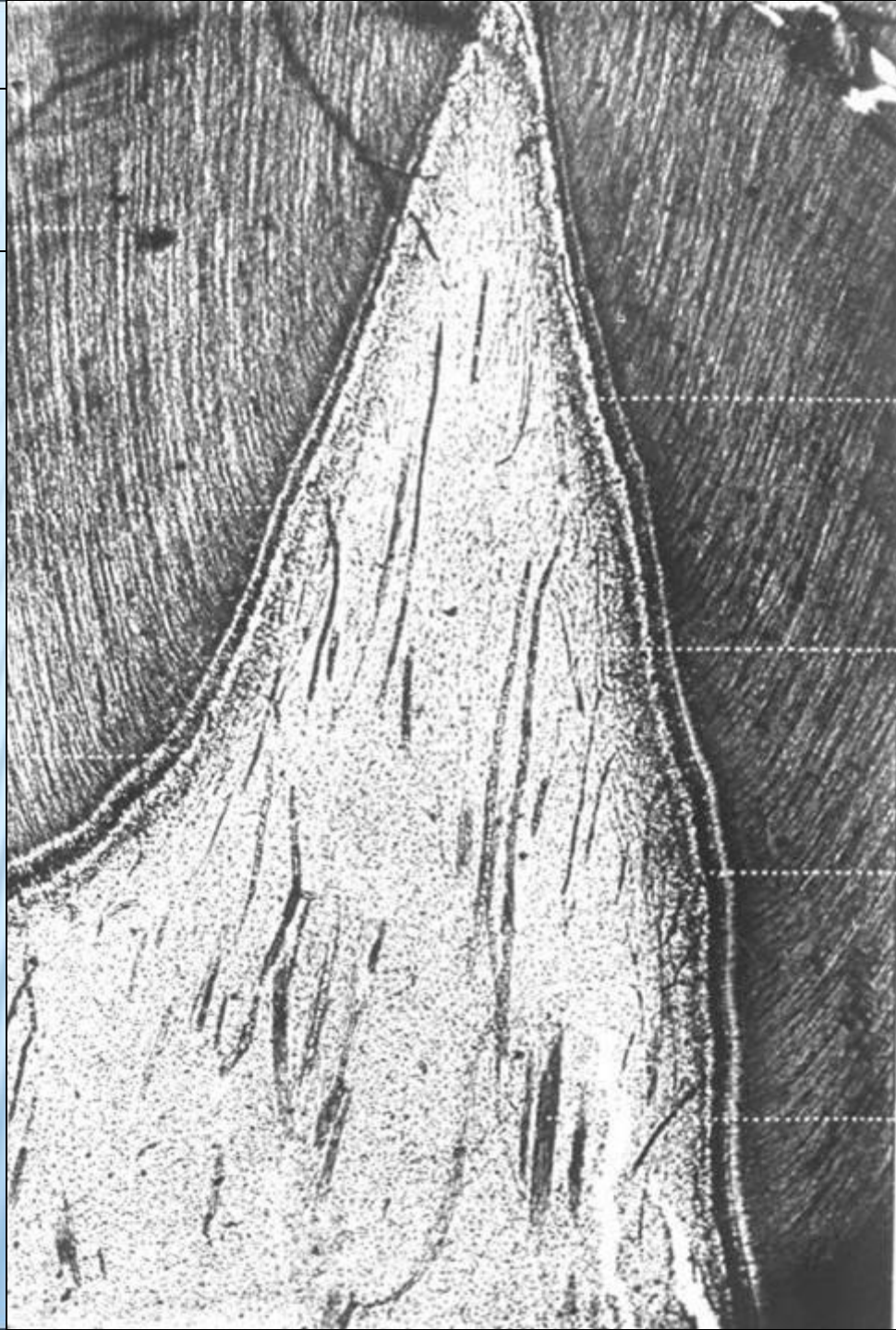


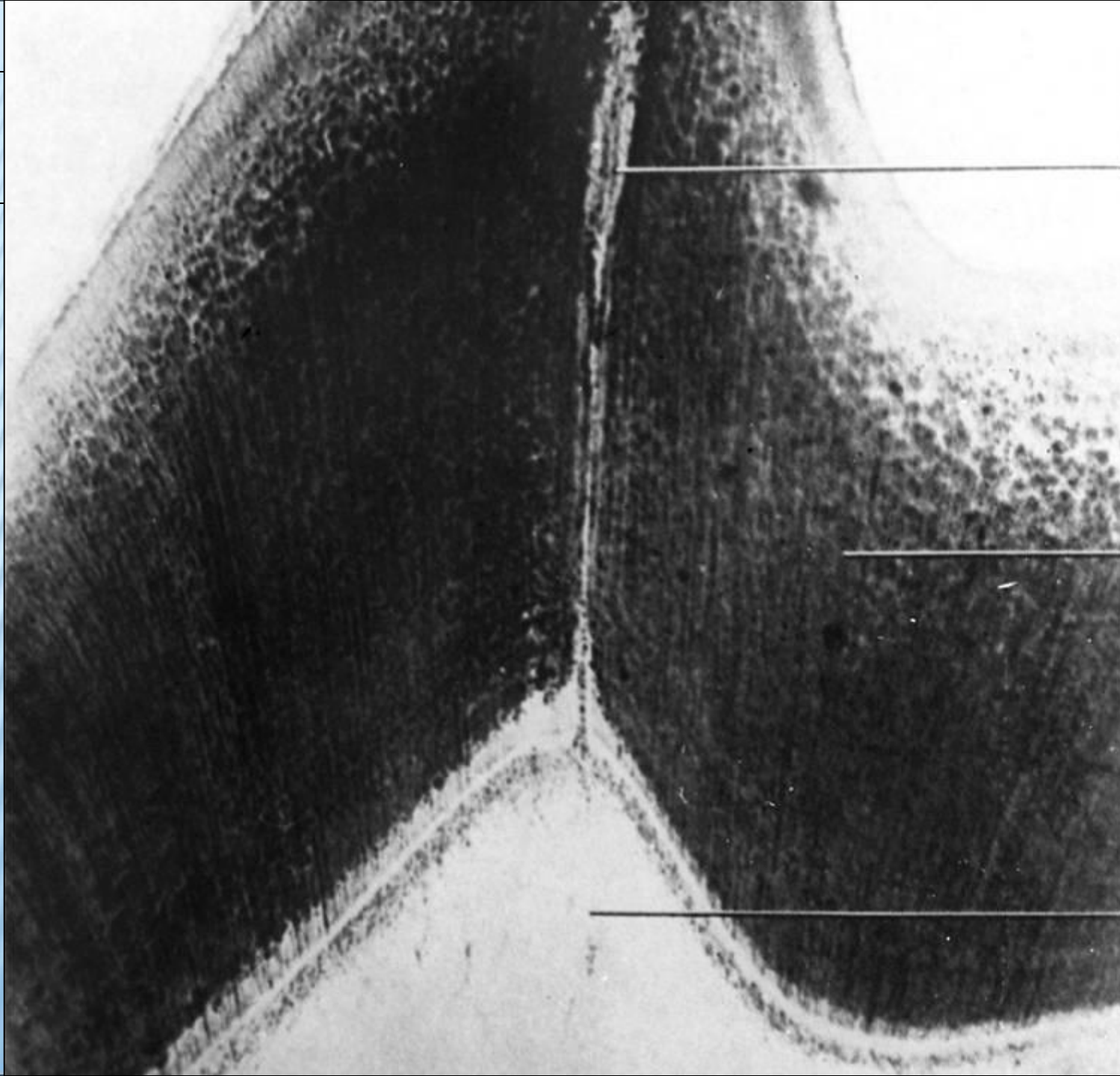
Paediatric dentistry VI

Treatment of permanent dentition









Pulp horn

Dentin

Pulp

Pulp



A

Epithelial
diaphragm
Wide open
root end

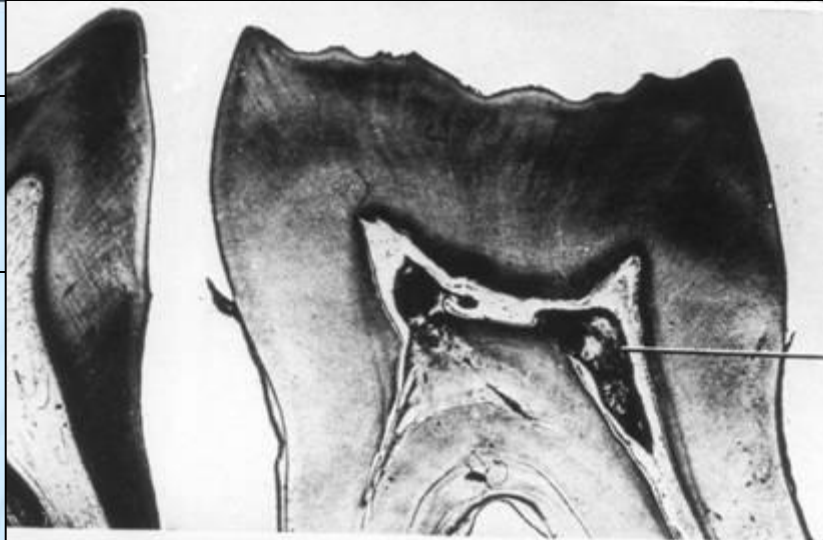
B



Pulp

Cementum

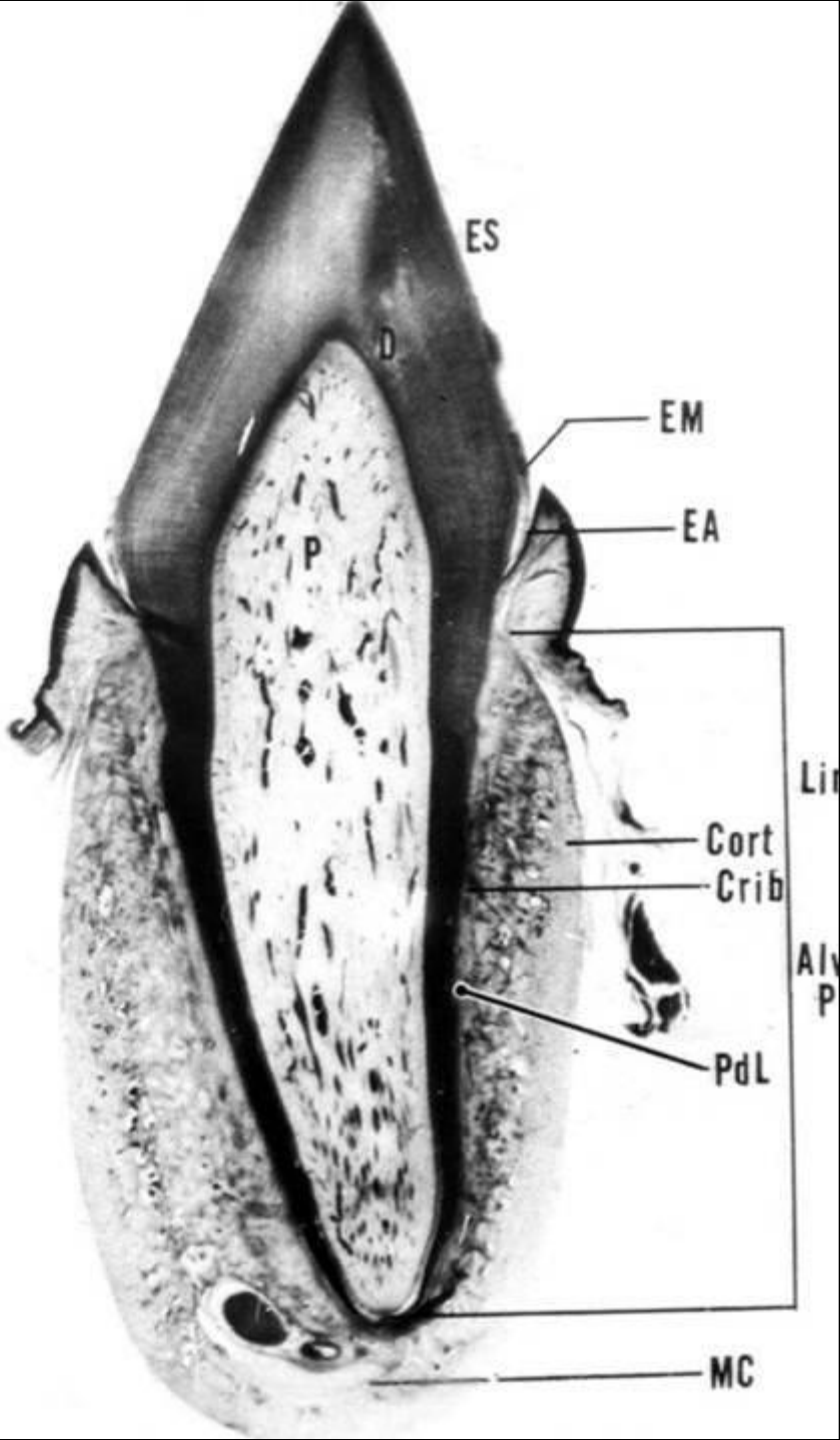
Apical
foramen

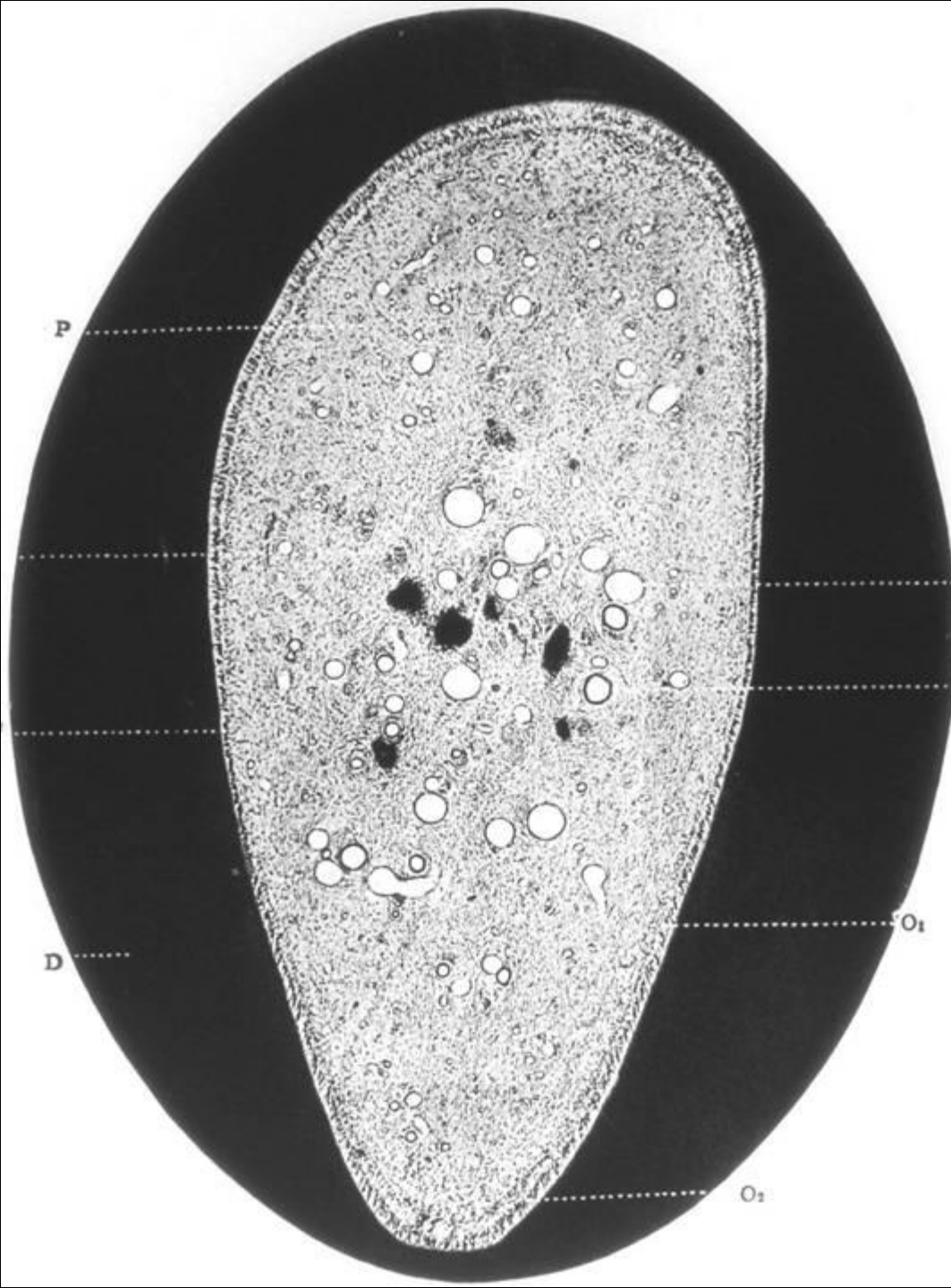


B

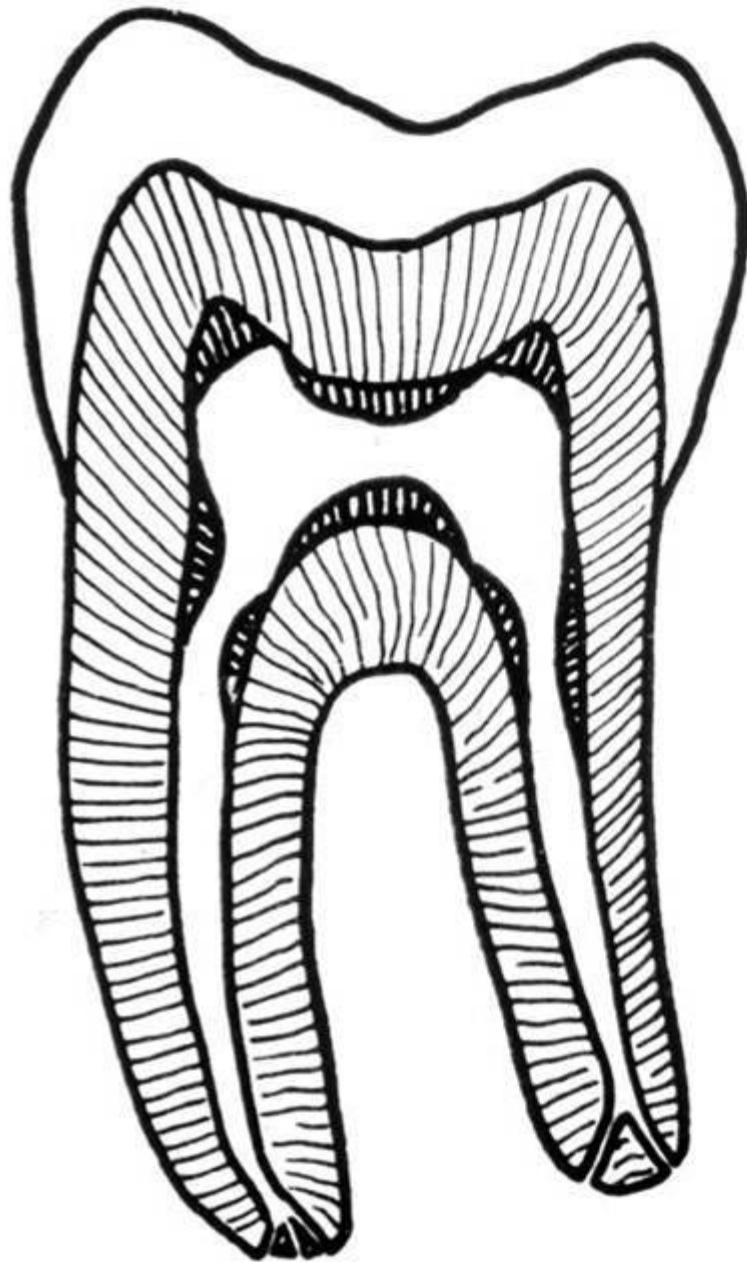
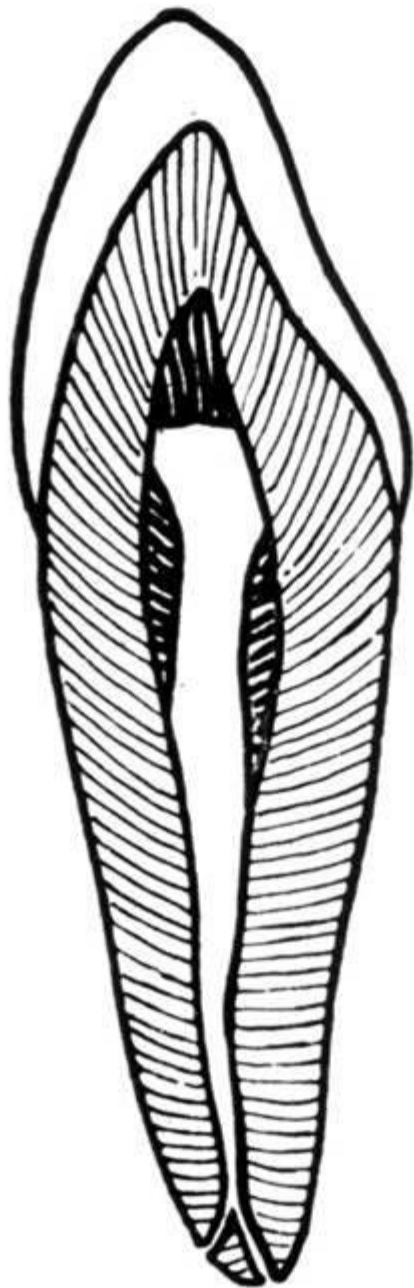
Pulp
stone

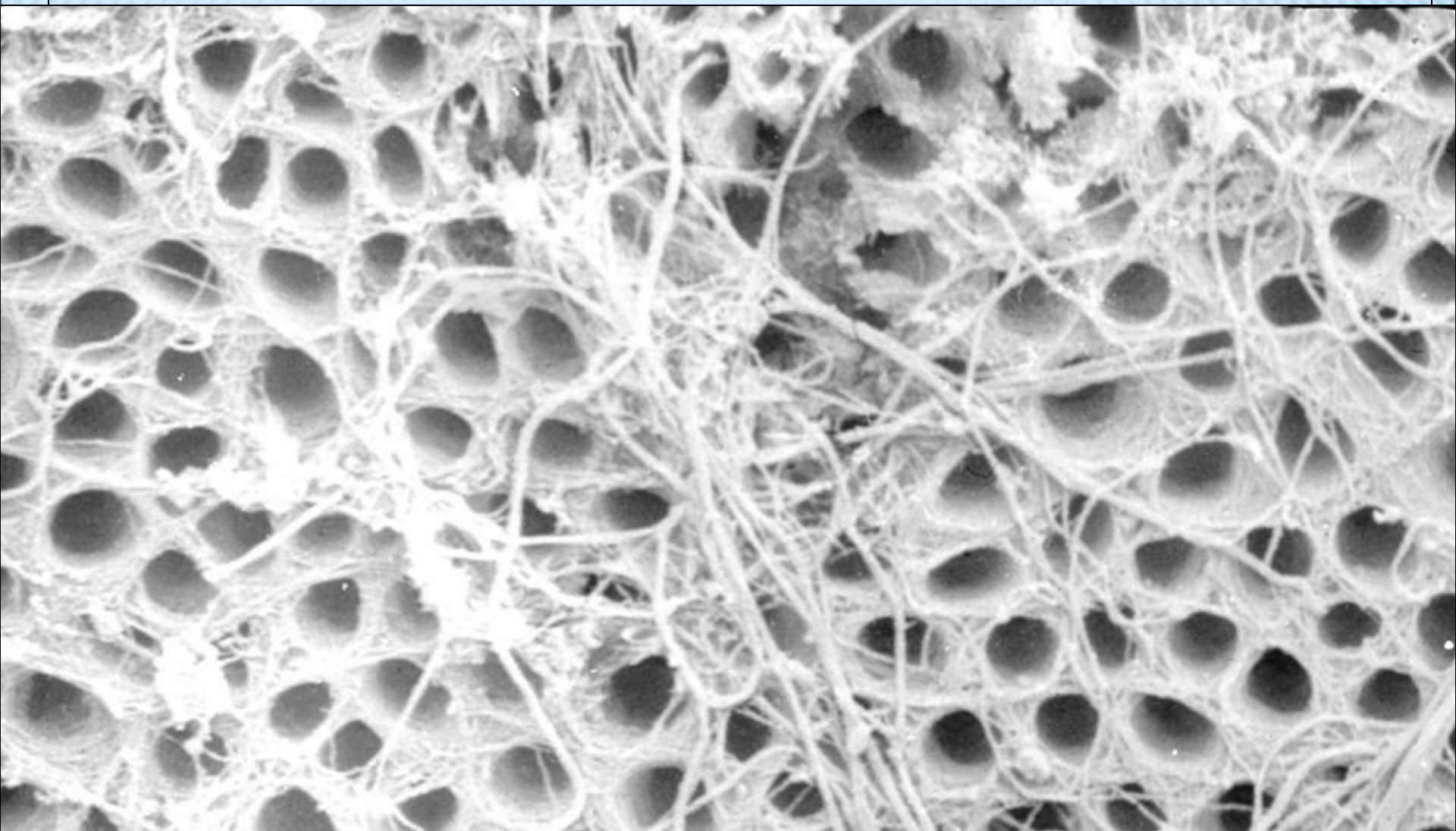












Stages of root development

normally – 7 stages, for our purposes only 4 are of significance – crown is out of the bone and is present in the oral cavity (the remaining 3 are intraosseal)

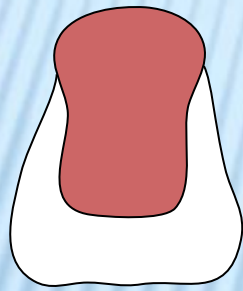
The first stage of development – the root is shorter than the crown, maximally of the same length (1:1). Dentine layer is very thin, dental pulp cavity is large, dentinal walls are divergent apically and the foramen apicale is very large (open apex) – shape of the mesenchymal papilla

The second stage of development – the root is longer than the crown, dental pulp is large, dentinal walls of the root are divergent apically, foramen apicale is large (open), dentine layer is very thin

The third stage of development – the root reached almost its expected length, dentine is thicker than in previous stages, dentinal walls are parallel in the apical part, dentine layer is thin,

The fourth stage of development – the root has reached the expected length (2:1), foramen apicale is closed (physiological constriction), dentine is thicker, but the dental pulp cavity remains large.

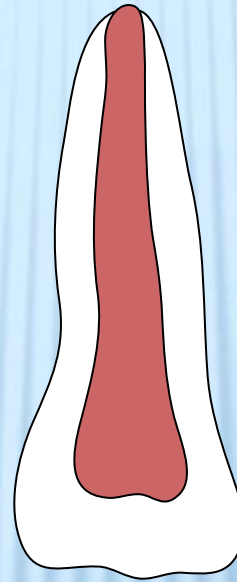
Stages of the root development



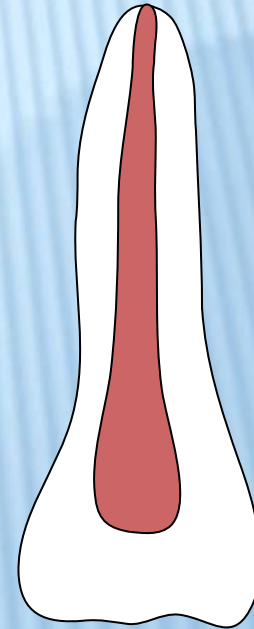
I.



II.



III.



IV.

Teeth with incomplete root development

Tooth eruption - complete apex formation (3 years)

× Anatomical differences

- + Larger dental pulp cavity both in the crown and root
- + Thinner dentine layer
- + Root shorter
- + Clinical crown lower
- + foramen apicale open, no physiological constriction

Histological differences

- + Different mineralization of enamel
- + Rich vascularization
- + apex – shape of mesenchymal papilla
- + dental pulps contain many cells
- + collagen fibres are non oriented

× Biological properties

- + favourable
- + Rapid removal of noxes
- + No blood stasis - wide apex
- + Easy cell differentiation
- + Rapid formation of tertiary dentine

Caries media – D3 - in dentine

1. a 2. stage of development

Only occlusally, in buccal grooves

In frontal teeth – approximal caries

Molars, premolars – approximal caries = **caries pulpaе proxima**

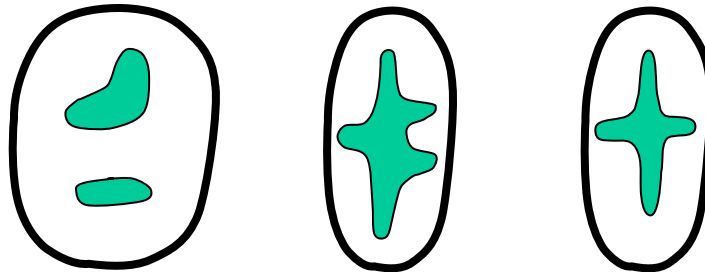
3. a 4. stage of development

Similar to the situation in adults

Therapy - fillings

Molars, premolars

Preventive extension



1

2

3

Caries media – D3

Preparation – as narrow as possible (better primary prevention)

Minimal preparation into dentine

Caries in dentine = caries pulpae proxima (the 1. a 2. stage of development - also in the 3.stage)

Fillings

glassionomer cement + alkaline cement

compomer

composite resin

Frontal teeth

Preparation – the same rules as in adults

Fillings

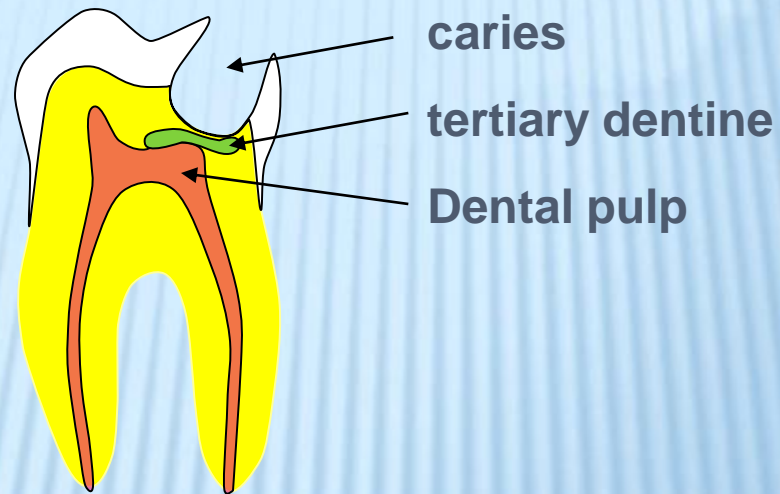
glassionomer cement + base (Dycal)

compomer

Composite resin

Caries pulpae proxima

DIAGNOSIS



Caries pulpae proxima

Subjectively

patient can feel the cavity

Gingival bleeding (irritation by food –inflammation)

Loss of point of contact

Sharp edges can injure the tongue

Mesial shift as a consequence of loss of point of contact

Pain

On biting (thin dentine layer)

On thermic stimuli

On chemical stimuli

Pain character

Is not spontaneous

short

Disappears when the stimulation is stopped

Caries pulpae proxima

On examination

Large cavity (undermined)
approximal caries

Soft tissue (dentine)

1. permanent molars –often non cavitated lesion - only on the X-ray

X-ray

Radiolucency in the dental pulp vicinity

Tertiary dentine formation

TOOTH VITALITY THREATENED

Procedures – to maintain dental pulp vitality

Indirect dental pulp capping

Carious dentine removal

complete (one-step method)

incomplete (more visits)

Excavation

Hand instruments

rotatory

Low revolutions

Round bur

Dentine wound – covered by Ca(OH)_2 -
different kinds, most frequently a paste

Caries pulpae proxima)

One-step method

-

permanent filling

Expectation:

Increased tertiary dentine formation

remineralization of the soft dentine

Destruction of microbes

Caries pulpaе proxima

More visits- temporary filing
(intermitent /stepwise ↓ excavaction)
Removal of carious dentine, Ca (OH)₂, IRM

2 months later - removal of:

Temporary filling

Ca (OH)₂

Remnants of carious dentine

application:

New layer of Ca (OH)₂, usually alkaline cement

Cemente base

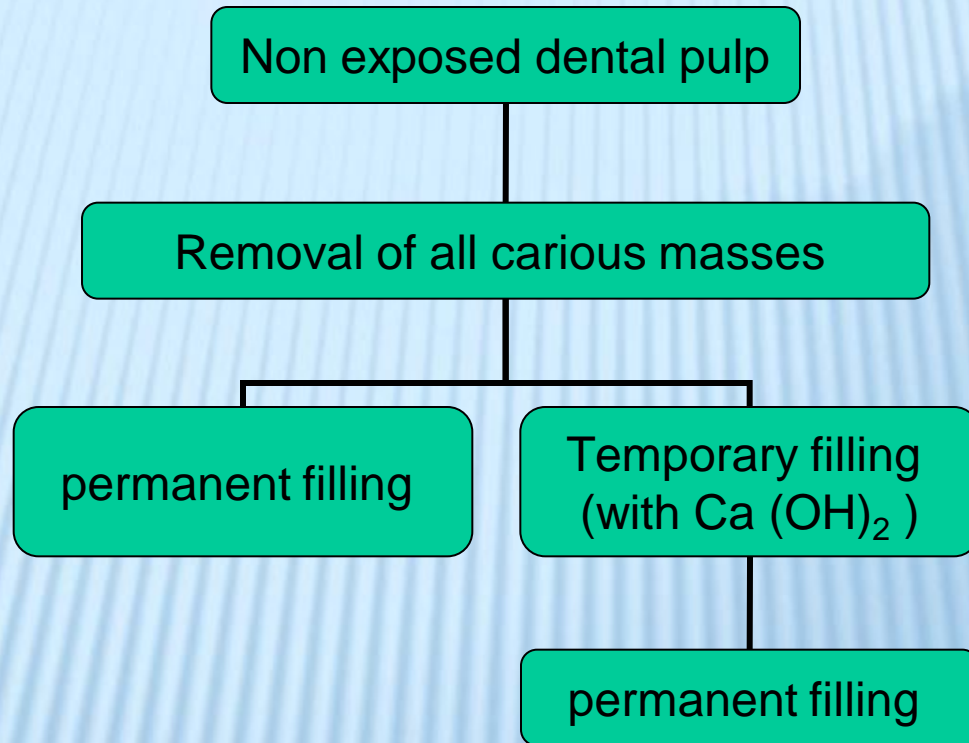
permanent filling

GIC

Composite resin

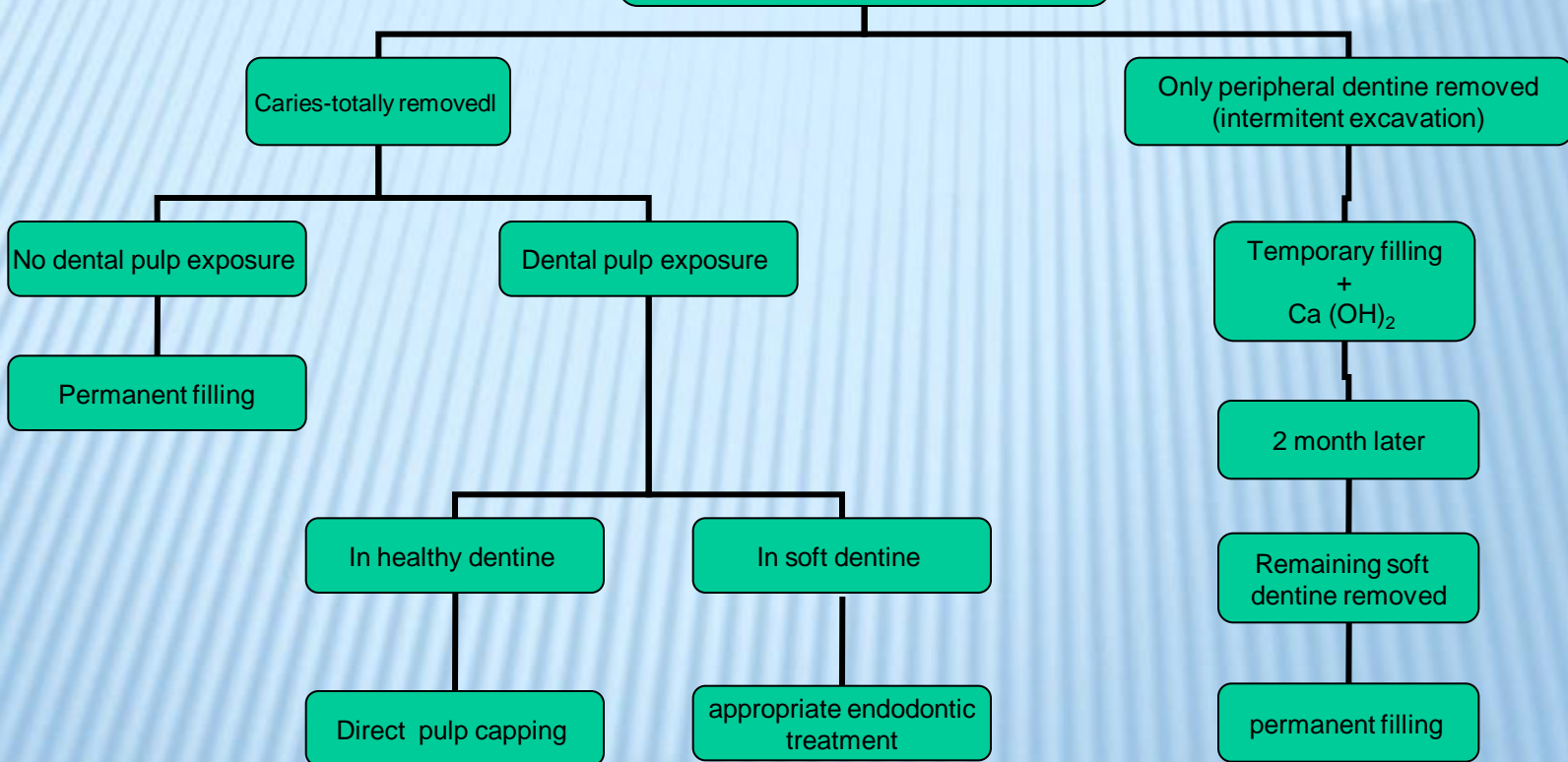
crown

Non penetrating carious lesion in the dental pulp vicinity



DANGER OF PENETRATION

PERIPHERAL DENTINE REMOVAL



Caries pulpae proxima

Molars, premolars



Central cavity

the same preparatory rules as in adults

Approximal caries

Preparation- very delicate and careful

All edges rounded (pulpoaxial wall, gingivo - axial wall)

Filling: comp. resin, GIC, may be silver amalgam + base

- alkaline cement

- alkaline cement + ZnO phosphate cement

matrix - in erupting teeth often not possible – shorter clinical crown, strip + wedge or special matrix (T-matrix, sectional matrix, the auto-fix system)

Caries pulpae proxima

Frontal teeth

Preparation the same, minimal preparation (dove-tail on the oral surface – more cervically)

Filling

- glassionomer cements + Dycal
- compomer filling
- composite filling +
Dycal

Foramen caecum

carefully, **very close to the dental pulp !!!**

GIC + base

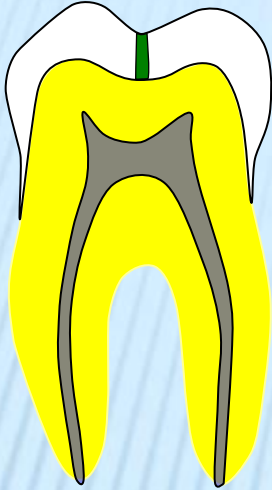
compomer + base

composit resin

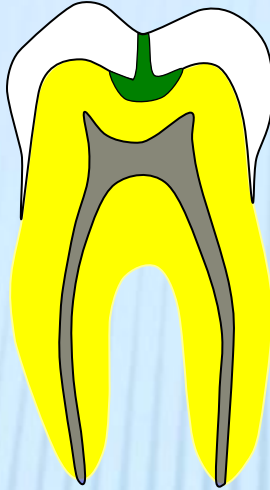
Base - Dycal

- Dycal + ZnO phosphate cement

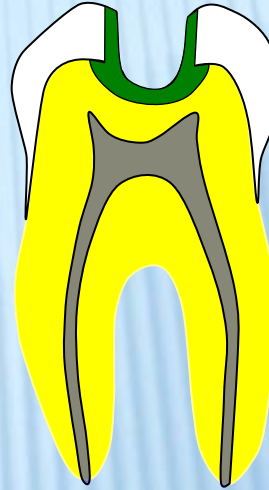
CS
caries superficialis



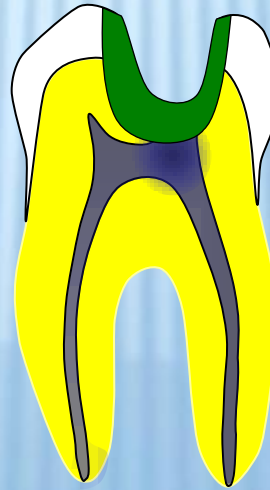
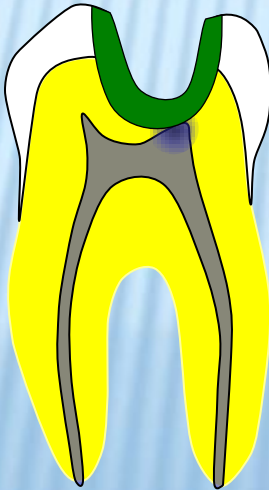
CM
caries media



CPP I
caries pulpa proxima, caries into 1/2
of the dentine thickness, changes in
the dental pulp
no signs of the pain



CPP II
caries pulpa proxima
dentine – continuous ,
but thin
microbs present
pain on stimulation, not
spontaneous



Exposure of the dental pulp
pain – spontaneous
Pulpitis

Direct dental pulp capping

Aim – dentine bridge formation
 Condition – dental pulp has to be healthy, no inflammation

$\text{Ca}(\text{OH})_2$ – directly on the dental pulp

Effect

Layer of necrosis
 Hard tissue formation
 Tubular dentine formation

Under sterile conditions, usually in local anesthesia



Dental pulp exposure (perforation)

- ✗ Bleeding has to be stopped
- ✗ Removal of coagulum (gently)
- ✗ $\text{Ca}(\text{OH})_2$ gently pressed on the exposed dental pulp
- ✗ Layer of cement
 1. ZnO – eugenol
 2. ZnO – phosphate
 3. hermetic filling = permanent

Caries pulpaе proxima - summary

Most frequently in approximal caries
Also in occlusal caries
especially in the
1. and 2. developmental stage

Protection of the complex dentin –
dental pulp



Intermittent excavation (step-wise)
or
Indirect dental pulp capping

Complication

Dental pulp exposure
accidental exposure

in healthy dentine

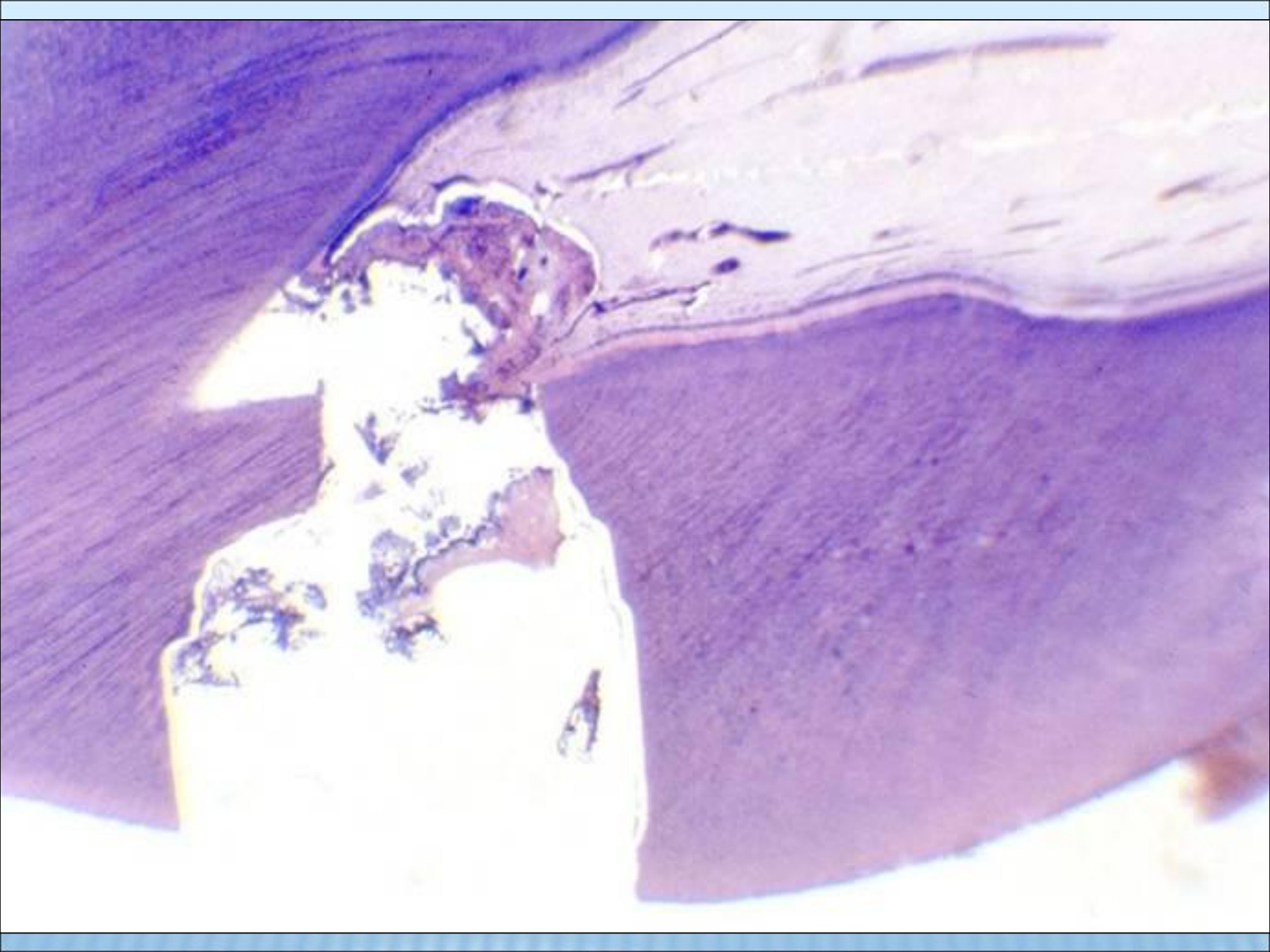
direct capping (small extent)

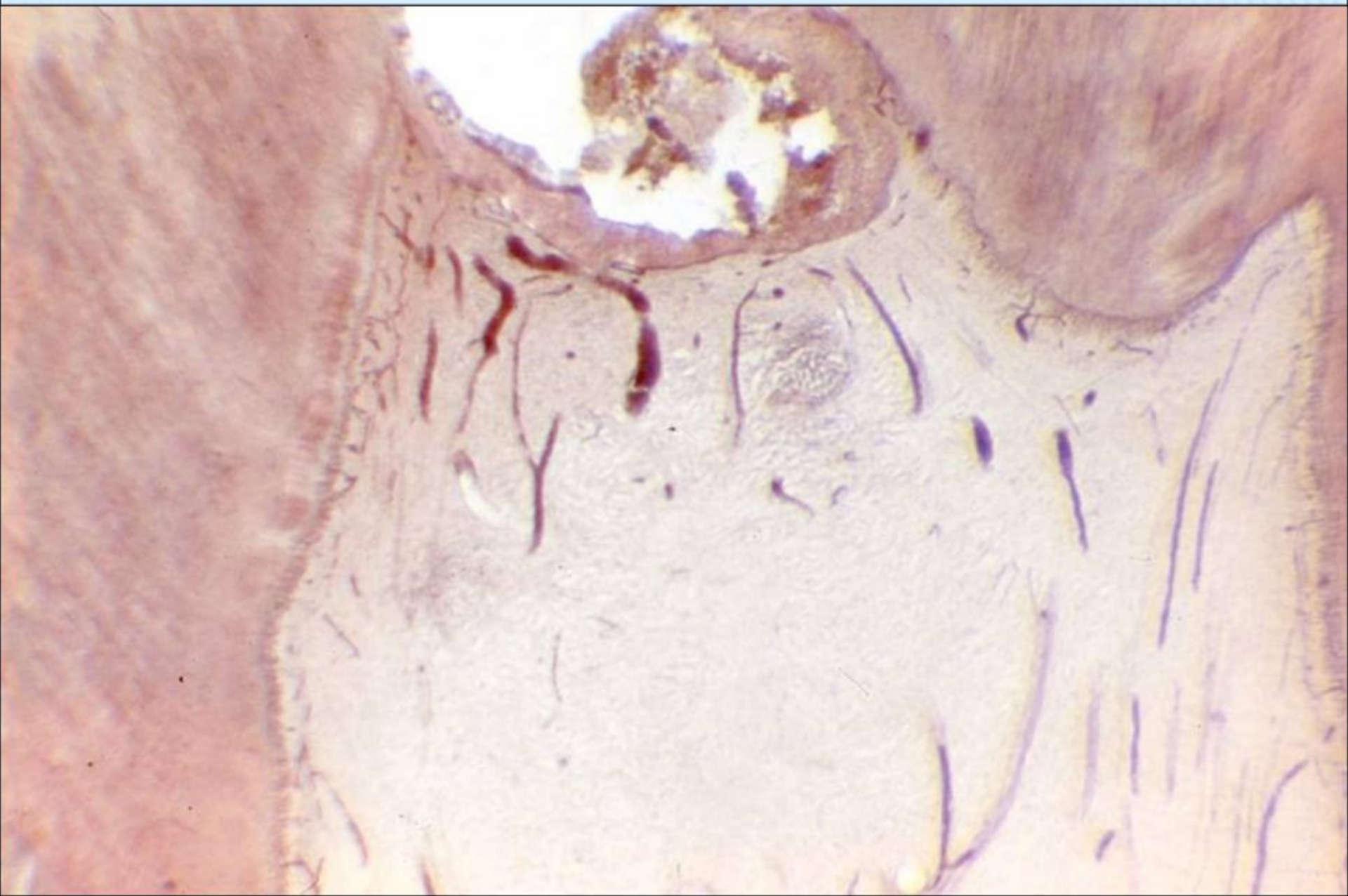
in carious dentine

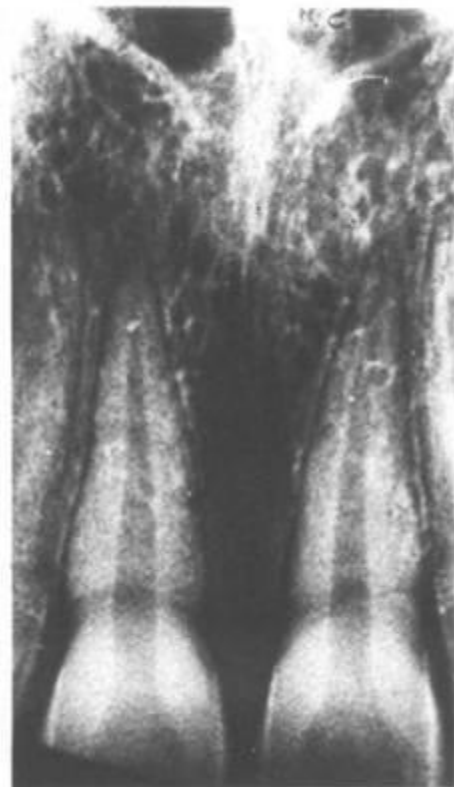
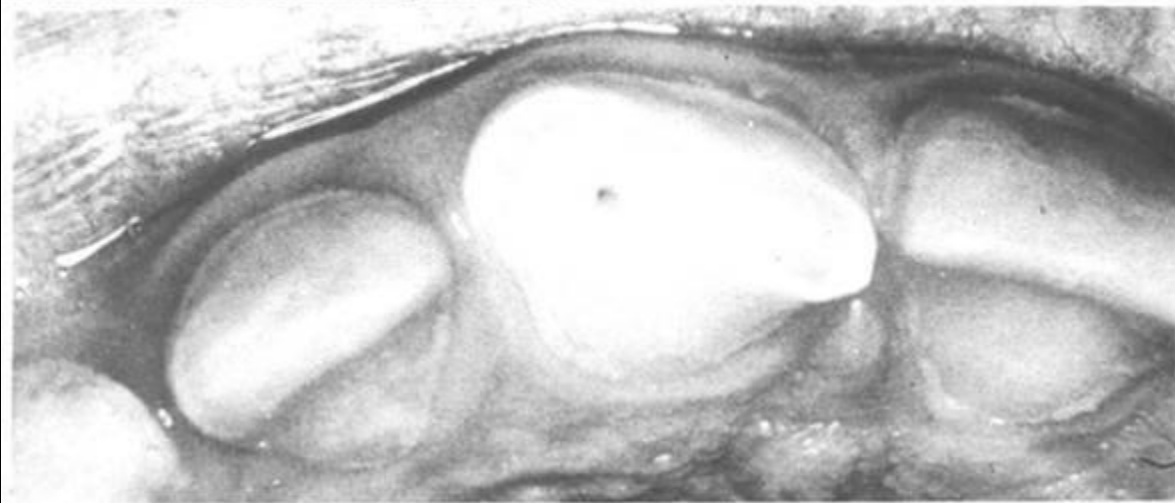
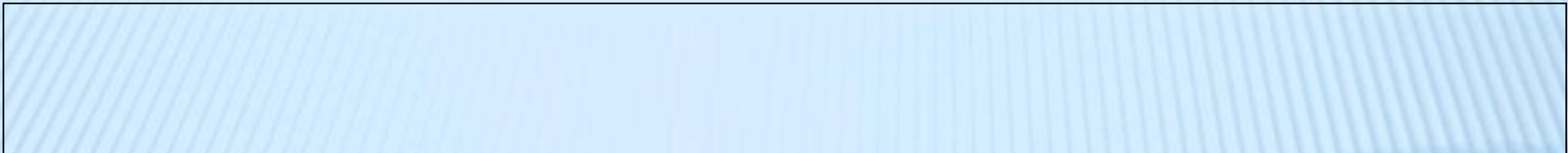
partial pulpotomy

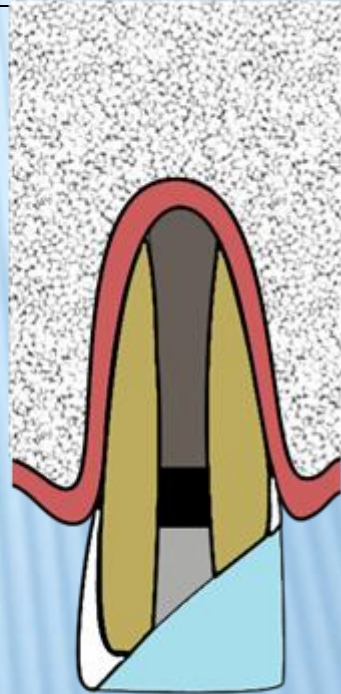
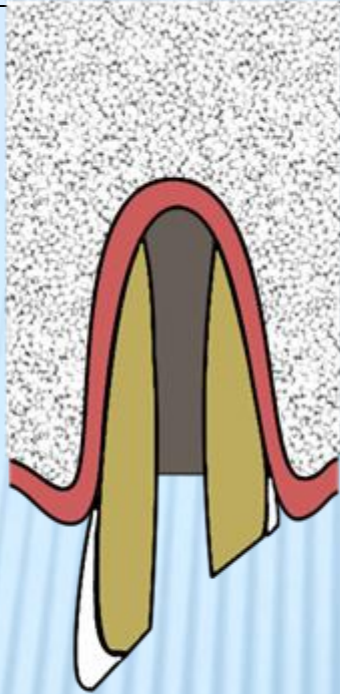
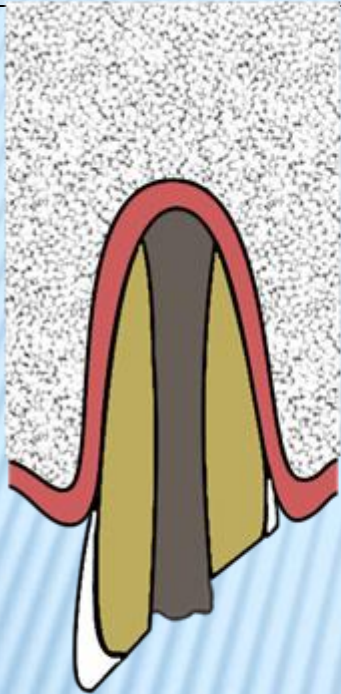
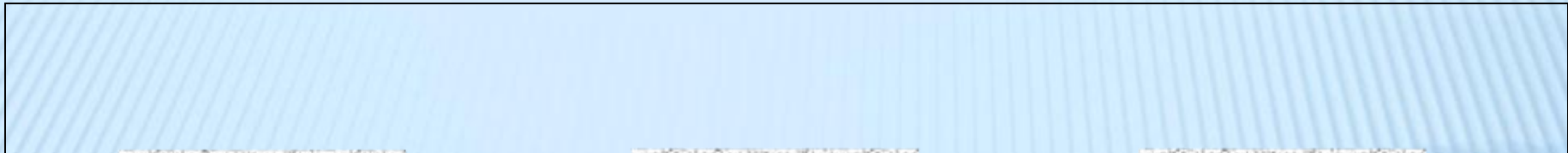
possibly

coronal pulpotomy

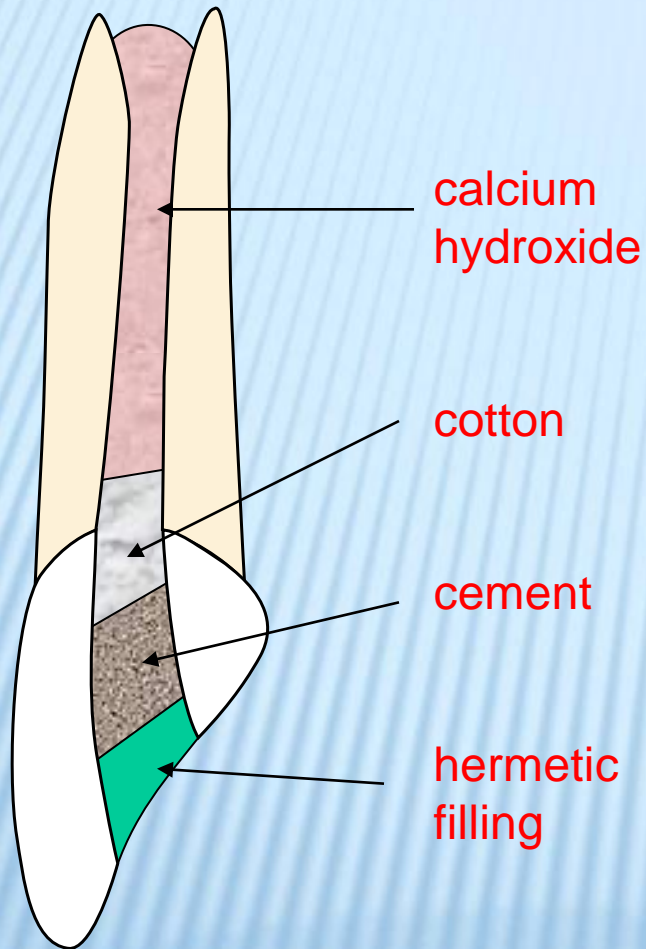




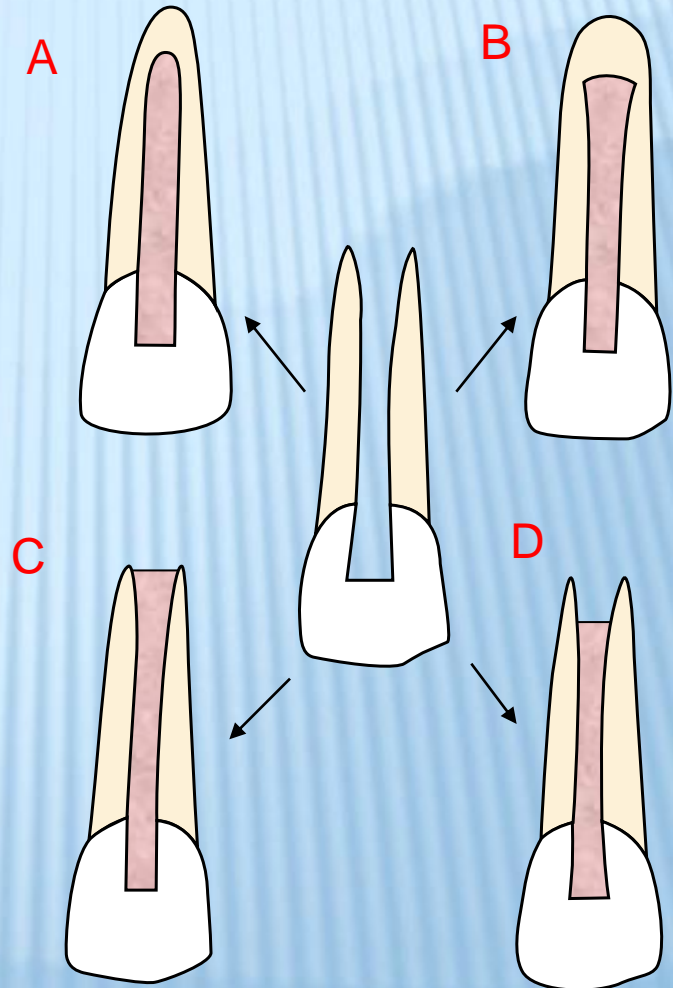




Apexification



- A. hard tissue
- B. hard tissue, dent.pulp.cavity. shorter



- C. connective tissue
- D. con. tiss., d.p.c. shorter

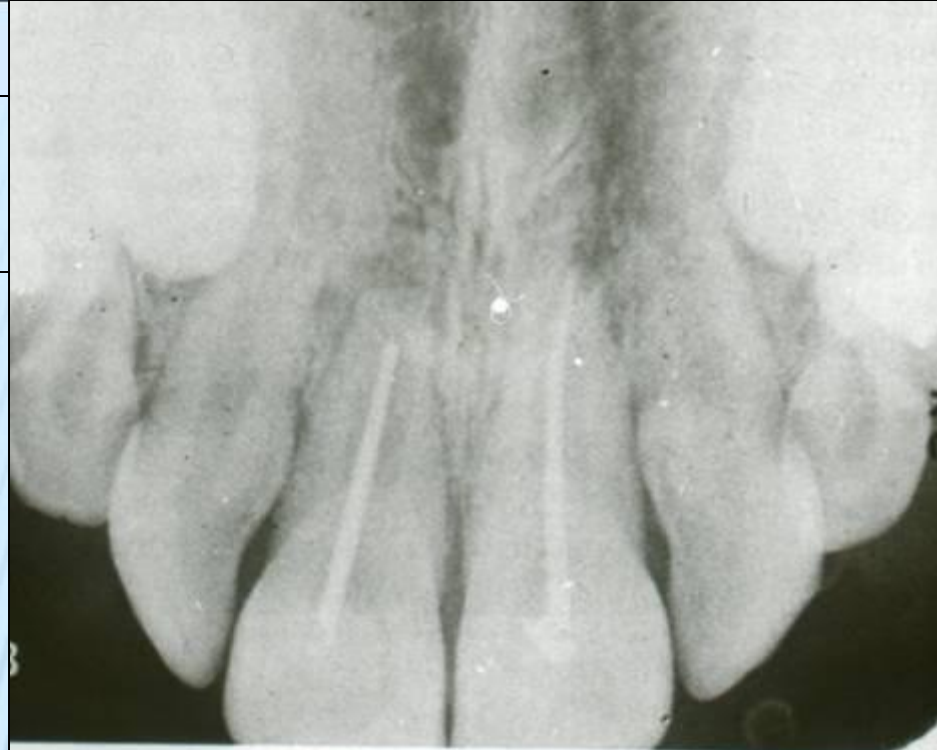
Apexification

Apexification is a method for treatment of immature permanent teeth in which root growth ceased due to pulp necrosis (total pulpitis). Its purpose is to induce the root end closure with no canal wall thickening and continuous root lengthening. The working procedure is similar to other treatments in endodontics – local (block) anaesthesia, rubber dam isolation, working length determination.

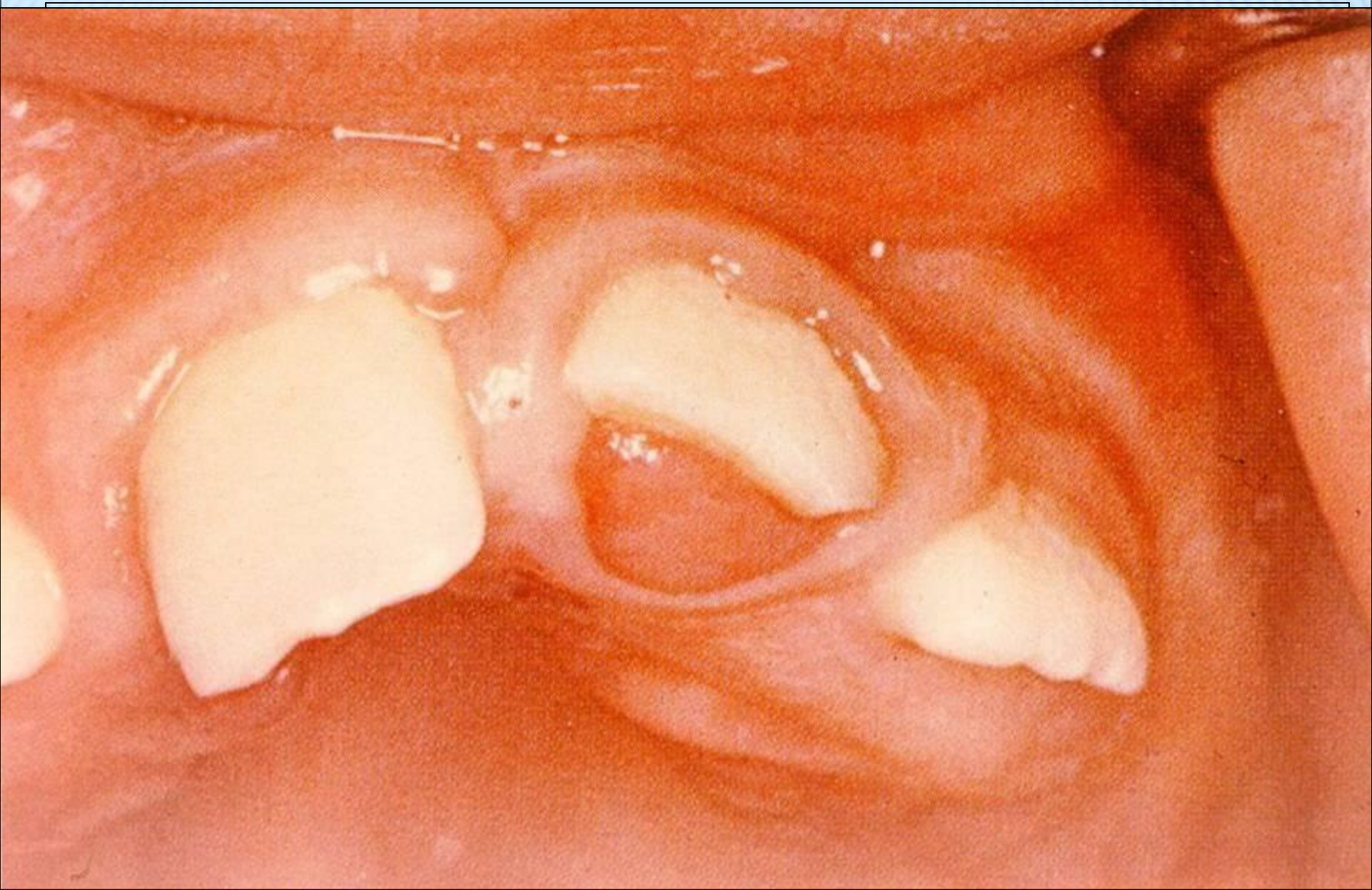
- 1 Access opening, rinsing out the necrotic contents, root canal shaping under rinsing. In case of total pulpitis, it is necessary to remove the dental pulp and to stop the bleeding. For irrigation we can use physiological saline in case of pulpitis or necrosis. In case of gangrene, disinfectants should be used (chlorhexidine, sodium hypochlorite). Root canal shaping should be very gentle using H-file, remnants of the necrotic content will be dissolved by calcium hydroxide which is used as a temporary filling. A calcium hydroxide dressing in a creamy consistency can be applied with a lentulo spiral under low revolutions or with a special syringe. For the compaction of the calcium hydroxide sterile cotton pellet can be used. Then, the tooth is hermetically closed by a filling consisting of a sterile cotton pellet, base (zinc phosphate) and a permanent material.
- 2 The second visit is scheduled from 1 week –in case of bleeding (pulpitis) to 3 weeks in case of necrosis/gangrene. The dressing is exchanged for a new one.
- 3 The root is monitored clinically and radiographically in 3 months intervals to examine the formation of an apical hard tissue closure.
- 4 When a completed apical barrier is formed the canal is obturated with a permanent root canal filling material.
- 5 Because the roots after apexification with calcium hydroxide were found to be fragile (dissociation of dentine), MTA or Biodentine have been used recently. After one appointment with calcium hydroxide the bioceramic material can be used. The thickness of MTA and others in the root canal should be about 3-5 mm. The method seems to be very promising.



Fig. 6 Ca(OH)_2 -CMCP paste, 120 days, contralateral root of Fig. 5. Complete apical closure by means of cementum deposition is present. Newly formed alveolar bone has grown into the apical canal. Continuous, but complicated, periodontal ligament is also seen between the apical barrier and the alveolar bone (hematoxylin and













Diseases of the dental pulp in permanent teeth with incomplete root development

Clinically –subjective symptoms not very distinct

Significant for therapy

- + extent of the inflammation
- + stage of development

1. hyperemia
2. partial inflammation
3. total inflammation

Classification of diseases of the dental pulp is the same as in adults:

reversible and irreversible inflammations

patologico-anatomical classification, chronic, acute

necrosis, gangrene

referred pain (synalgia) is present as well (see endodontics I)

Hyperemia – momentary pain

partial pulpitis

- + pain – individual differences
- + no sensitivity on percussion
- + not longer than 24 h.

total pulpitis

- + reparation no longer possible
- + intensive, long-lasting pain
- + sensitivity on percussion

differential diagnosis

- × periodontitis
- + papillitis
- + otitis media
- + tonsillitis
- + varicella
- + aphtosis
- + sinusitis maxill.
- + neuralgia n. V
- + incipient herpetic gingivostomatitis

Hyperemia

frontal and distal teeth, all stages
(I., II., III., IV.)

decayed masses removal

intermitent excavation (step-wise) + permanent filling 4-8 weeks later

indirect dental pulp capping + permanent filling

On accidental dental pulp exposure

Direct dental pulp capping (sound dentine)

Partial pulpotomy (decayed dentine)

Pulpitis acuta partialis

frontal and distal teeth, all stages

Vital pulpotomy (coronal)

Pulpitis acuta totalis

frontal teeth

I. stage - extraction

II. stage – dental pulp removal - repeated root canal filling by calcium hydroxid

(apexification) - within 6 - 12 months root canal will be closed.

Apex closed – permanent root canal filling (central cone, condensation methods using gutta-percha)

If the previous method will fail – surgical-conservative treatment.

III. a IV. stage - vital extirpation, root canal filling

Pulpitis acuta totalis

premolars, molars

I. a II. stage – extraction

premolars in the II. stage exceptionally – treated by
apexification (repeated filling by $\text{Ca}(\text{OH})_2$)

the method fails - upper premolars may be treated by
endodontic surgery under favourable conditions

III. a IV. stage – vital extirpation, permanent root canal filling.

Mortal extirpation – only exceptionally

In the III. stage - calcium hydroxide may be used – better
apical closure.

Dental pulp diseases
necrosis, gangrene, acute periodontitis
frontal teeth

I. stage - extraction

II. stage

Root canal content removal

Shaping, cleansing

Repeated filling by Ca(OH)_2 (apexification)

apex closed – permanent root canal filling. If the previous method fails – surgical-conservative treatment.

III. a IV. stage – root canal treatment one appointment method

periodontitis acuta – *management of the acute phase, then shaping and obturation*

Dental pulp diseases
necrosis, gangrene, acute periodontitis
distal teeth

I. and II. stage - extraction

premolars in the II. stage – exceptionally the same procedure as in frontal teeth (apexification)

If the previous method fails – surgical-conservative treatment in the upper jaw (favourable conditions)

III. a IV. stage – root canal treatment – one-appointment method or multiple visit method

periodontitis acuta – management of the acute phase, then root canal treatment, mostly by multiple visit method

Chronic periodontitis

frontal teeth

I. stage - extraction

II. stage - surgical - conservative treatment (apexification possible under favourable situation)

III. a IV. stage – root canal treatment, one visit method if possible, or multiple visit method. Exsudation persists – endodontic surgery. With the exception of radicular cyst – repeated root canal filling with calcium hydroxide, successful mainly in the diffuse form.

Chronic periodontitis

premolars, molars

I. and II. stage - extraction

in premolars in the upper jaw exceptionally surgical - conservative treatment, possibly apexification

III. a IV. stage – root canal treatment – multiple visit method. Method with $\text{Ca}(\text{OH})_2$, - possible, particularly in the diffuse form. Exsudation persists - extraction