

CHARACTERIZATION OF CARIES - DEFINITION & LOCALIZATION

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Faculty of Dentistry

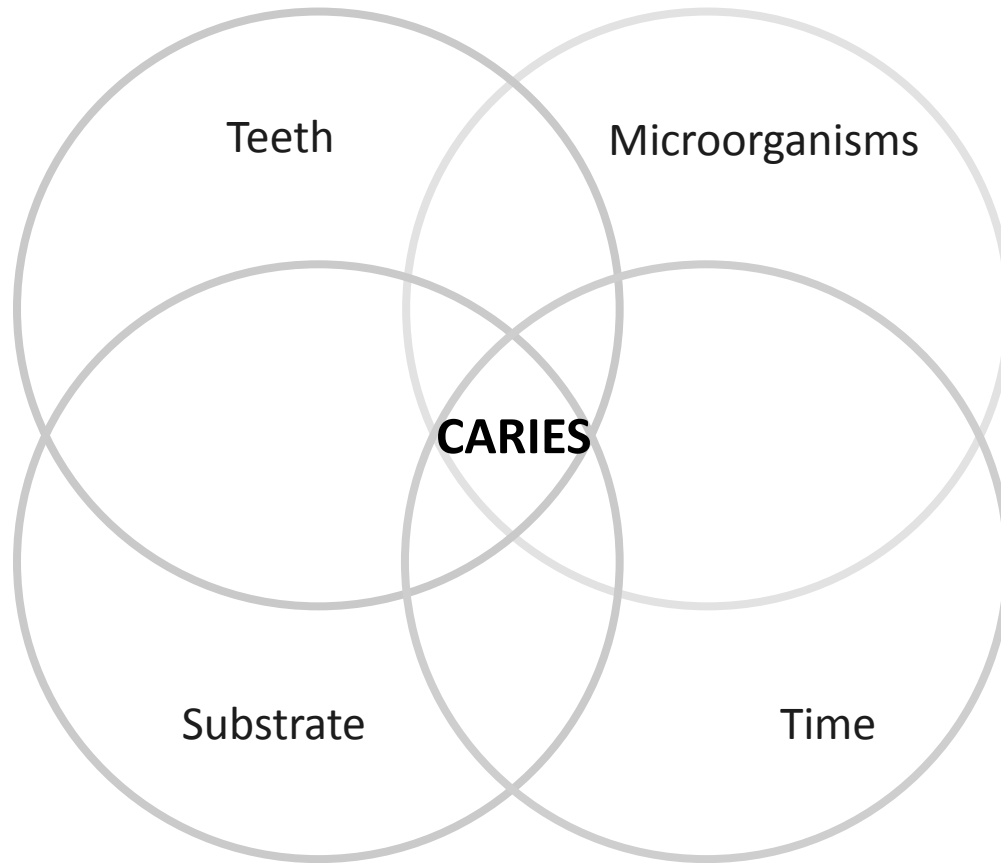
Department of Conservative Dentistry

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Concept of dental caries

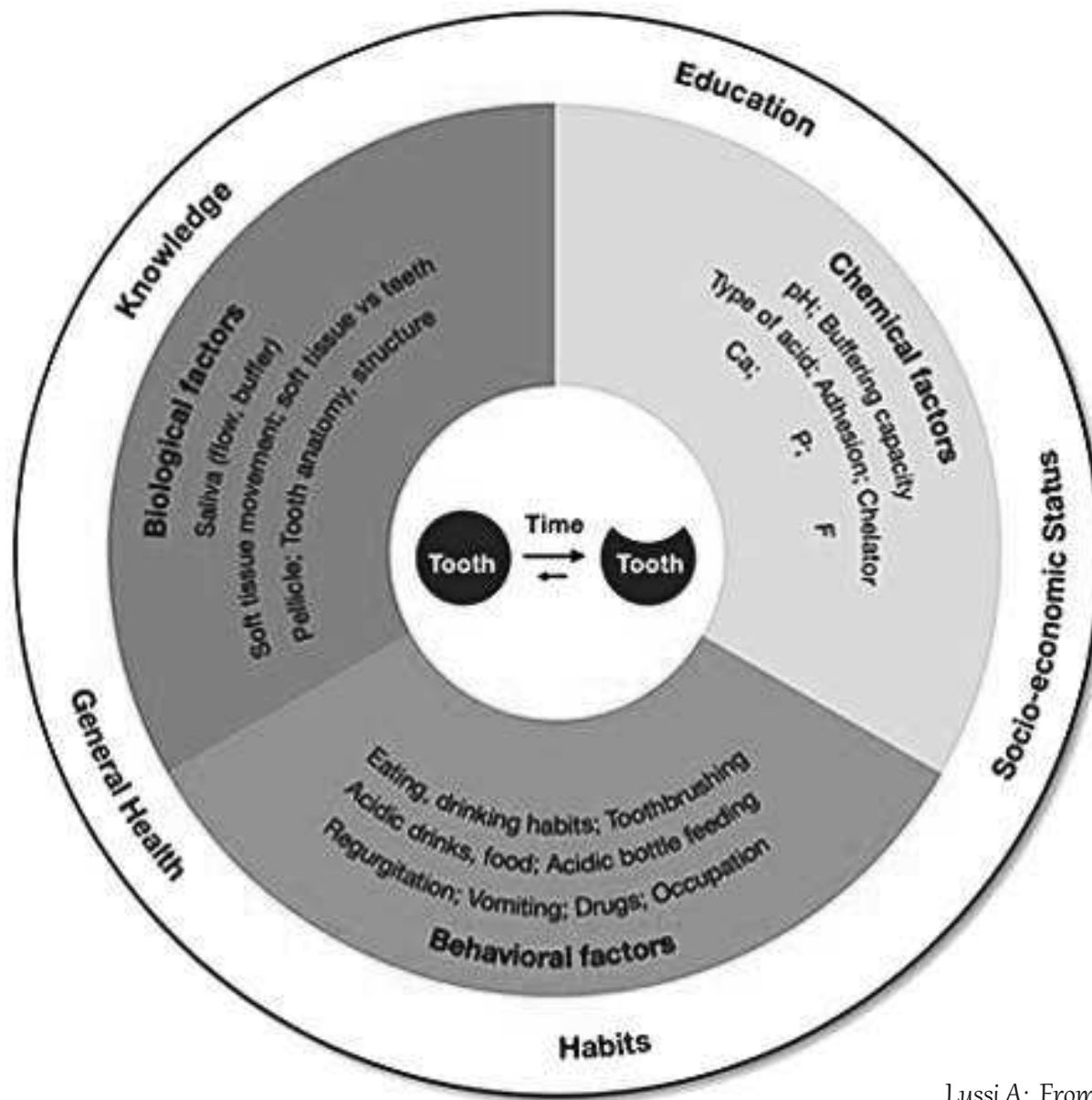
- Primer, secunder factors



Concept of dental caries

- progressive process
- in the hard tissues of the teeth
- due to the disturbance in the balance of the demineralization-rem mineralization processes
- induced by the bacterial deposit (plaque) on the surface of the teeth
- acidic pH level
- chronic process progresses into the deeper layers
- initial phase of caries formation is reversible, but in time irreversible destruction is formed

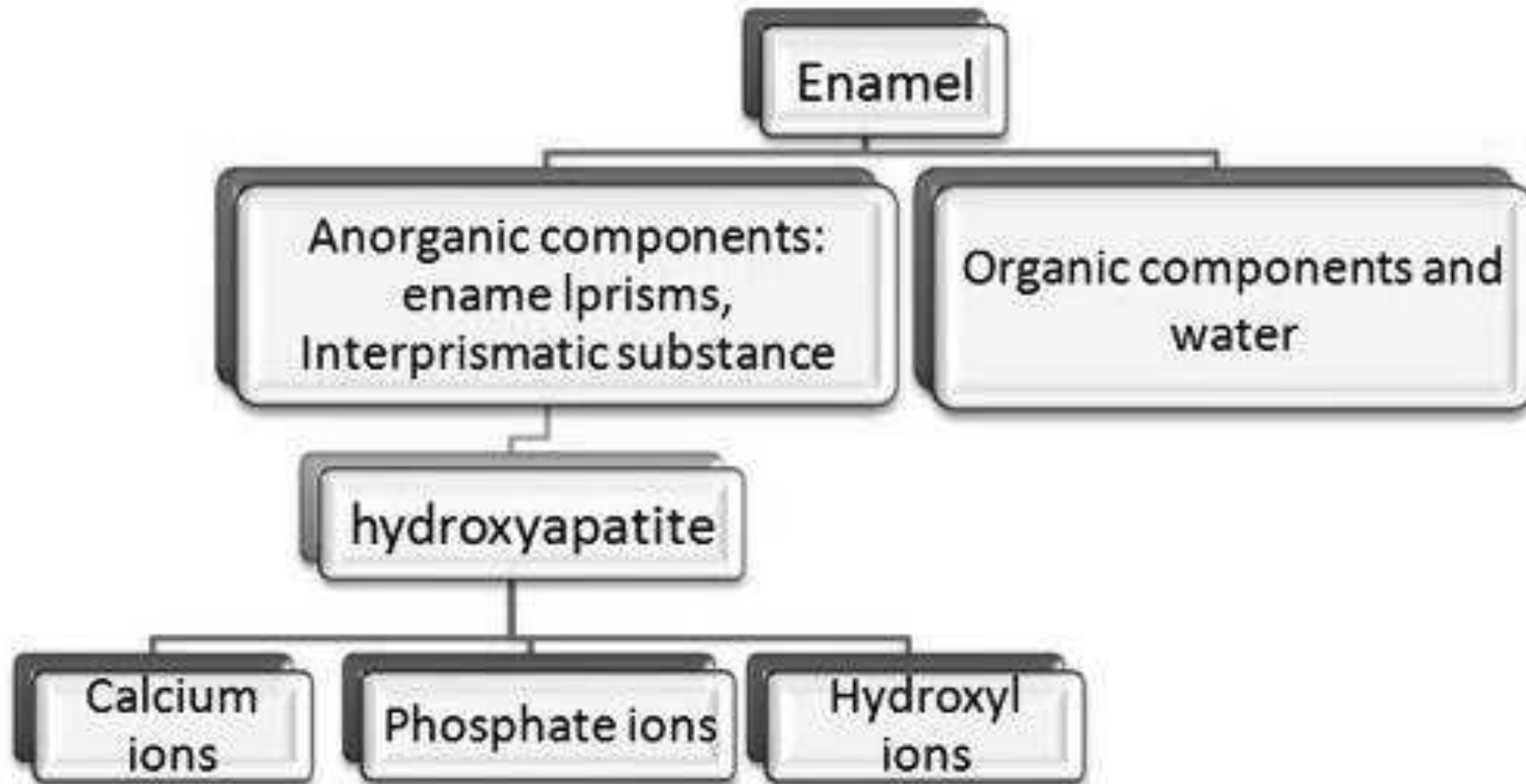




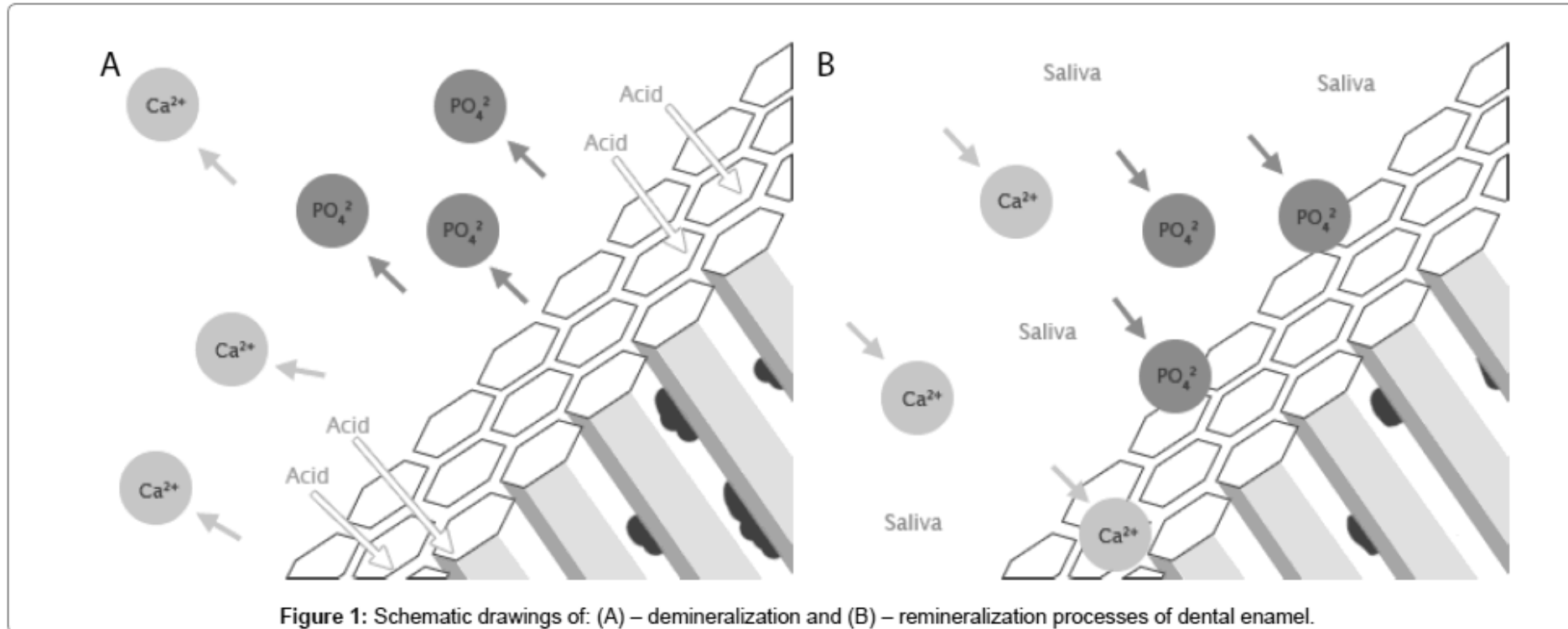
Lussi A.: From diagnosis to therapy 2006



The components of the enamel



Deminerlization, remineralisation

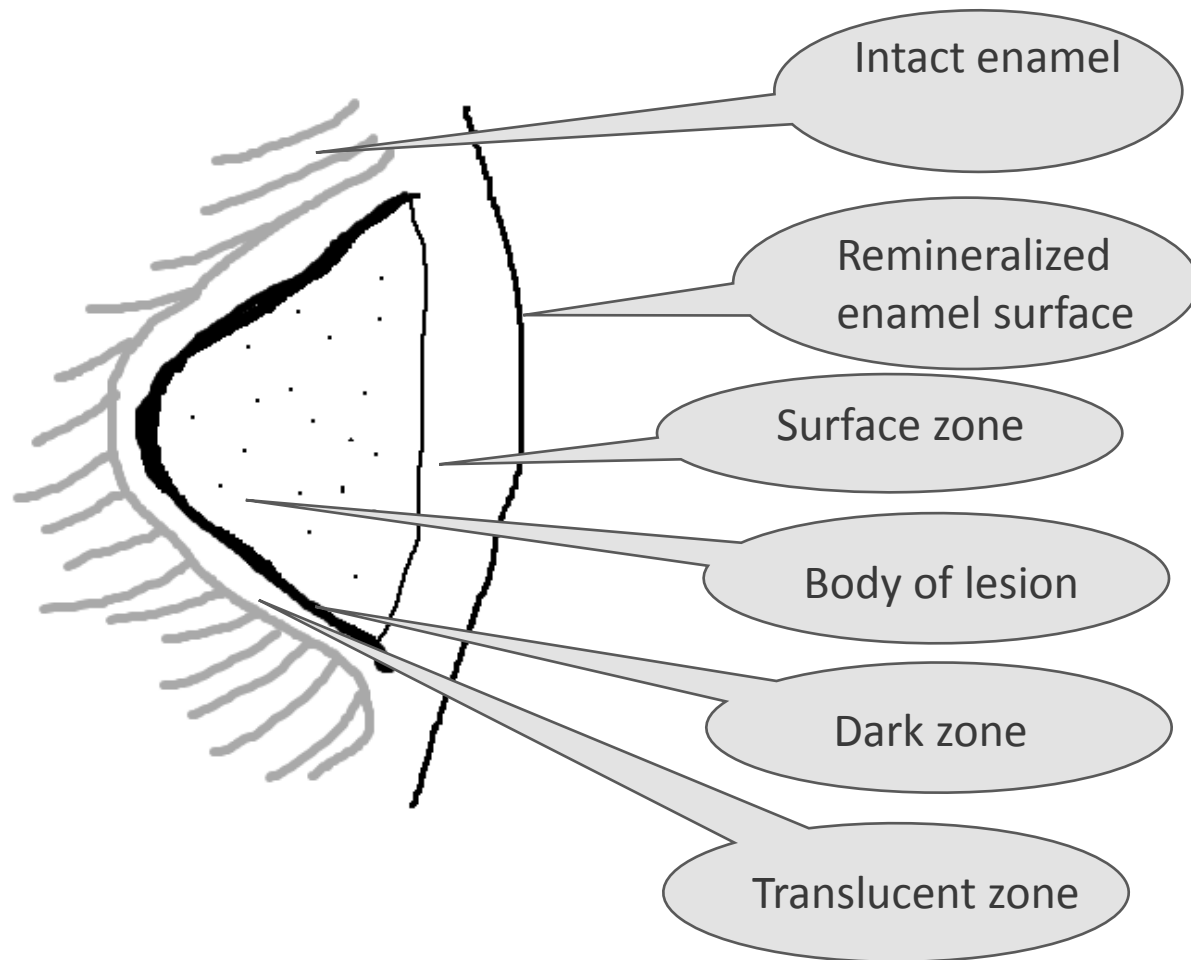


The process of demineralization

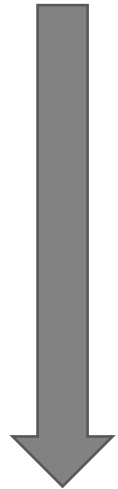
- loss of minerals, which starts in the interprismatic region of the tooth enamel
- enamel crystals become thinner, intercrystal spaces broaden
- arrangement of the crystals are lost
- porosity of the enamel increases, it loses its transparency, causing the opaque, matt, “white spot” appearance
- the superficial layer of the enamel (10-30 μm) is sound and hard
- a periodic process characterized by the continuous alternation of de- and remineralization



Layers of the demineralized area



Reducing the chance of demineralization



- limiting the consumption of refined carbohydrates
- number of acidogenic bacteria
- amount of acids in the oral cavity
- amount of plaque



- mechanical plaque control: toothbrushing, flossing, etc.
- antimicrobial function of the saliva
- salivary secretion
 - Immunization may be considered?



The definition of remineralization

- The re-deposition of minerals into the demineralized areas of the hard tissues of the erupted tooth.
- The formation of apatite crystals through the deposition of calcium (Ca^{2+}), phosphate (PO_4^{3-}) and fluoride (F^-) ions from the supersaturated saliva of synthetic materials.
- Remineralization is achieved through the growing of the remnant apatite crystals, rather than the formation of new ones.
- Fluoride ions promotes apatite deposition, it precipitates in the form of fluoro-apatite, and enhances crystal growth.
- The uptake of fluoride ions by the demineralized areas of the enamel is increased, compared to the intact enamel and it acts as a fluoride reservoir.
- The remineralized enamel differs from that of the intact enamel, as it is more compact and more resistant against acidic attacks.



CLASSIFICATION OF CARIES



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Caries

Reversible

lack of microscopic tissue

Irreversible

lack of macroscopic tissue



Localization

Anatomical

- **Coronal caries**
 - pits and fissures
 - smooth surfaces
 - approximal
 - vestibular, oral
- **Root caries**

Morphological

- **Enamel caries**
 - Incipiens (incipient)
 - Superficialis (superficial)
- **Dentin caries**
 - Media (moderate)
 - Profunda (deep)
 - Penetrans (deep complicated)
- **Cementum caries**



Classification of caries

- **Anatomy** / Location: predilection surfaces- Black class.
- **Morphology** / Depth: enamel, dentin
- **Formation:**
 - Primary caries
 - Secondary caries (next to the fillings and restorations)
 - Residual caries
(under restoration, at the bottom of the cavity, because of insufficient cleaning)
- **Time**, progression



Caries in time, according to progression

- Caries rapida
- Caries alba
- Caries humida
(light yellow color)
rapid, without protective
response
no transparent zone



- Caries tarda
- Caries nigra
- Caries sicca
(dark brown color)
slow, with protective response
hard, sclerotic dentin
- Caries insistens, arrested
caries
the process has stopped



Anatomical localization - Predilection sites

- What are the predilection sites? Why here?
- Fissures, pits
- Smooth surfaces:
 - Between tooth equator - gingiva
 - Approximal vestibulo-oral
- Root surfaces



Fissures & pits

- Morphology of fissures (types):

V

U

reverse Y



IK

I

- Type - caries frequency
- Location of fissures and pits




Caries spread- fissures

- In the enamel it is conical, based on the enamel-dentin junction, the peak is the fissure  follow the direction of enamel prisms
- Once the enamel-dentine junction (EDJ) is reached, the form is also a cone, pointing towards the pulp  softer dentin



Caries spread- smooth surfaces

- The lesion is formed under the contact point
- In the enamel it is conical and based on the enamel surface
- Reaching the EDJ , it spreads in lateral direction and the tip of the cone is pointing  towards the pulp



Root caries

- Mainly caused by actinomyces strains (Actinomyces naeslundii, Actinomyces viscosus, Actinomyces israelii), but also significant number streptococcus mutans colonies.
- Microorganisms invade the cementum along the Sharpey's fibers, from where they spread laterally.
- After the demineralization of the cementum layer the progression of the caries in the dentin is identical to that of the coronal caries.
- (The rate of progression is slower compared to the coronal caries, due to the lower numbers of dentin tubules.)



Root caries

- **Active**

softened, light yellowish brown color

- **Inactive**

smooth, bright surface, brown-black color, which is hard when probing

- **Transitional form**

the hardness of the surface is the most important, not the color



Localization

Anatomical

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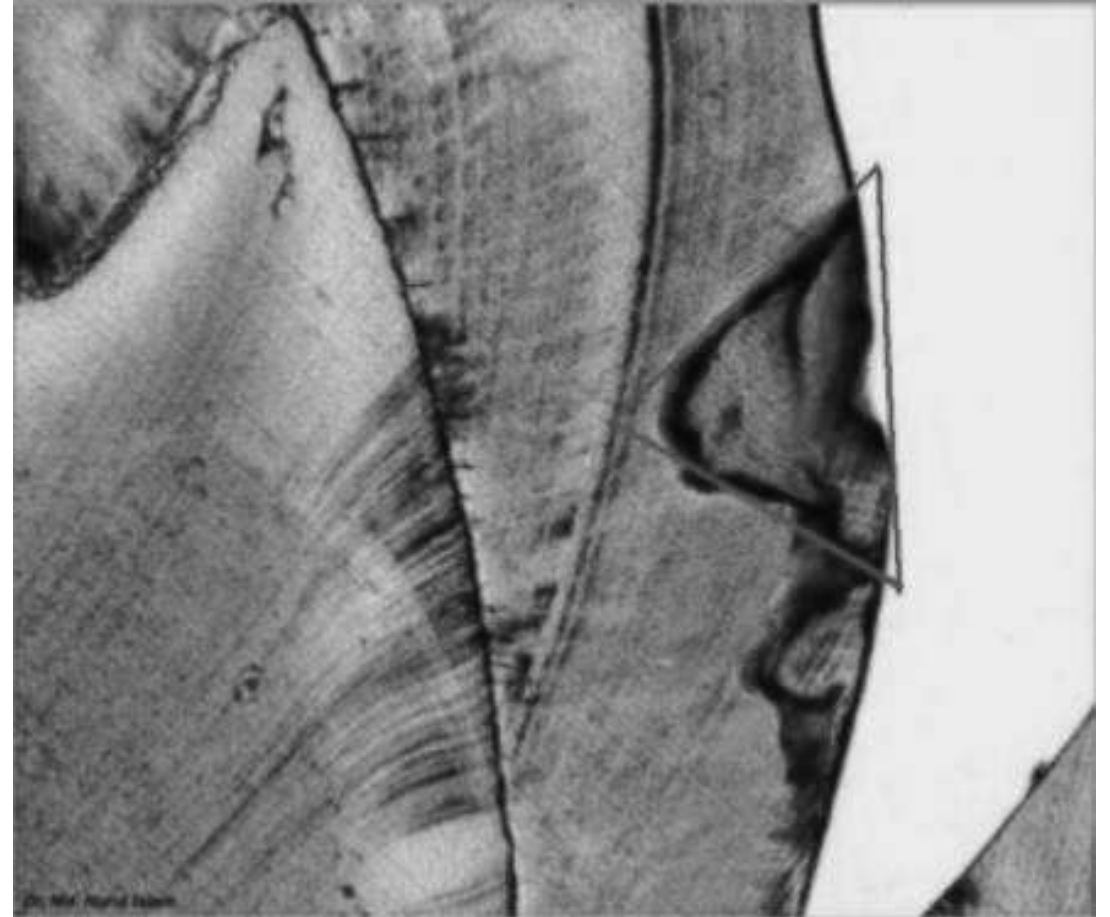
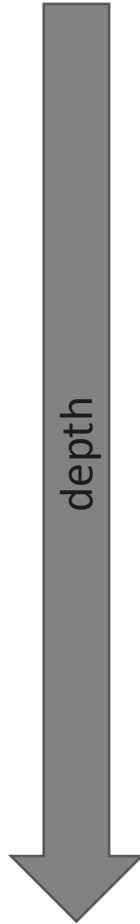
Morphological

- **Enamel caries**
 - Incipiens (incipient) (could be rev.)
 - Superficialis (superficial)
- **Dentin caries**
 - Media (moderate)
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 - Penetrans (deep complicated)
- **Cementum caries**



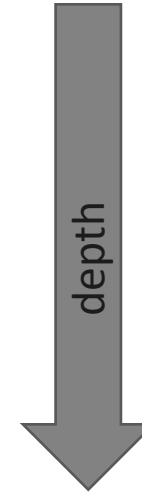
Enamel- Caries incipiens

- Surface zone
10% loss
Pore volume: 5%
- Body of lesion
25% loss
Pore volume: 25%
- Dark zone
6% loss
Pore volume: 2- 4%
- Translucent zone
1,2% loss
Pore volume: 1%
- Intact enamel
Pore volume: 0.2%

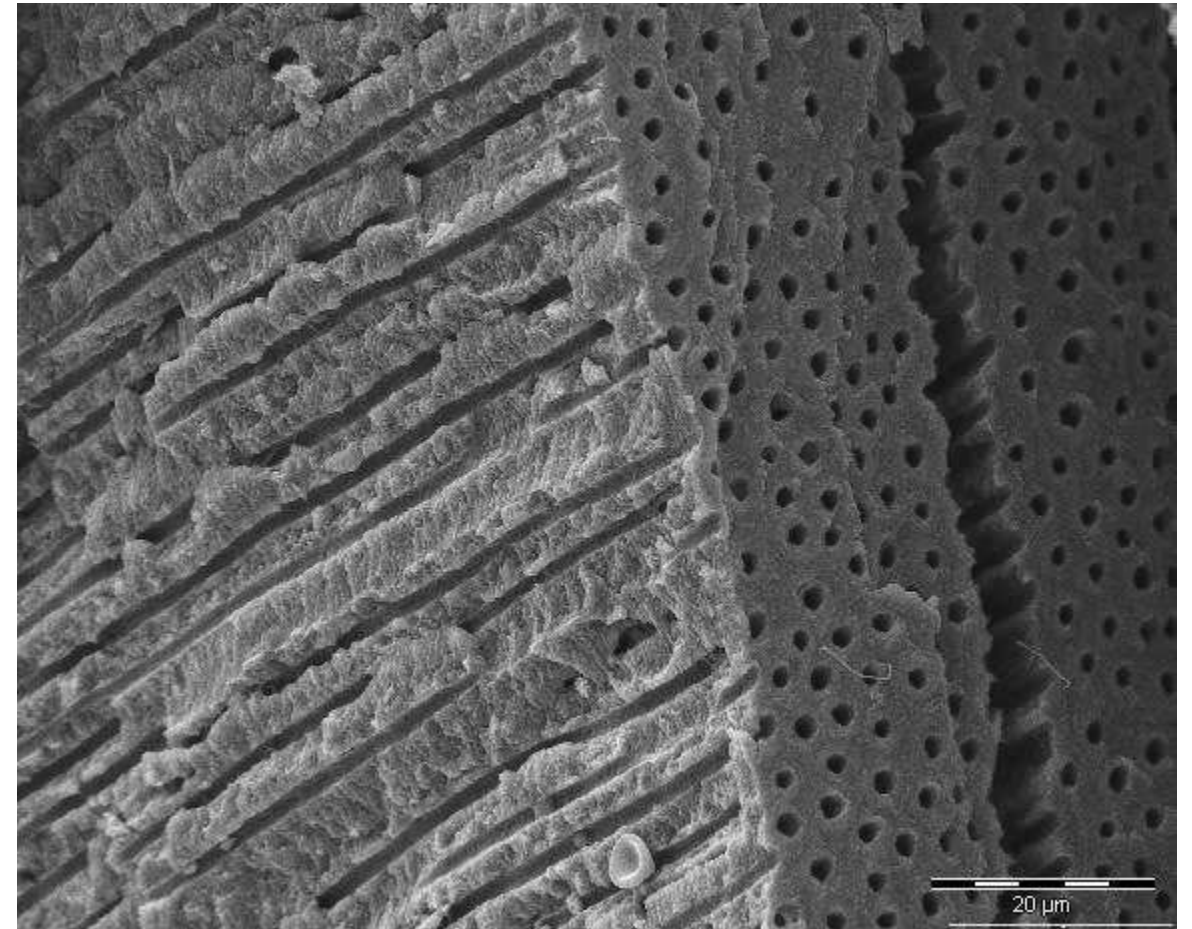
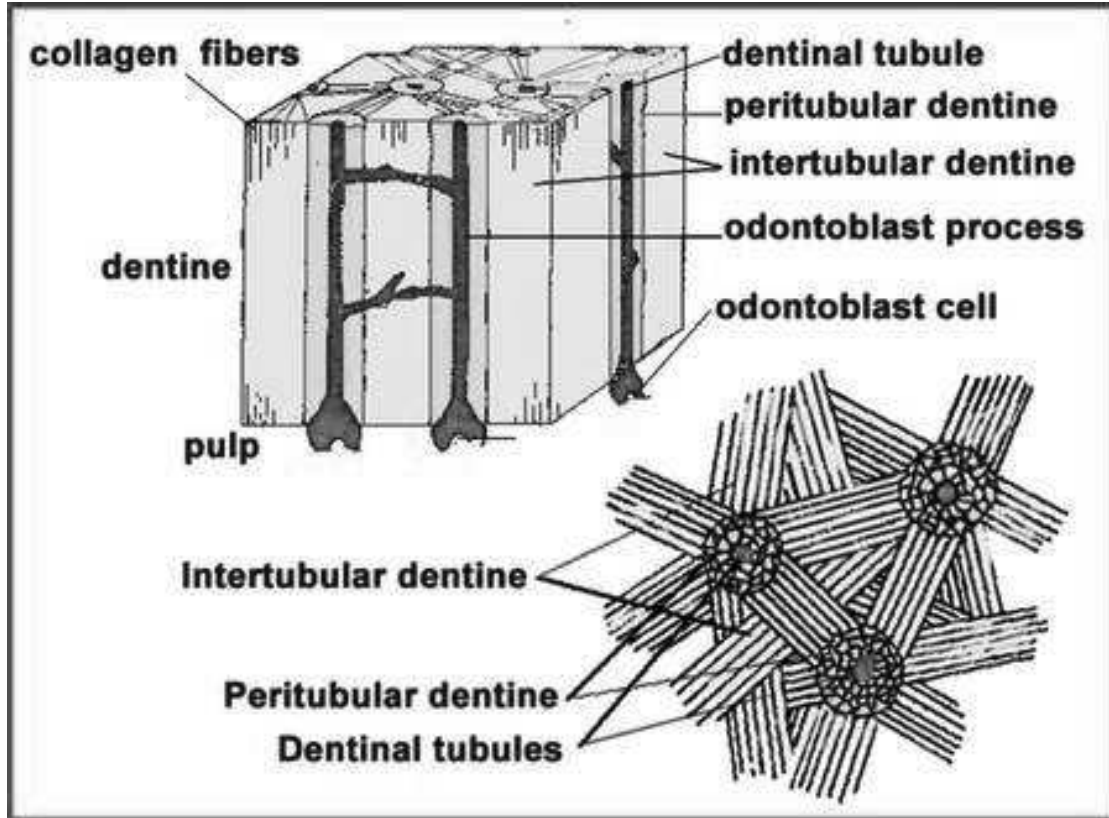


Enamel- Caries superficialis

- There is already a lack of macroscopic hard tissue
- Layers (fissures):
 - Full disintegration zone
 - Disintegrated prisms
 - Intact prisms, affected interprismatic substance



The structure of the dentine



Dentin caries

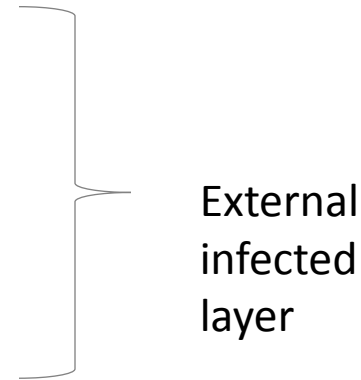
- **Caries media:** affects the outer surface of the dentin
- **Caries profunda:** deeper layers of dentin
- **Caries penetrans:** reached the pulp chamber



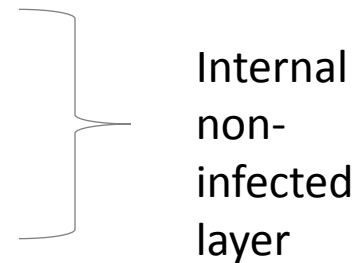
Dental caries histological layers

Silverstone 1981

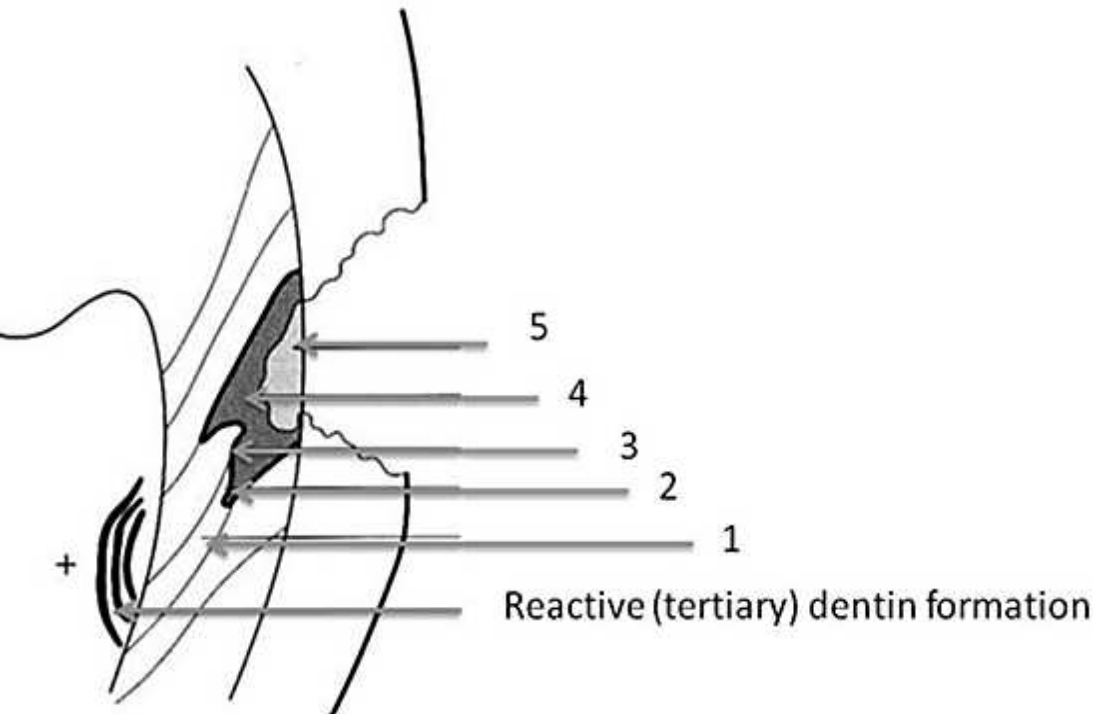
- Necrosis (cavity) (destruction)
- Penetration layer (bact. invasion)
- Demineralization



-
- Sclerotic dentin (sclerosis)
 - Intact dentin
 - Reparative dentin



Schematic drawing of the histology of dentin caries



Zones:

1. Fatty degeneration of Tomes' fibers
2. Dental sclerosis
3. Decalcification
4. Bacterial invasion
5. Decomposed dentin

1. Reparative dentin (reactive, tertiary)
2. Dentinal tubules
3. Affected carious dentin
4. Infected dentin
5. Enamel lesion

Fejerskov et al. 2008



Layers of dentin caries

- Infected dentin

Softened, disintegrated, many bacteria, there are no odontoblast process

- Turbid dentin

Less bacteria, demineralization, denatured collagen

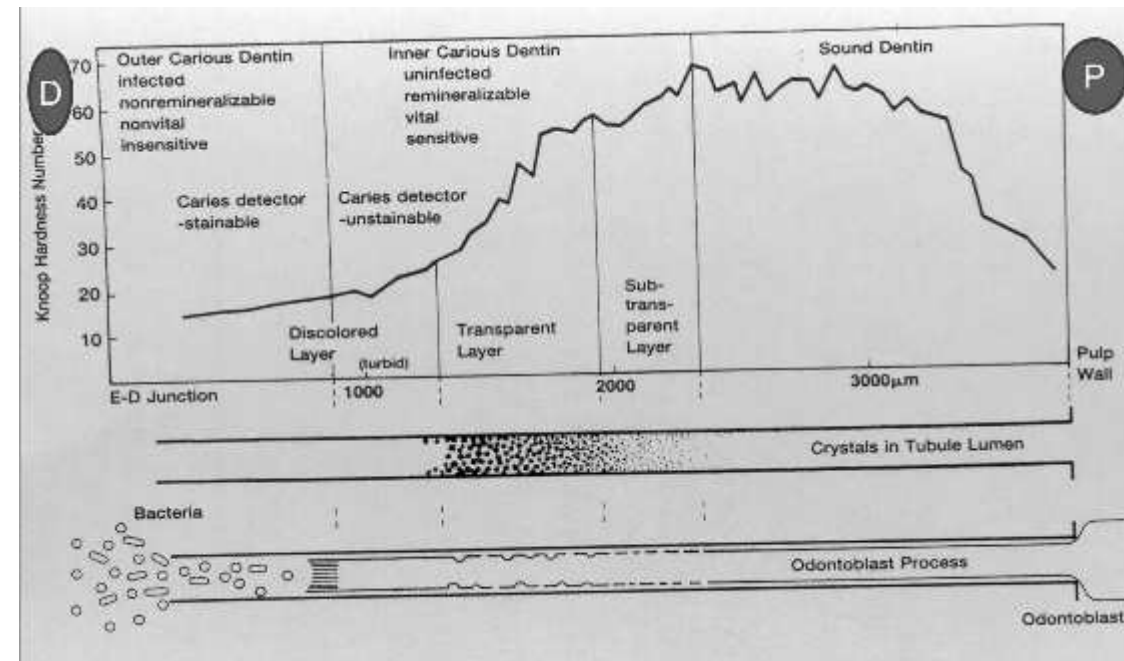
- Transparent dentin

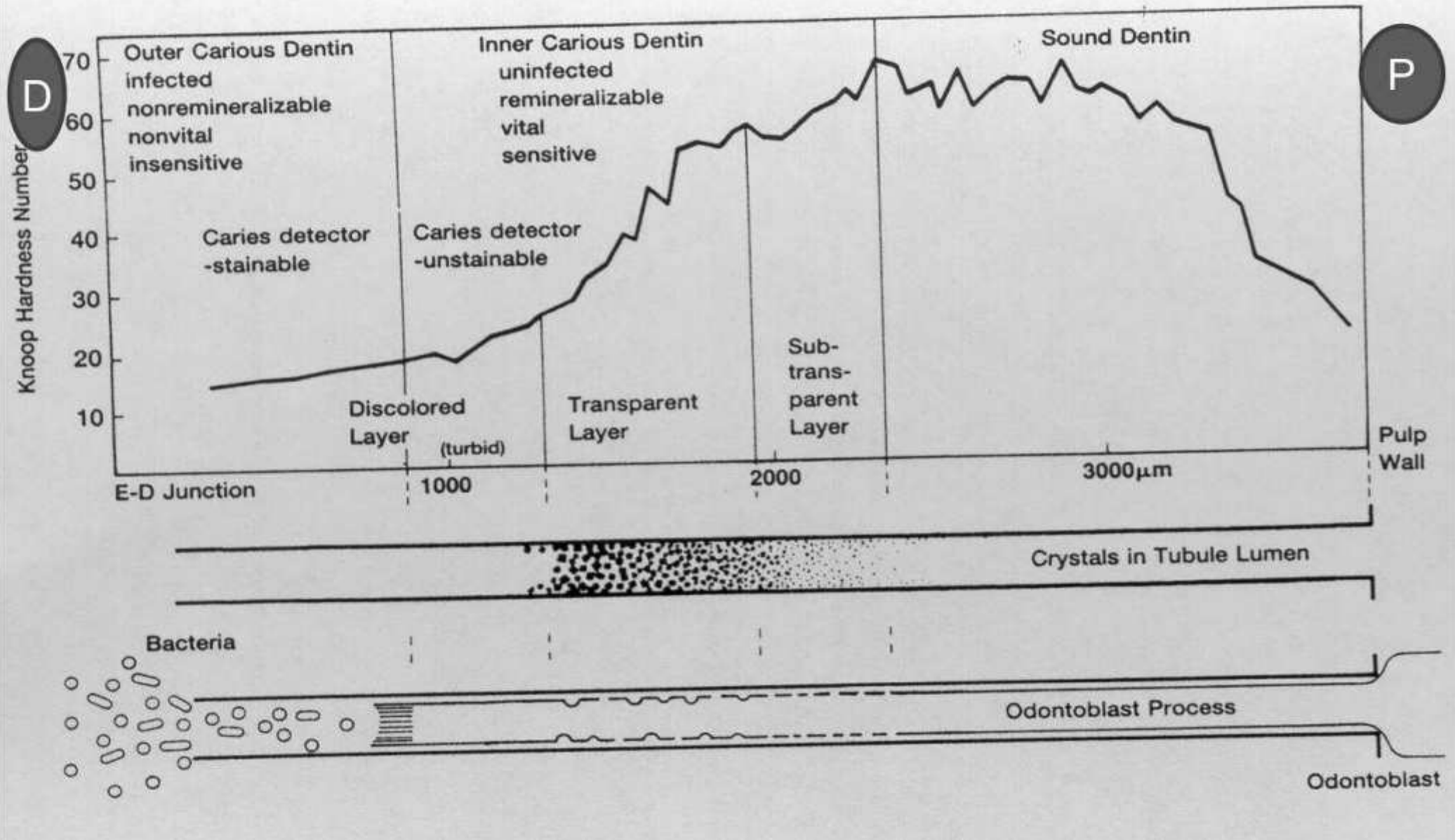
no bacteria, bigger crystals in tubules

- Subtransparent dentin

no bacteria, smaller crystals in tubules

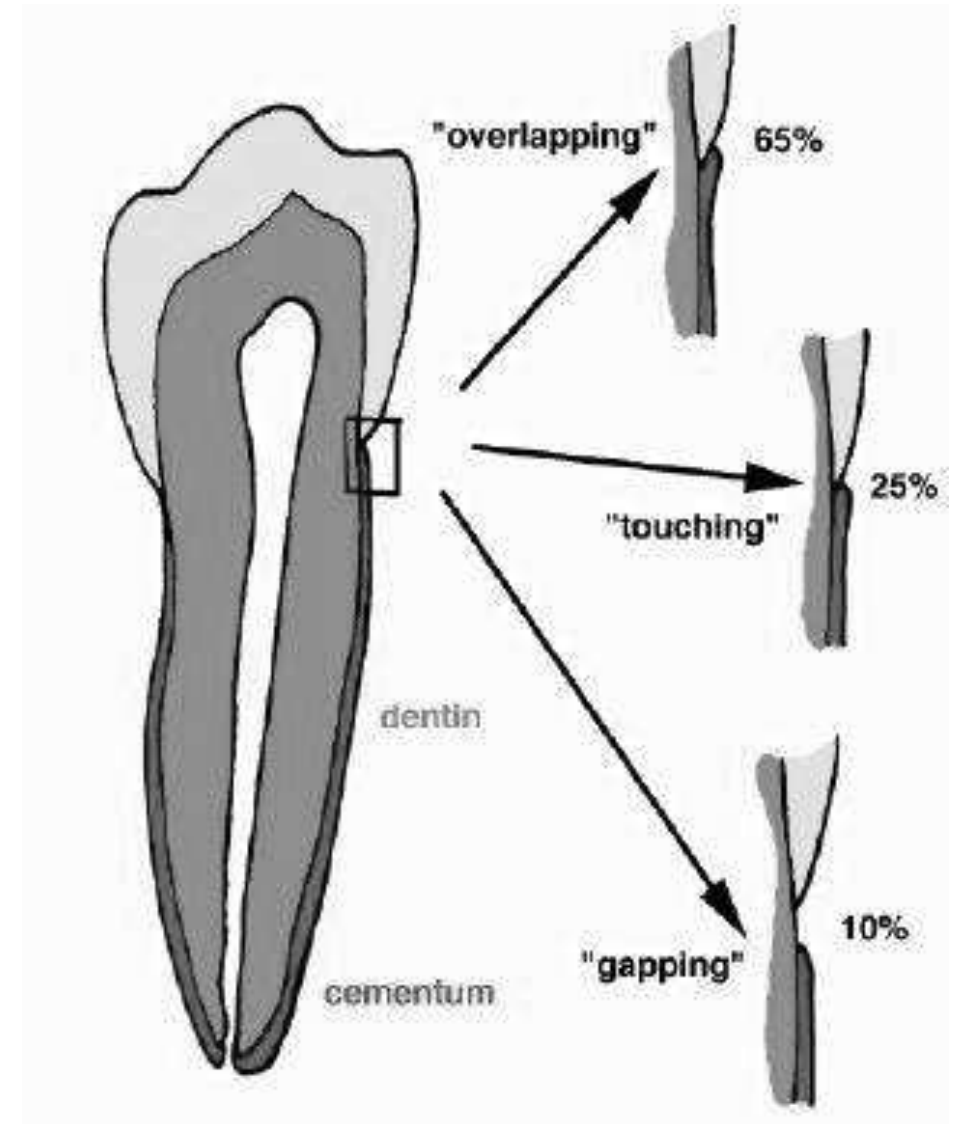
- Normal dentin





Cementum caries

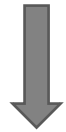
- the enamel-cement junction is not always unified (3 variations)
- the cementum is acellular in the coronal third
- after the damage in the cementum, caries spread like the same way as in the dentin of the crown



Histopathological changes

- **Caries incipiens:**

Changes in dentin for carious stimuli



Tertiary dentin (reparative dentin)

- **Caries superficialis:**

Enamel cavity, microorganisms are in dentin tubules

Penetration zone

Is spread under EDJ caries



Histopathological changes

Caries media/ profunda:

- dentin disintegrated, lots of bacteria
- no „dead tract”
- (no normal dentin is found above the pulp)

