

# Restorative dentistry

I., II., III.

3. Year

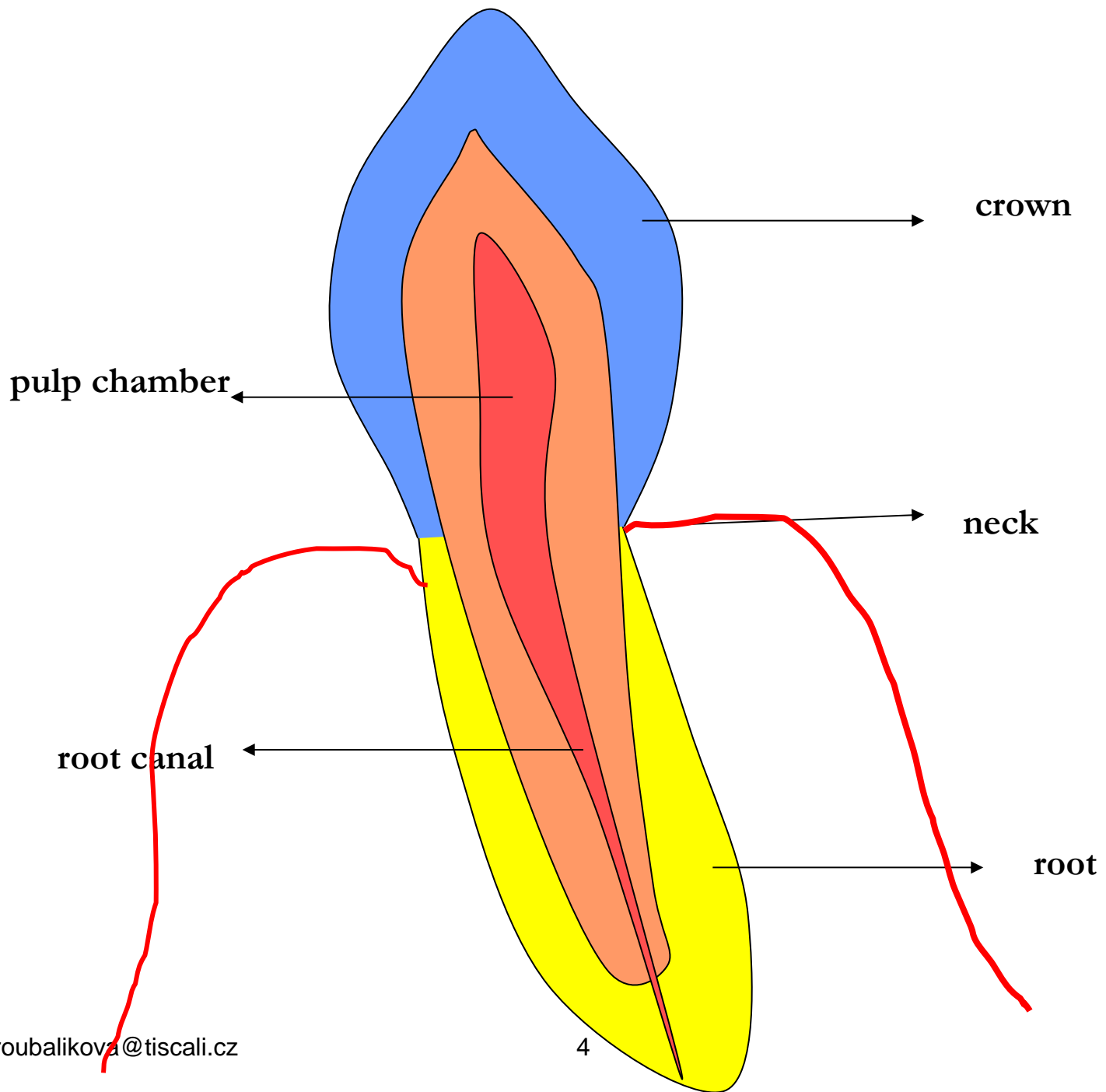
L. Roubalíková

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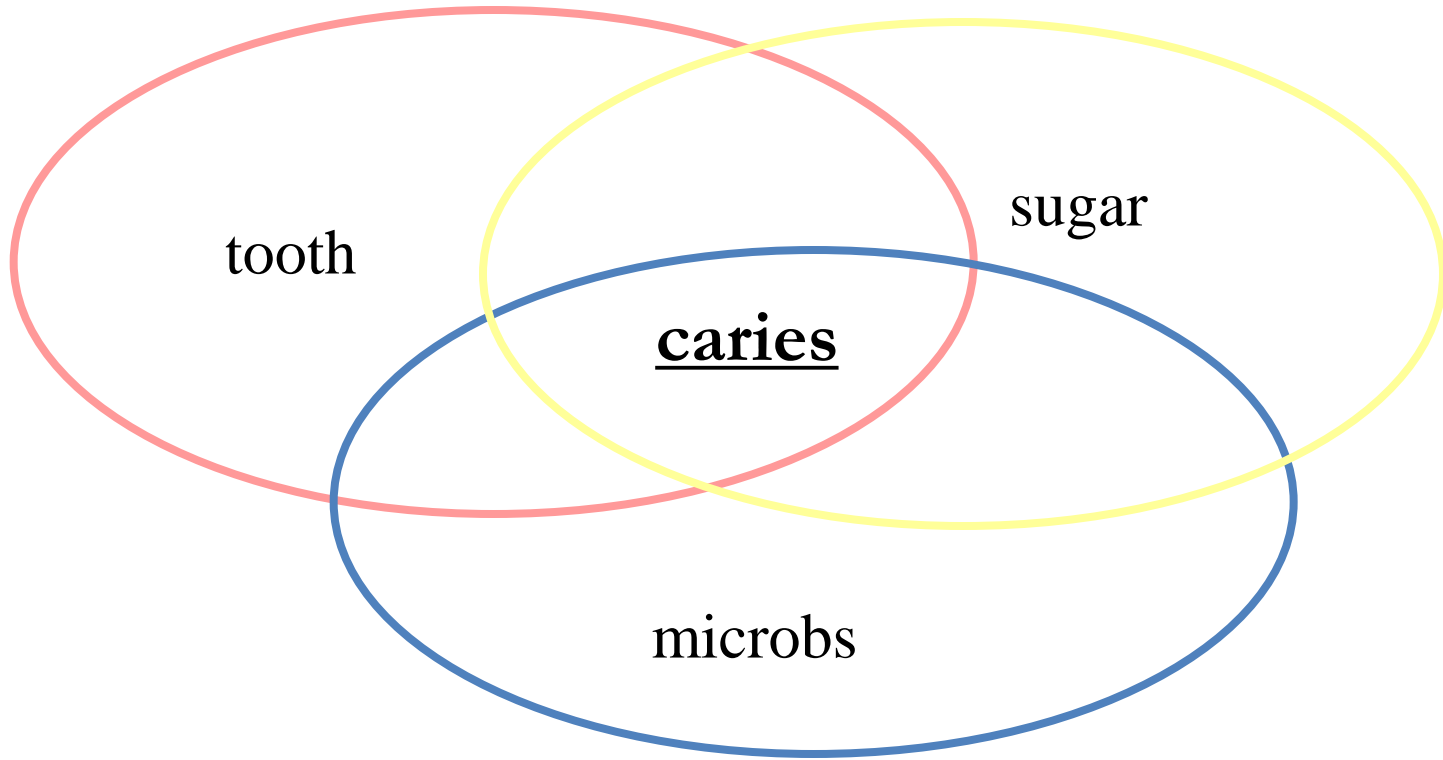
# Dental caries

- Etiology and pathogenesis (dental biofilm, remineralization, importance of saliva)

# Understanding dental caries



# Dental caries



**time**

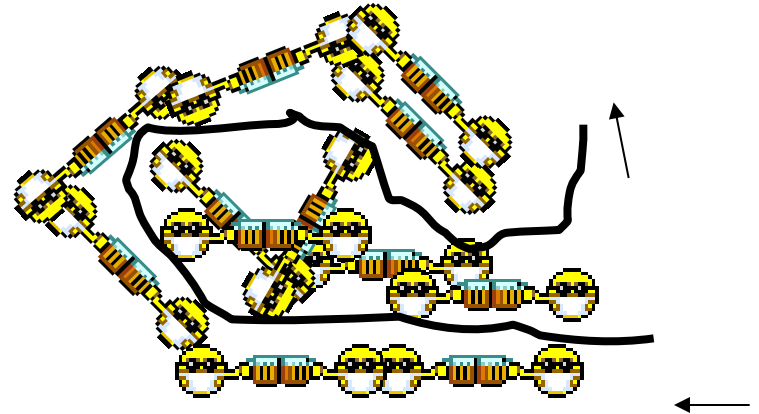
Factors that are necessary for origin of dental caries

# Dental Caries

Infectious microbiological disease of the teeth that results in localized dissolution and destruction of the calcified dental tissues.

# Biofilm – Dental Plaque

- Complex community**
- Microbs live in symbiosis**
- Biofilm is permeable**
- Microbs have good conditions to survive and are much less sensitive to antimicrobial agents in comparison to planctonic form**



# Dental Biofilm – Dental Plaque

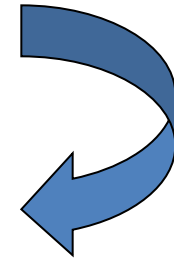
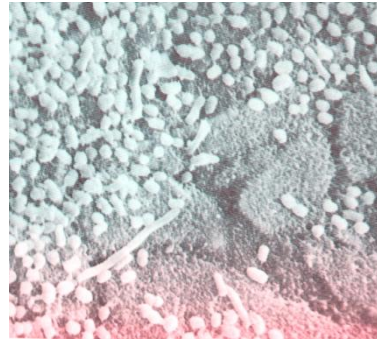
A gelatinous mass of bacteria adhering to the tooth surface.



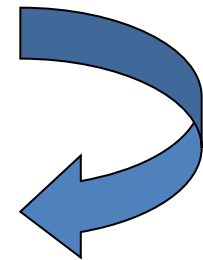
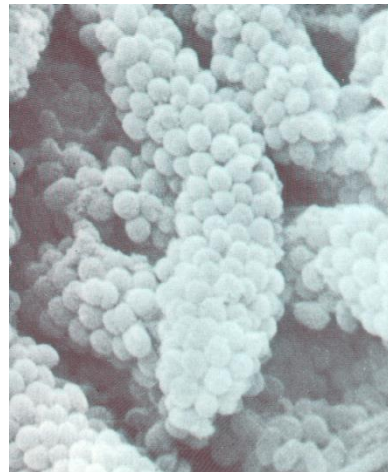


# Dental biofilm

- Adhesion



- Colonisation



- Maturation

# Sugars

**Fermentable (mono-, di- tri- sacharides)**



**Sucrose, glucose, lactose** → **Acids**

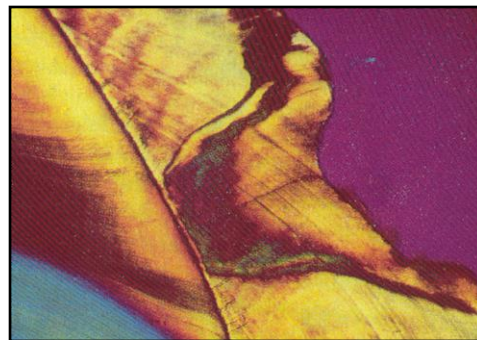
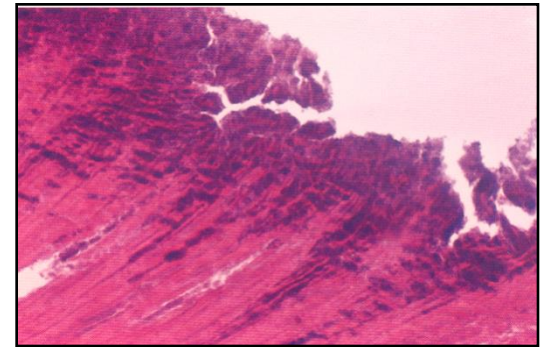
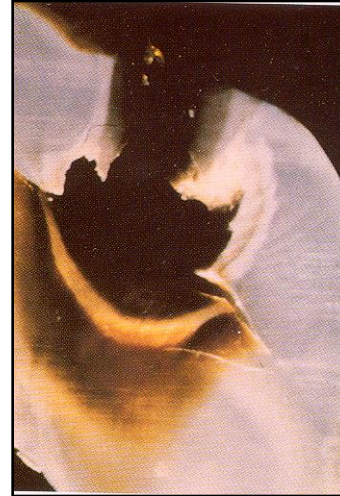


**Demineralization**

**Cavitated lesion**

**Demineralization**

**Non cavitated lesion**



**Time**

# Importance of saliva

- Plaque formation
- Microbial source
- Mineral source
- Microbial clearance (removes microbes from oral cavity)
- Buffer capacity

# Caries danger areas (Habitually unclean places)

- Pits and fissures
- Proximal surfaces
- Cervical area

No self cleaning

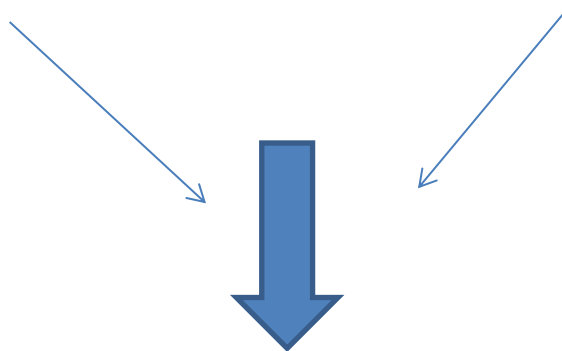
# Predictable (habitually) clean areas

- Cusps
- Proximal ridge, oblique, transverse ridge
- Incisal edge
- Buccal or oral surface upon the maximal convexity
- Proximal surface upon the contact point

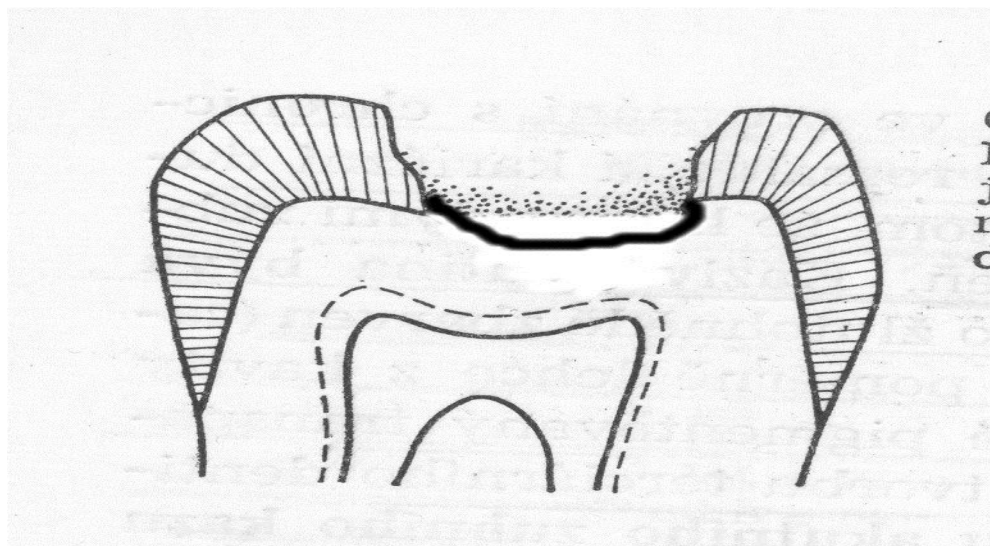
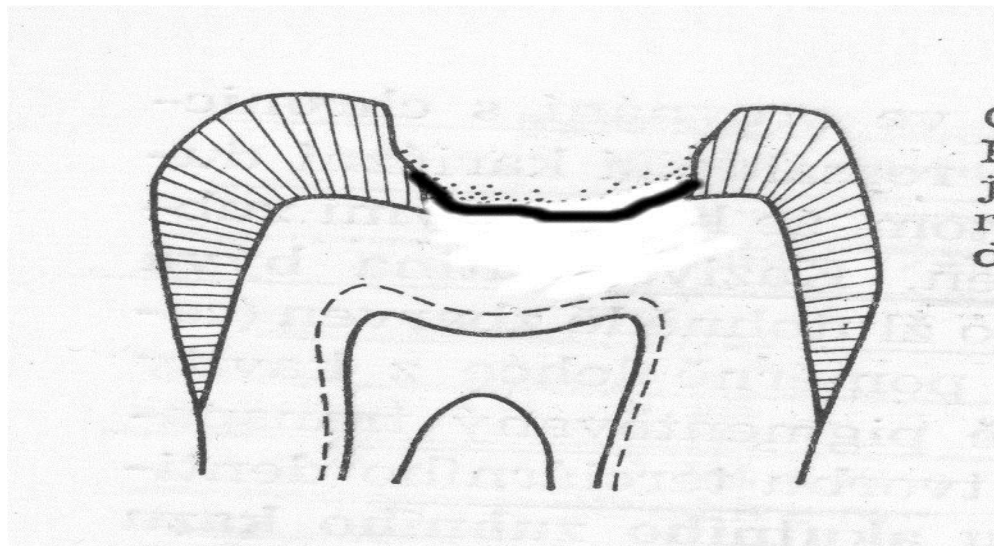
## Self cleaning

# Caries - depth

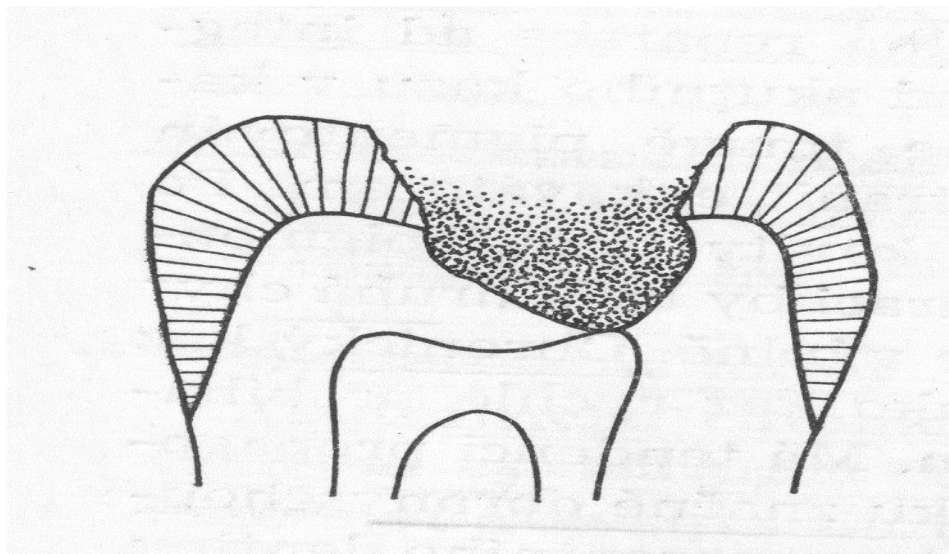
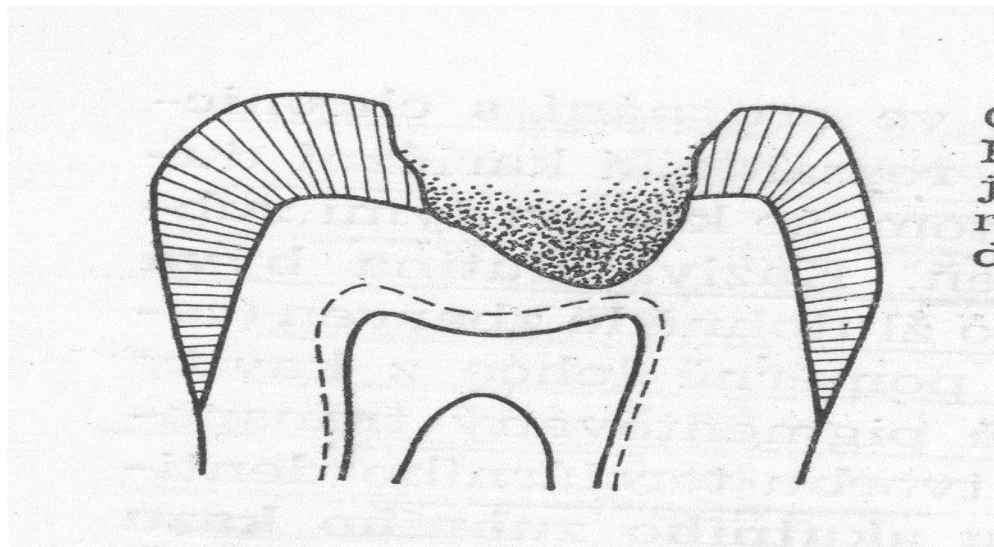
- Surface caries (caries superficialis)
- Middle caries (caries media)
- Caries close to pulp (caries pulpae proxima)
- Caries penetrating into the pulp (caries ad pulpam penetrans)



Deep caries







# Caries - Topography

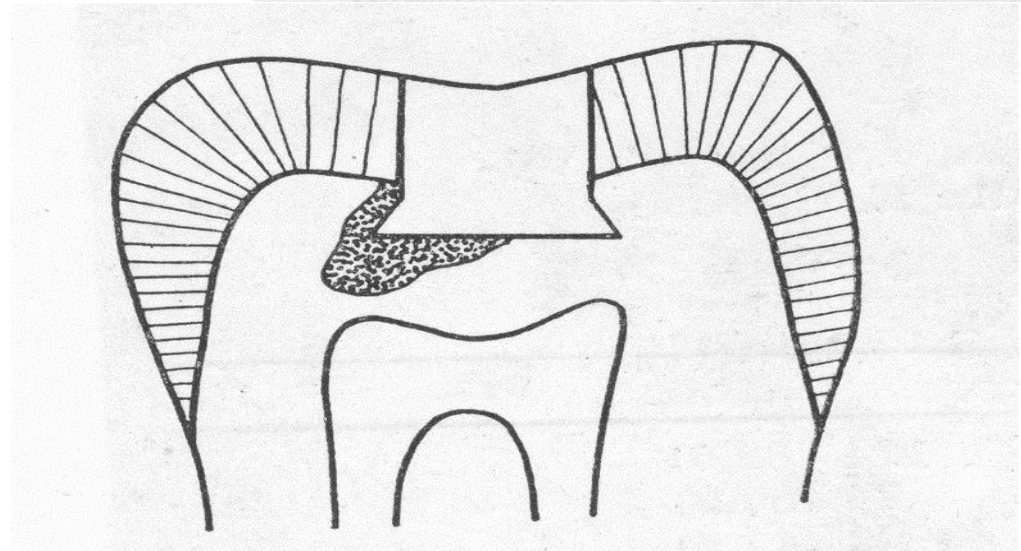
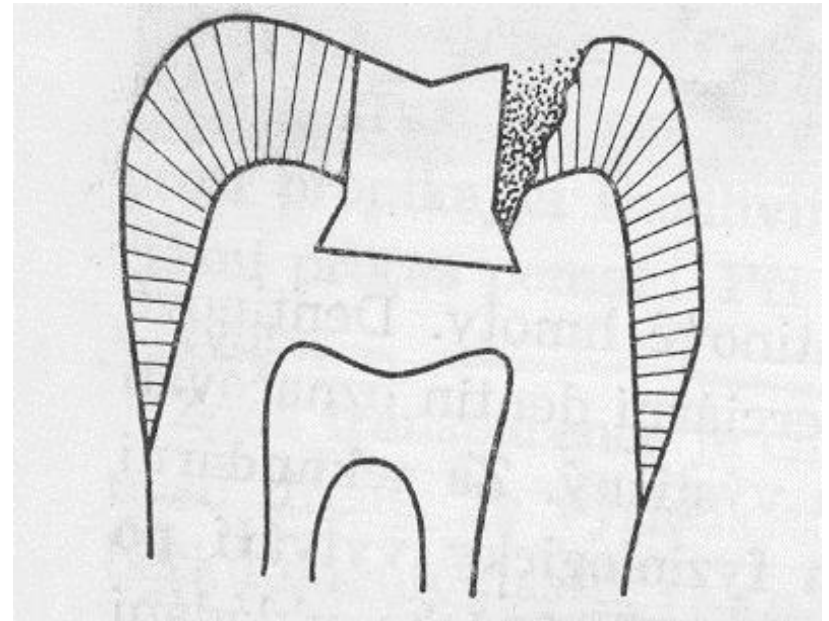
- Coronal caries
- Root surface caries
  
- Enamel caries
- Dentin caries
- Cementum caries

# Caries

- Acute
  - Chronic
  - Arrested
- } Acc to its history

- Penetrating
- Undermining

Primary caries  
Secondary caries  
Recurrent caries



# Diagnosis of dental caries

# Investigation

- **Mirror**
  - **Sharp Probe**
  - **Illimination**
  - **Magnification**
- Dark spot, white spot, hole, defect
- **X- ray, other methods i.e. transillumination, infrared laser fluorescency (Diagnodent, Diagnocam)**

# Dental Caries - Treatment

- Non cavitated lesion:

On molecular basis

- Dental hygiene
- Fluorides, Calcium, Phosphates
- Diet
- Antimicrobial agents (ozone, chlorhexidine)

# Dental Caries - Treatment

- Cavitated lesion:

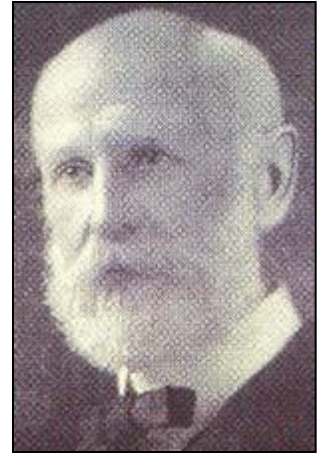
Preparation

Filling

**Drill and fill**



# Preparation



Instrumental treatment

Remove caries

Leave the rest of the dental tissues

- to be restored
- to be resistant against the bite forces
- to be prevented against the recurrent caries

(Black 1914)

# Classification of cavities according to Black

# Class I.

Caries in fissures and pits – occlusal surfaces of premolars and molars

# All pit and fissure restorations.

They are assigned in to three groups.

R. on occlusal surface of premolars and molars

R. in foramina coeca – usually on occlusal two thirds of the facial and lingual surfaces of molars.

R. on lingual surface of maxillary incisors.

# Class II.

Proximal surfaces of molars and premolars

# Class III.

Proximal surfaces of incisors and canines  
without loss of the incisal edge

# Class IV

Proximal surfaces of incisors and canines  
with the loss of incisal edge

# Class V.

Cervical area



# Class VI.

Caries on abraded incisal edges.

# Classification of dental caries

## Mount and Hume

- Location
  1. Occlusal
  2. Proximal
  3. Cervical
- Size
  1. Small
  2. Medium
  3. Big
  3. Large

# Classification of dental caries

## Mount and Hume

Examples:

1,2 – caries in fissures or a pit, medium size

3,4 – caries in cervical area, large size

# Indication of filling materials



**Material of the first choice**



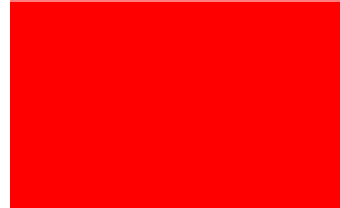
**Material of the second choice**



**Material of the third choice**



**Materials possible to use with limitations**

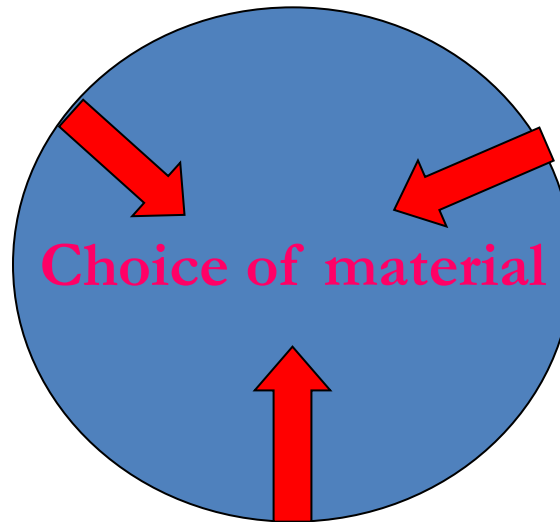


**Material is not indicated**

# Consideration

## **Caries**

- **Size**
- **Location**



## **Patient**

- **General health**
- **Cooperation**

**Regional circumstances**

**Intermaxillary relations**

**Bite forces**

# Indications of filling materials

## Class I.

Material	Mount and Hume 11	12	13	14
Amalgam				
Composite				
Glassionomer				
Indirect restoration aesth.				
Inlay metal				

# Indications of filling materials class II.

Material	21	22	23	24
Amalgam	Green	Green	Green	Green
Composite	Light Green	Light Green	Yellow	Yellow
Glassionomer	Light Red	Light Red	Dark Red	Dark Red
Indirect restoration aesth.	Dark Red	Dark Red	Green	Green
Inlay metal	Dark Red	Dark Red	Green	Green

# Indications of filling materials class III.

Material	21	22	23	24
Amalgam	Red	Red	Red	Red
Composite	Green	Green	Green	Green
Glassionomer	Yellow	Yellow	Yellow	Red
Indirect restoration aesth.	Red	Red	Red	Red
Inlay metal	Red	Red	Red	Red



# Indications of filling materials class IV.

Material	21	22	23	24
Amalgam	Red	Red	Red	Red
Composite	Green	Green	Green	Green
Glassionomer	Red	Red	Red	Red
Indirect restoration aesth.	Red	Red	Red	Red
Inlay metal	Red	Red	Red	Red

# Indications of filling materials class V. anterior teeth

Material	21	22	23	24
Amalgam	Red	Red	Red	Red
Composite	Green	Green	Green	Green
Glassionomer	Yellow	Yellow	Yellow	Yellow
Indirect restoration aesth.	Red	Red	Red	Red
Inlay metal	Red	Red	Red	Red

# Indications of filling materials class V. posterior teeth

Material	21	22	23	24
Amalgam	Red	Red	Yellow	Yellow
Composite	Green	Green	Yellow	Yellow
Glassionomer	Yellow	Yellow	Light Green	Light Green
Indirect restoration aesth.	Red	Red	Red	Red
Inlay metal	Red	Red	Red	Red

# Indications of filling materials class V. acc. to cavosurface margin

Material	Enamel	Enamel cementum	Cement um
Amalgam	Red	Red	Yellow
Composite	Green	Green	Yellow
Glassionomer	Yellow	Yellow	Light Green
Indirect restoration aesth.	Red	Red	Red
Inlay metal	Red	Red	Red

# Amalgam *Indication*

- ✓ Moderate to large cavities (heavy occlusal stress, difficult isolation of operating field, subgingival cavities, cavities reaching the root).

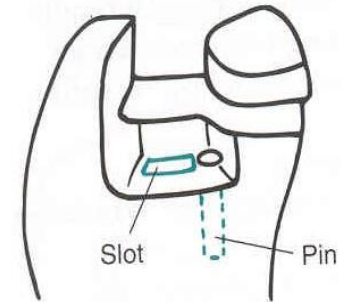
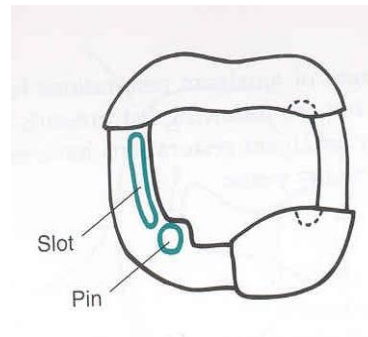
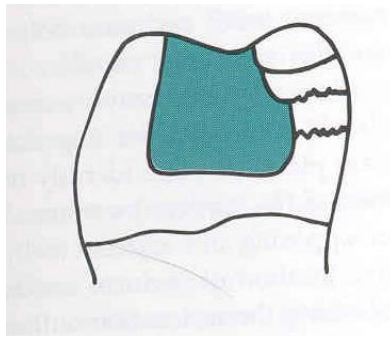
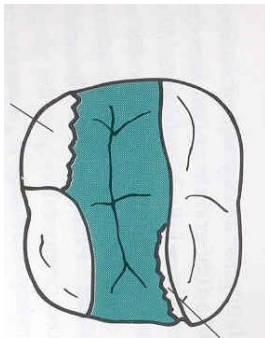
13 a 24 p Mounta and Hume

- ✓ Big reconstruction (core)
- ✓ *Temporary fillings*
- ✓ *(intermittent excavation).*

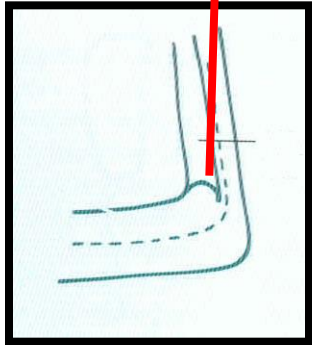
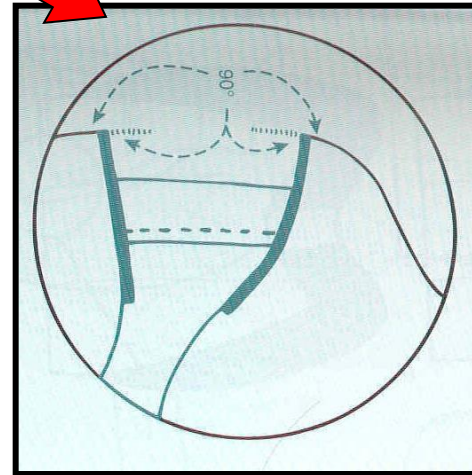
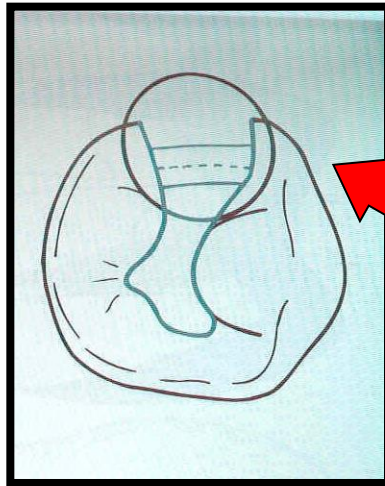
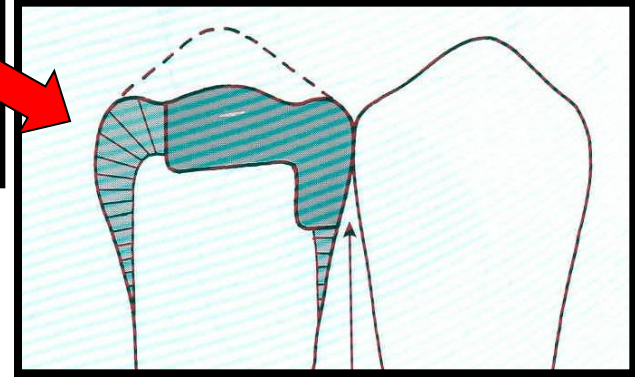
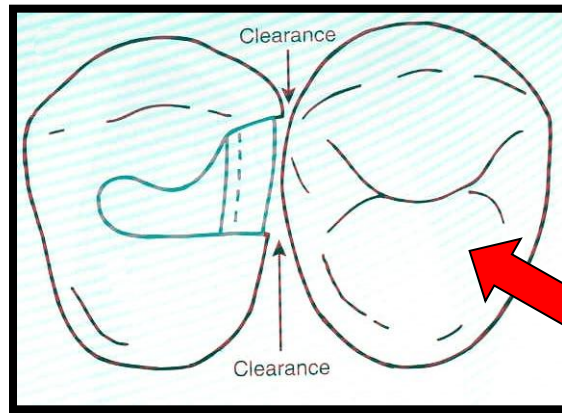
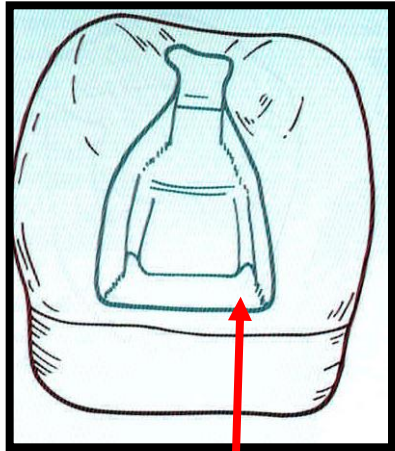
*Sturdevandt's Art of Science of Operative Dentistry*

# Amalgam

- Highest abrasion resistance
- Isolation of operating field is not a critical factor
- Preparation must be exact

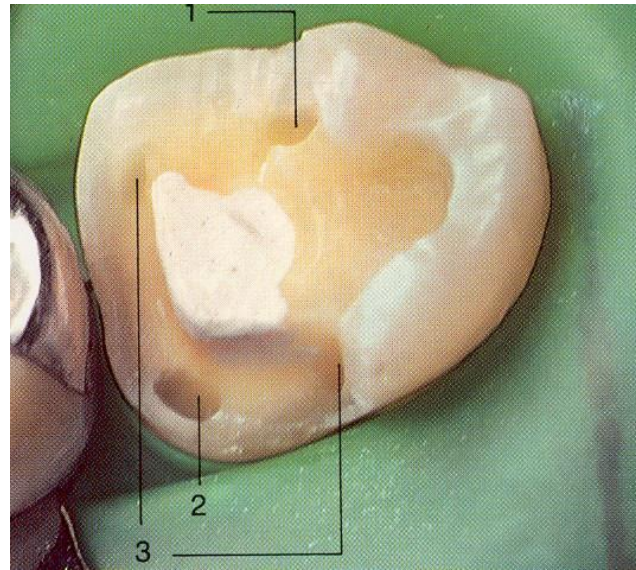
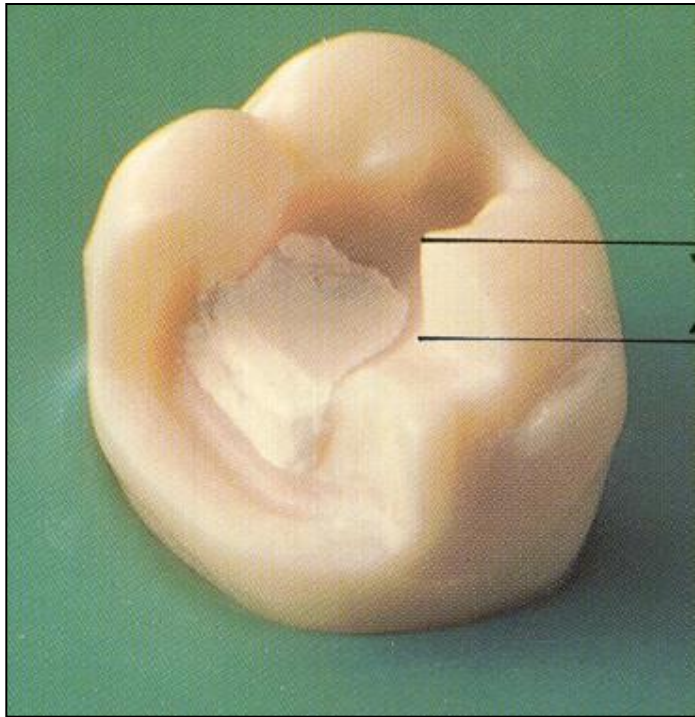


Sturdevandt's Art of Science...



Sturdevandt's Art of Science...

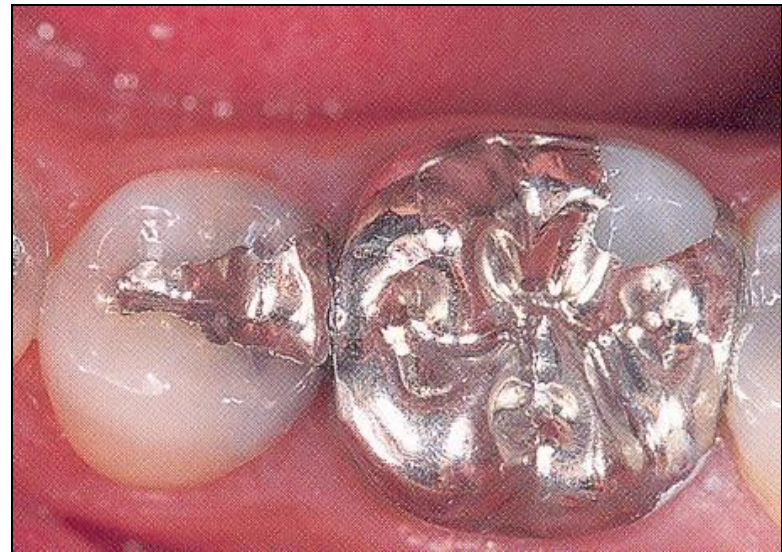








*Sedlmayer J. Amalgám – zapomenuté řemeslo.*



# The most common mistakes

## Preparation

- *Sharp edges*
- *Bad configuration of the gingival wall*
- *Rough margins*
- *Weakening of the proximal ridge*



## Manipulation

- *Trituration – rpm, time.*



# Contemporary trends in treatment of dental caries

- Miniinvasion
- Adhesive techniques

# Indications

- Class III., IV., V.
- Aesthetically prominent areas of posterior teeth, small – moderate restoration class I., II.
- Large restoration only in areas without heavy occlusal stress
- Good level of oral hygiene is necessary

# Contraindications

- Moderate to large restorations esp. Areas with heavy occlusal stress
- Restorations that are not in highly aesthetics areas
- Restorations that have heavy occlusal contacts
- Restorations that cannot be well isolated
- Restorations that extend onto the root surface
- Abutment teeth for removable partial dentures
- Temporary or caries control restorations.

# Glassionomers - advantages

- Chemical binding to hard dental tissues
- Thermal expansion similar to dentin
- Release fluoride ions (caries control restoration)
- Not sensitive to moisture

# Glass ionomers-disadvantages

- Long time for setting – sensitive to moisture
- Difficult sculpting - impossible
- Not high aesthetics
- Lower mechanical resistance (wear resistance, flexural strength, hardness)

# Glassionomers - indications

- Class V., III. – cavities out of enamel or/and patients with lower level of oral hygiene.
- Class I., II. – caries control filling (inner remineralization), composite material on the top is strongly recommended (weeks – months later). Tunnel fillings.



# Glassionomers contraindications

- Class V., III. – cavities in enamel in patient with good oral hygiene
- Class IV.
- Class I., II. – permanent filling (esp. large – moderate restorations)

# Composites in posterior teeth

# Indications

- Aesthetically prominent areas of posterior teeth
- Small - moderate classes I. that can be well isolated, large cavities only without heavy occlusal stress
- Good level of oral hygiene is necessary

# Contraindications

- Moderate to large restorations
- Restorations that are not in highly aesthetics areas
- Restorations that have heavy occlusal contacts
- Restorations that cannot be well isolated
- Restorations that extend onto the root surface
- Abutment teeth for removable partial dentures
- Temporary or caries control restorations.

# Clinical technique

- From the occlusal surface using the diamond burs (roundedn cylinder or ball)

# Cavosurface margin

- Outline includes the caries lesion only
- Fissures going into the caries lesion can be open and sealed (recommended).

# Retention principles

- Prepare the box or deep dish – the bottom is in dentin
- Do not prepare any undercuts!
- Do not bevel enamel, finish the border with diamond bur only.

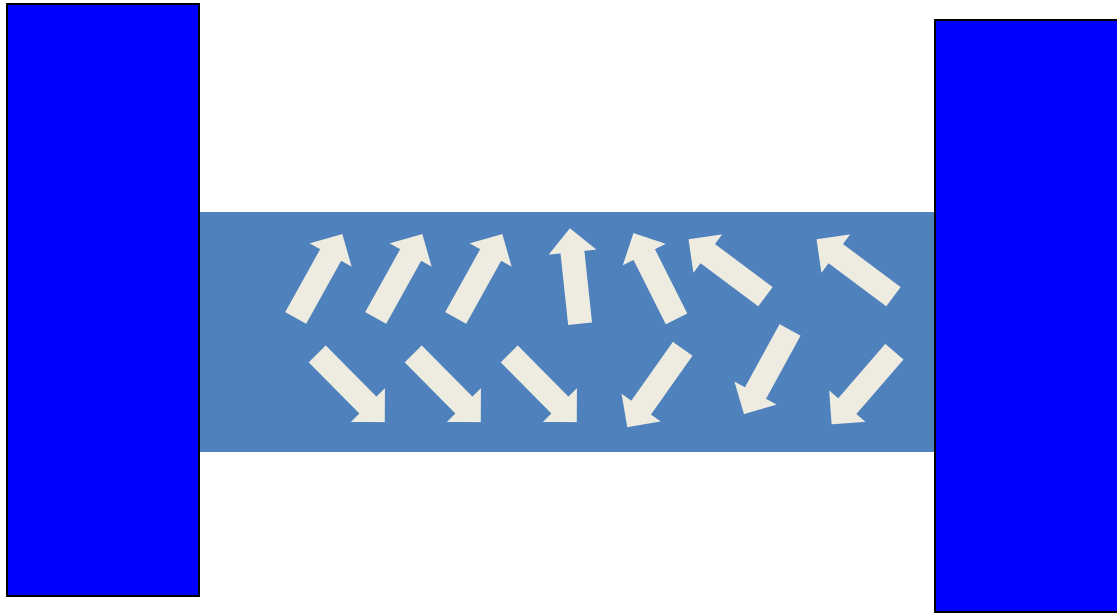
# **Removal of carious, infected, dentin and remaining defective enamel.**

- Spoon excavator or a slowly revolving , round carbid bur of appropriate size.
- Sharp hand instrument

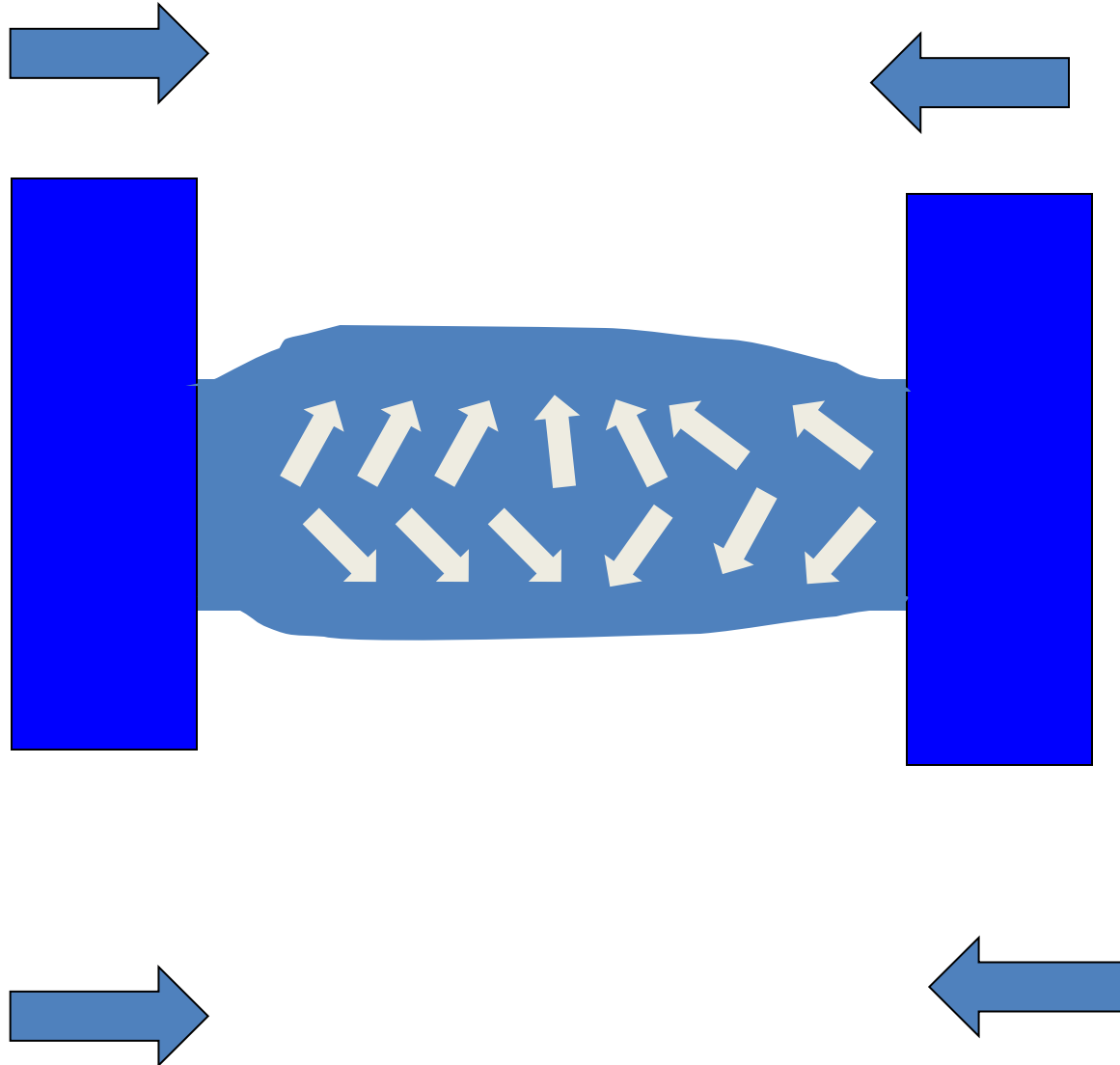


# Polymerization shrinkage and polymerization stress

# Polymerization shrinkage

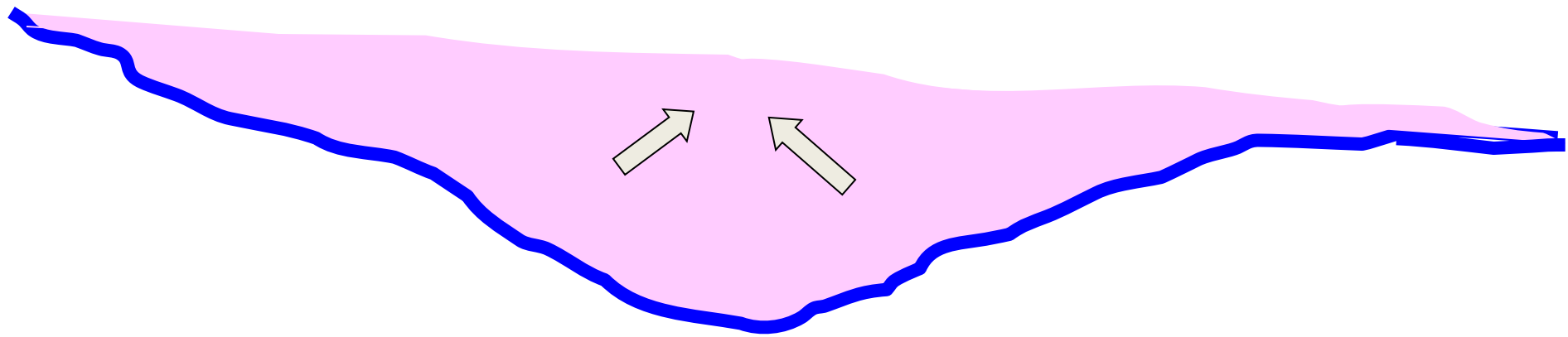


# Polymerization shrinkage



C – factor (Configuration factor)

**Surface of adhesion/free surface of the filling**



**1/1 and less is optimal**



**5**



**2**



**1**

# Forces of polymerization shrinkage depend on

- Composite material (content of filler)
- Geometry of the cavity (C-factor)
- Placement of the composite
- Mode of polymerization

# Forces of polymerization shrinkage depend on

- Composite material (content of filler)

Higher content of filler - lower shrinkage,  
higher polymerization stress.

# Forces of polymerization shrinkage depend on

Geometry of the cavity (C-factor)

Higher C-factor – higher stress



# Forces of polymerization shrinkage depend on

- Placement of the composite:

- *Create the first layer thin, flowable can be used*

*(Flowables – lower content of filler, higher shrinkage, lower polymerization stress)*

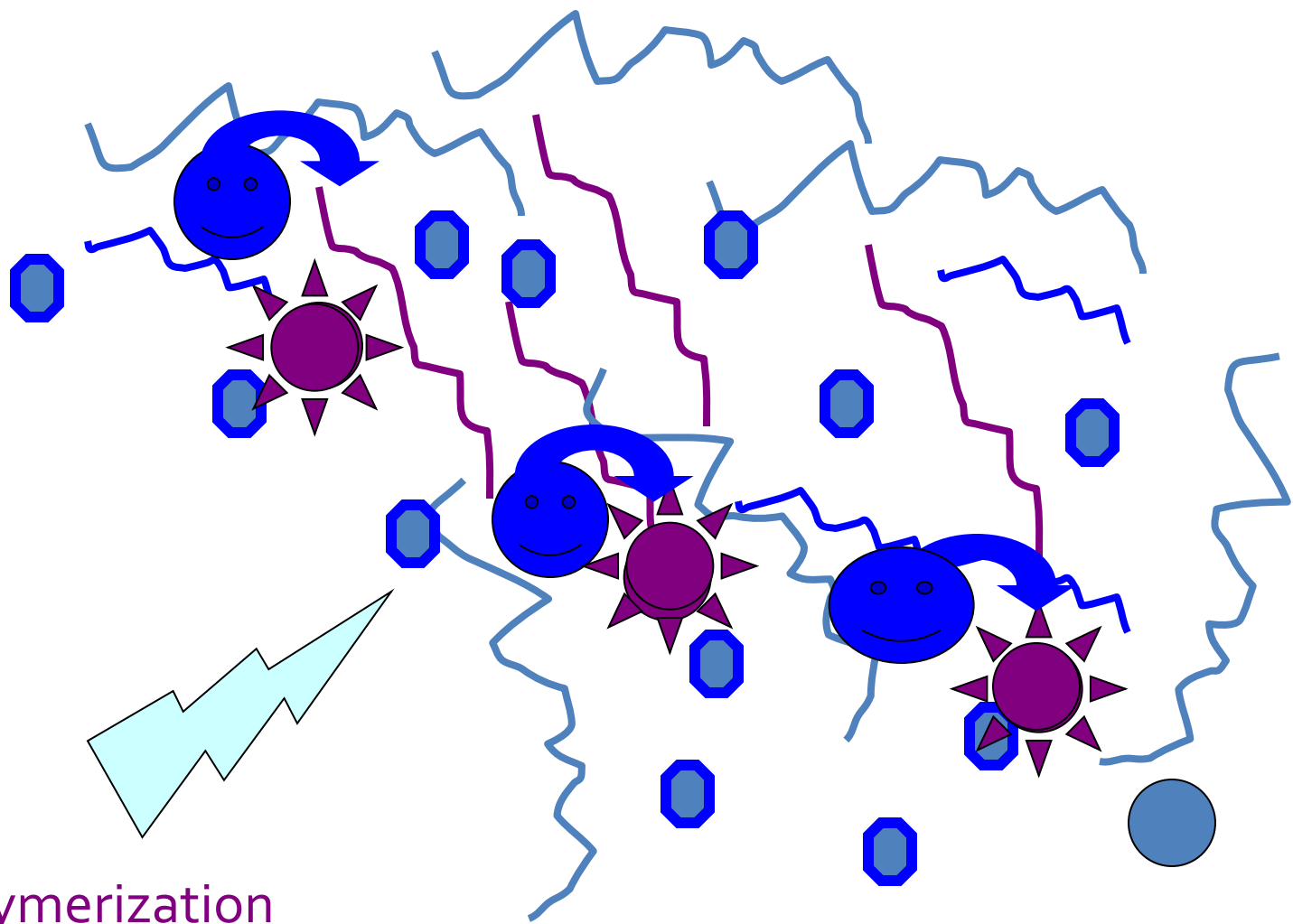
- *Place the material in increments with respect of the C-factor of each layer (each layer with large free surface). Maximum 1,5 mm*

# Forces of polymerization shrinkage depend on

- Mode of polymerization

## Phases

- Pre-gel (in this phase the material is still soft)
- G-point (material become hard)
- Post –gel (end of shrinkage –postgel shrinkage)

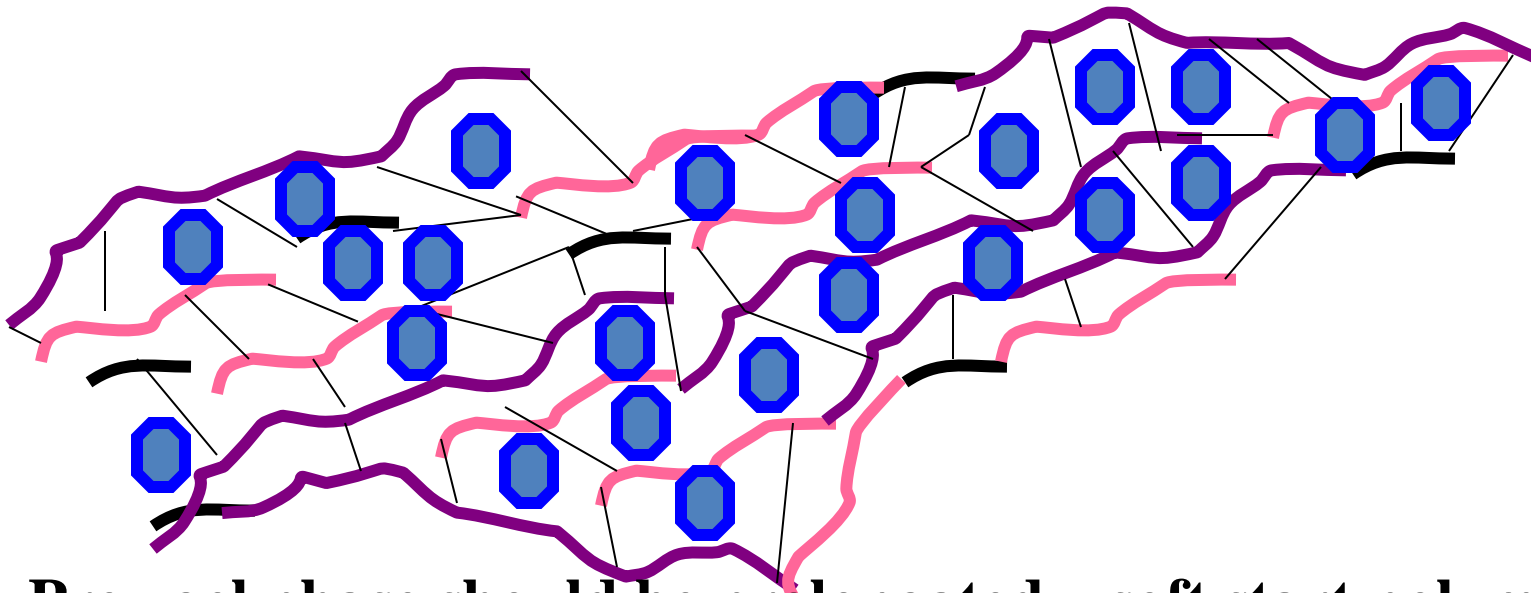


Light

Polymerization

Monomer  $\longrightarrow$  Polymer

Pre gel phase should be long – soft start !!!!



**Pre –gel phase should be prolonged – soft start polymerization**

**Gel**

**Post –gel**

**Now soft start seems not to be so important !!!**

# Marginal adaptation depends on

- Placement of composite material
- Dry operating field
- Adhesive systems



# Adhesives

- Acid etching technique
- Selfetching adhesive systems

# Adhesives

- Acid etching technique

Etching

Washing

Priming Bonding

# Adhesives

- Selfetching adhesive systems

Priming

Bonding

Less bonding strength in comparison to acid etching technique

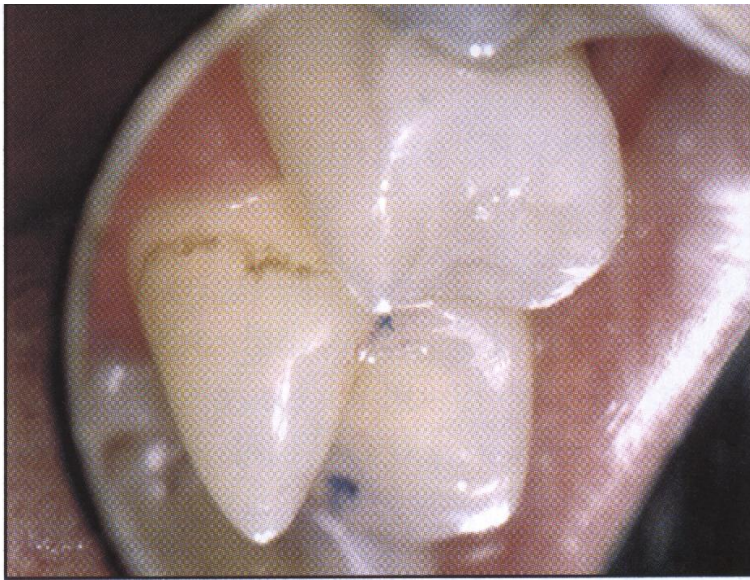
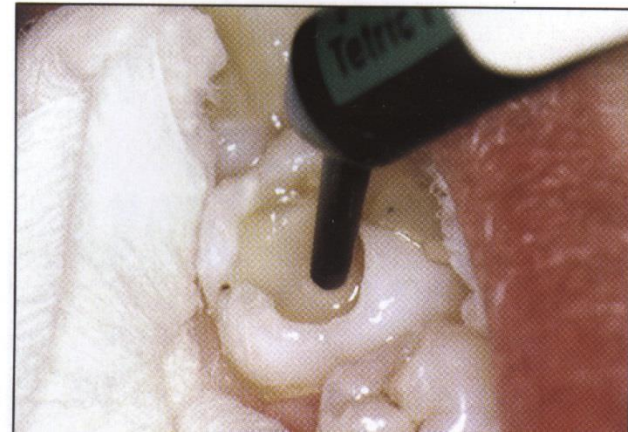


# Adhesives

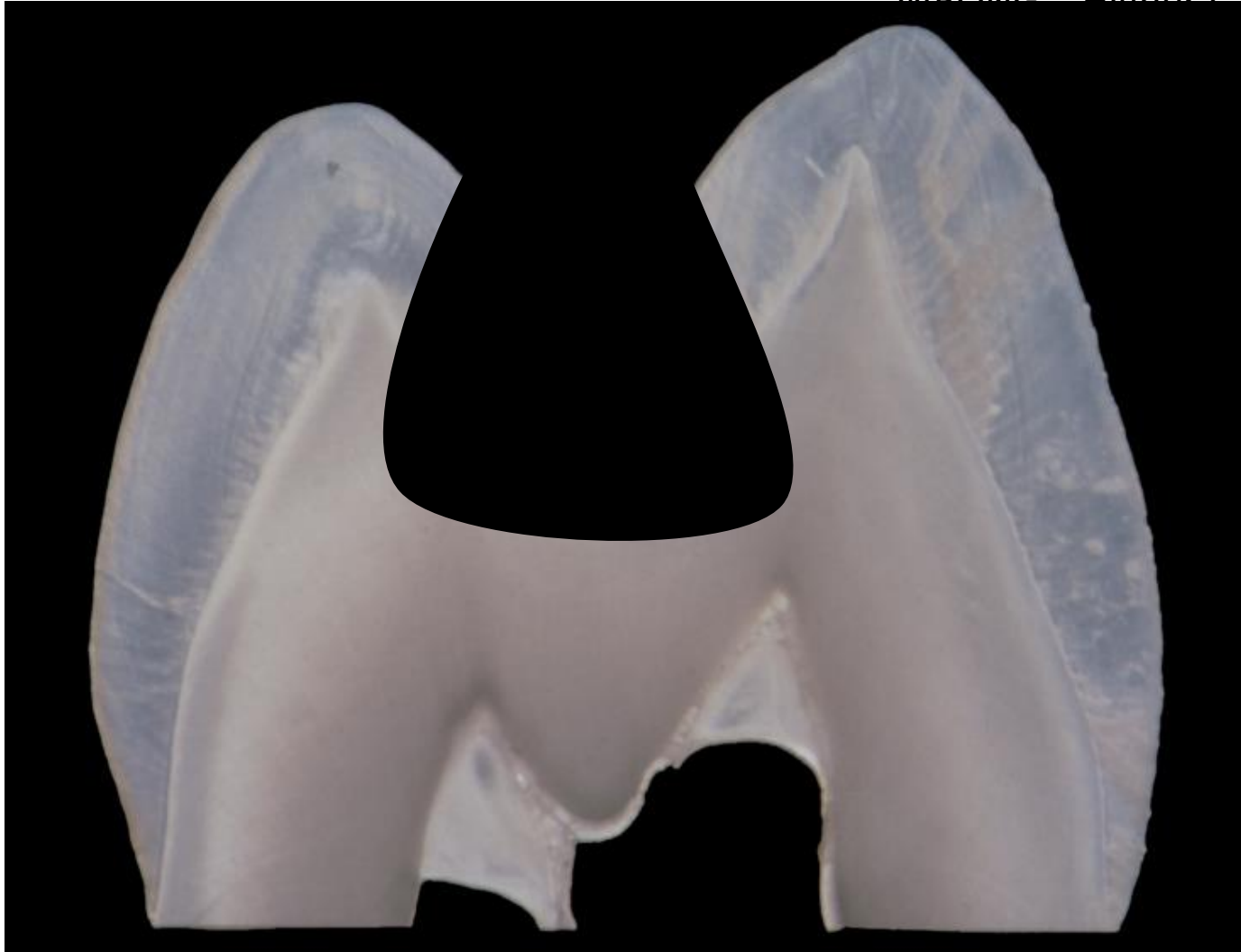
- Active and passive bonding

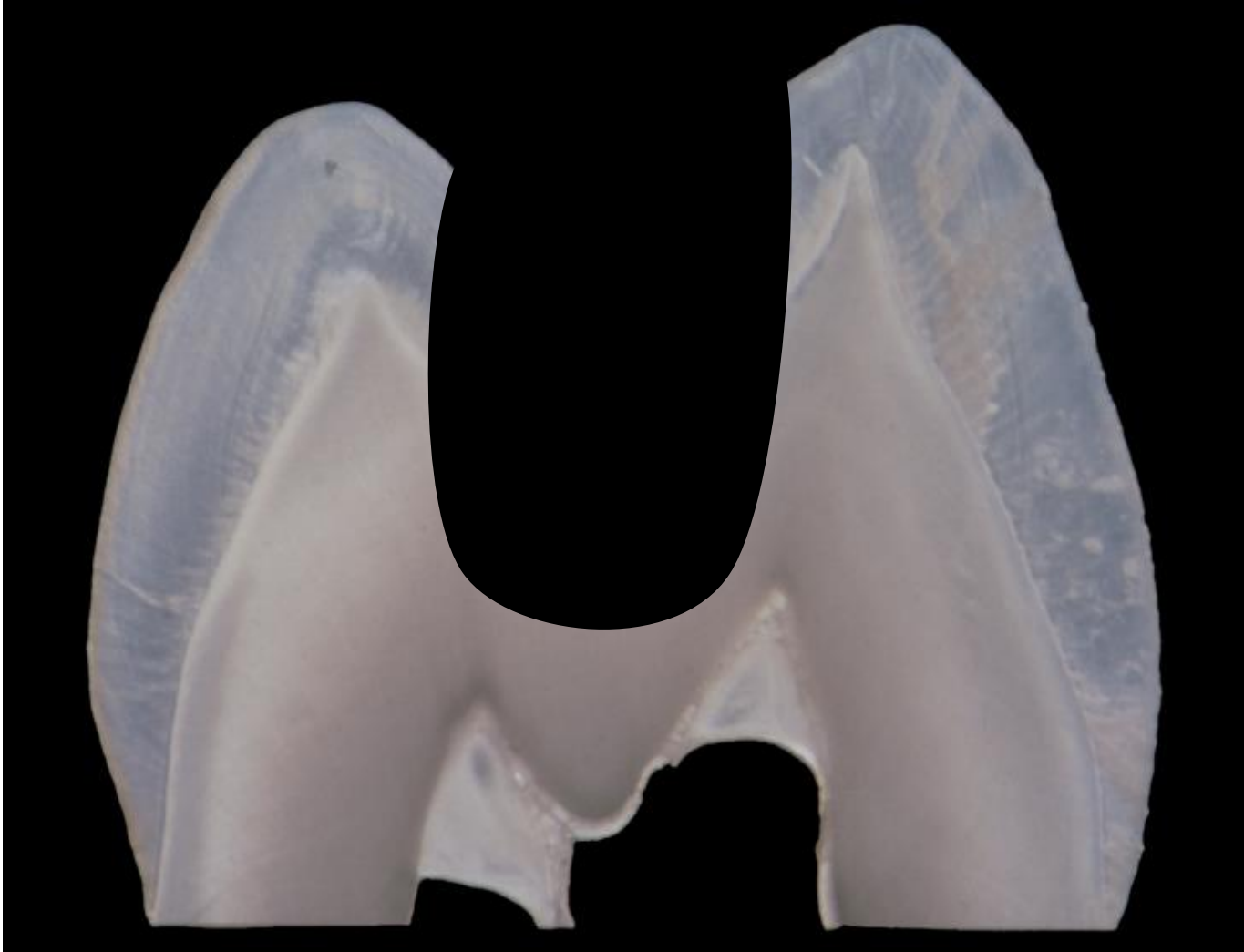
Active – rubbing with microbrush (selfetching)

Passive – without any rubbing (acid etching)

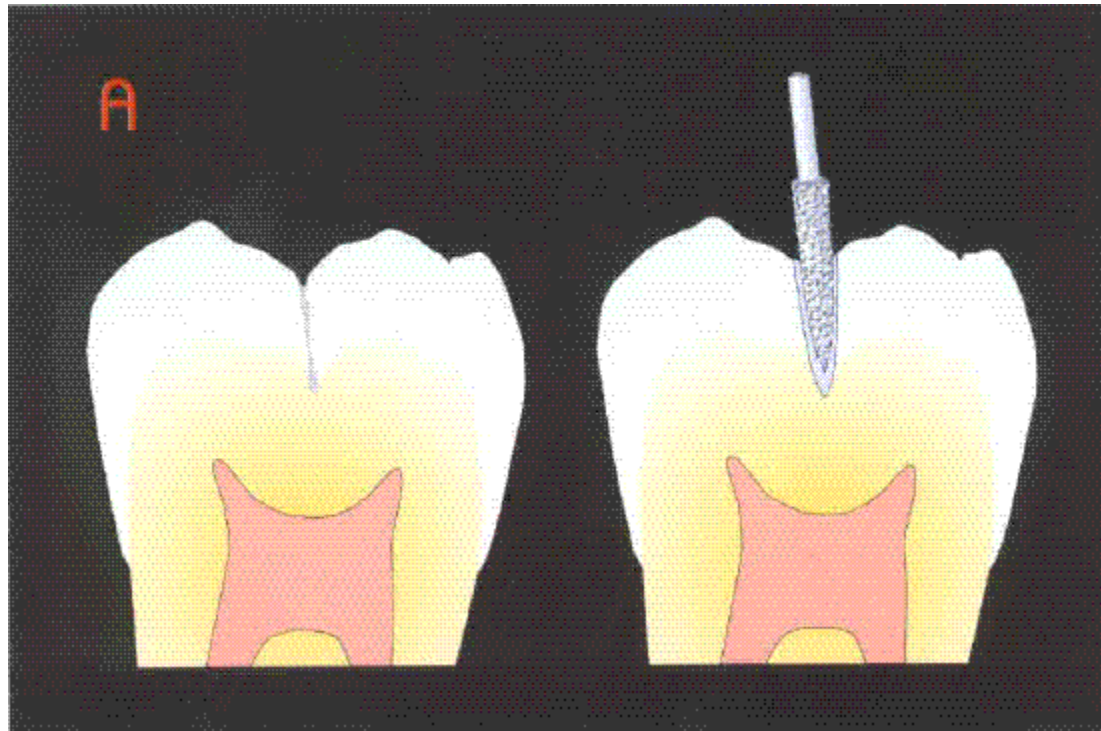


WRONG Higher  $\sigma_c$  factor

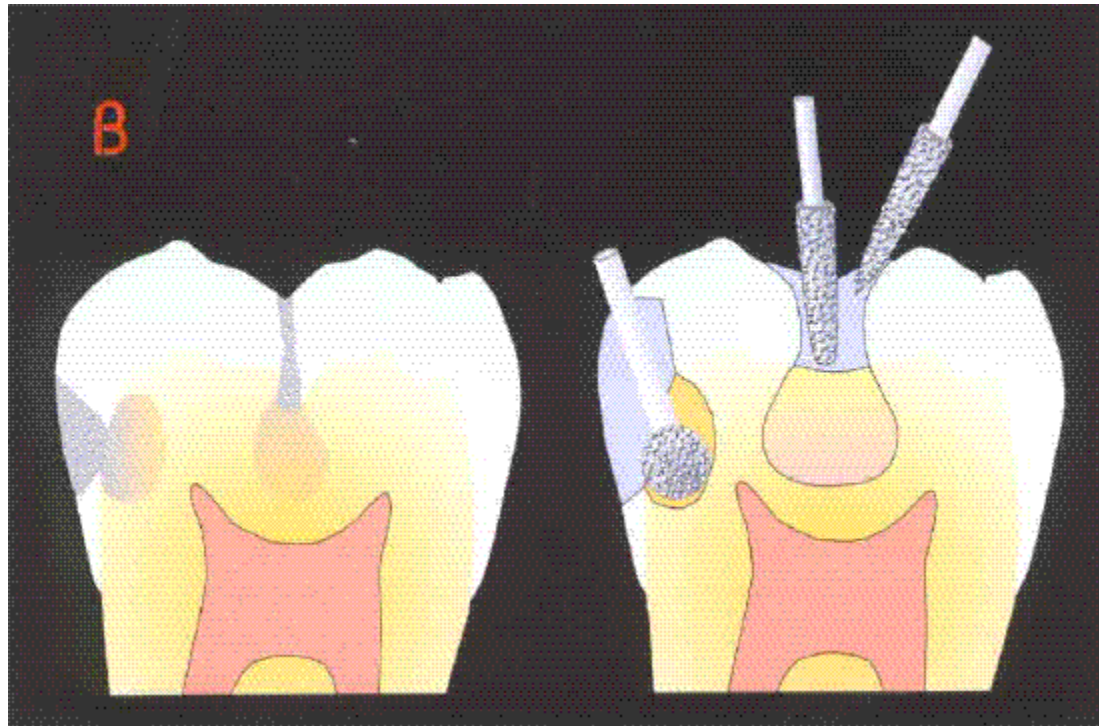




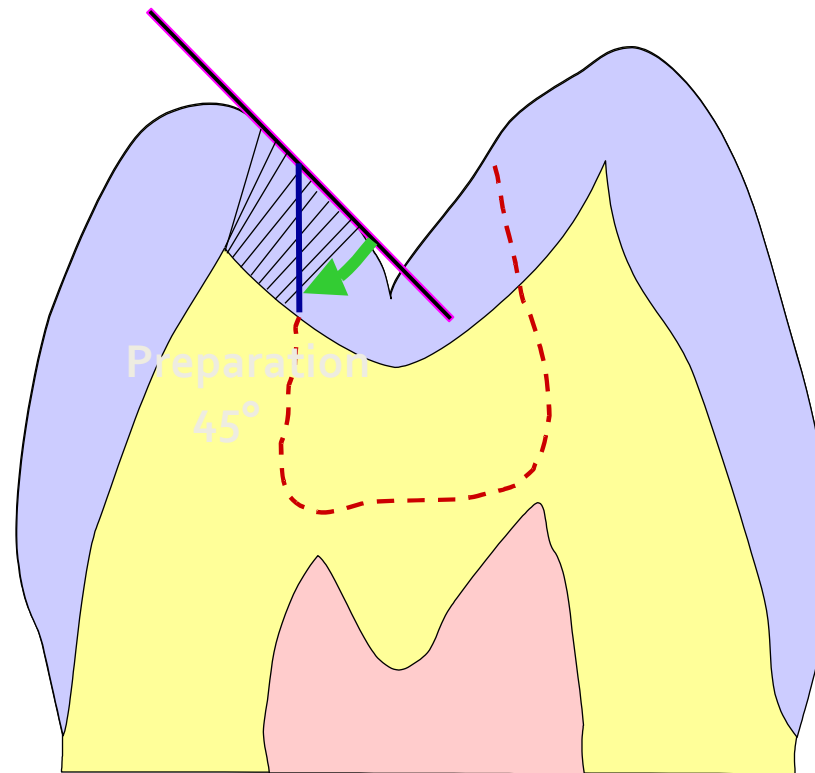
# Adhesive preparation in a fissure



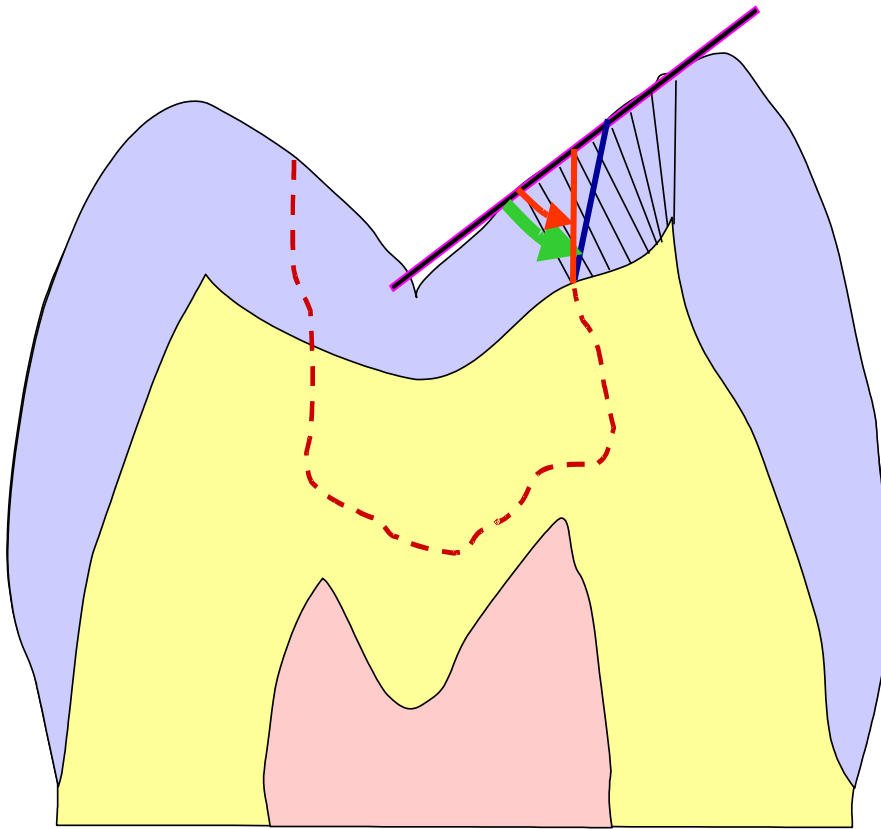
# Adhesive preparation



# Preparation of enamel borders



# Preparation of enamel borders

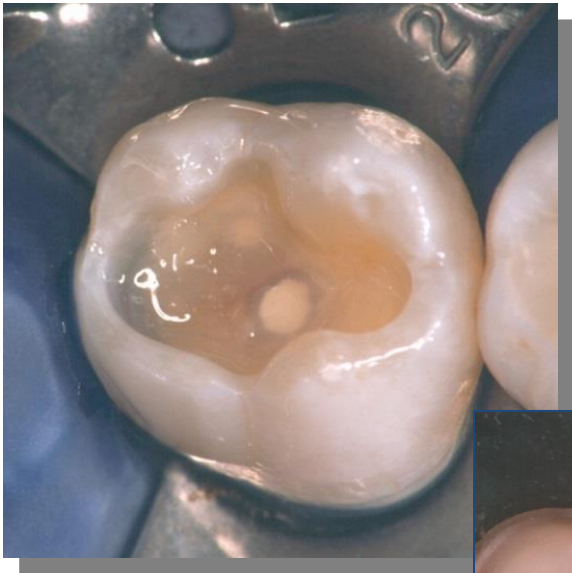


Next to cusp  
50-60°,  
Never cover the cusp

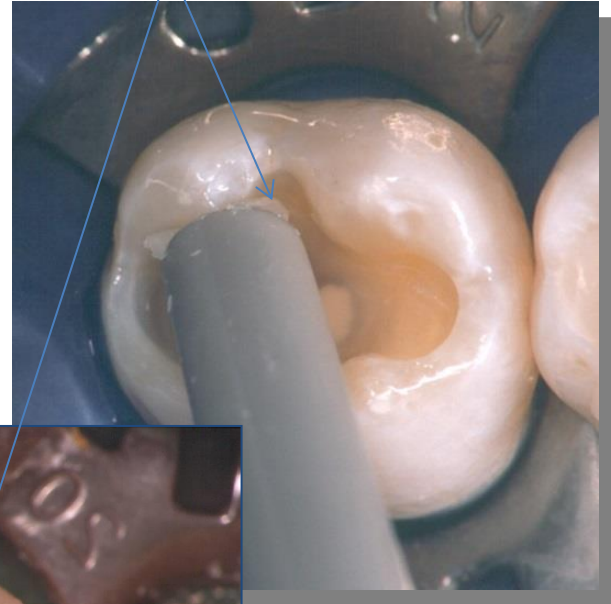


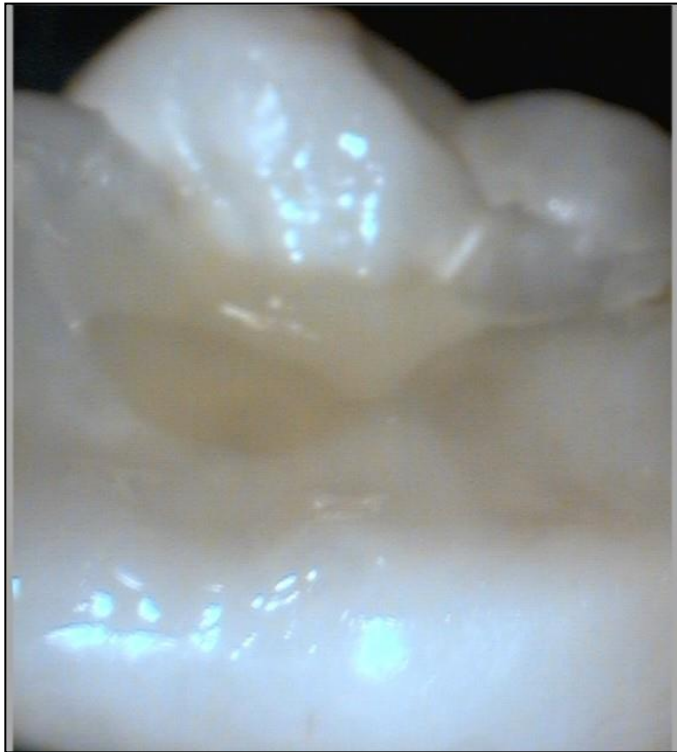
# Incremental technique

Flowable



Building cusp by cusp





Miniinvasive treatment – small cavity,  
Opening of fissures,  
preservation of intact areas - ridges

# Composite filling – class II.

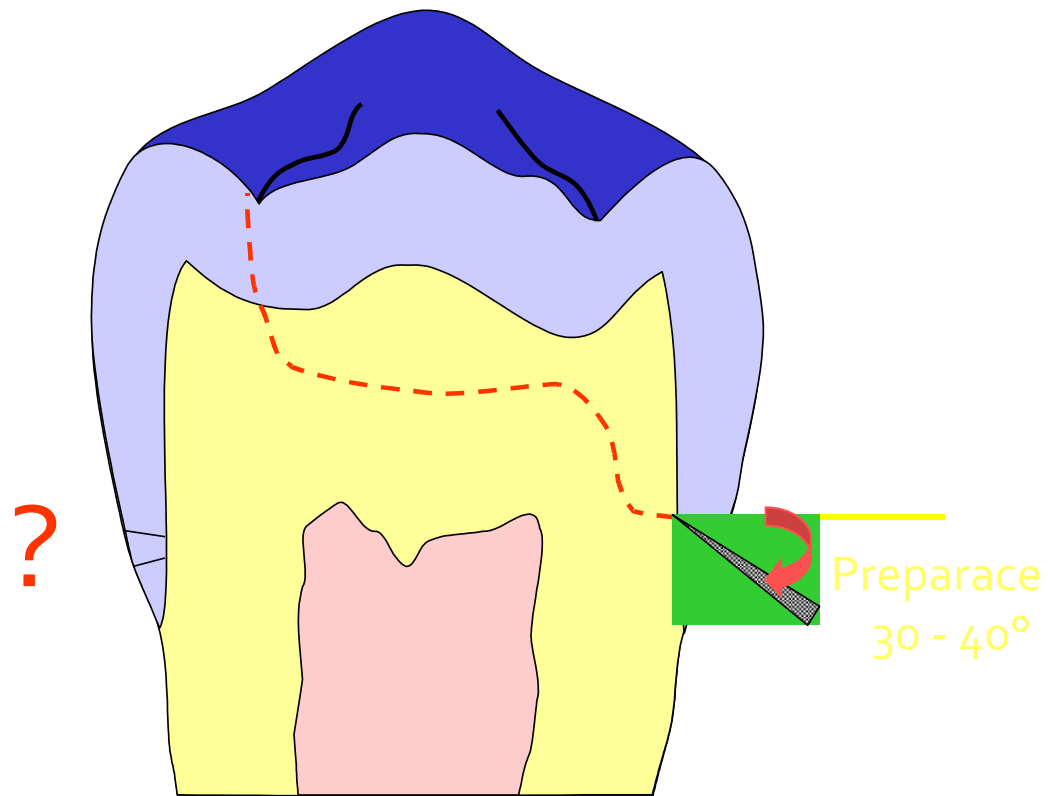
- Critical factors
  - contact area (contact point)
  - dry operating field (marginal adaptation)

# Preparation

- Occlusal cavity – class I.
- Proximal cavity

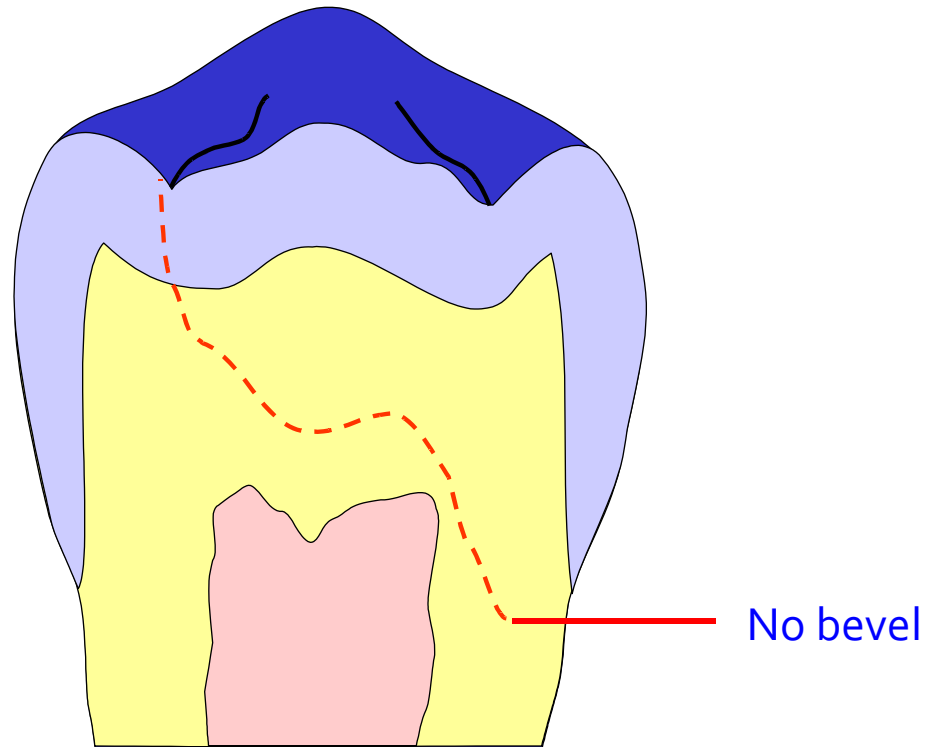
# Cervical margin

In enamel

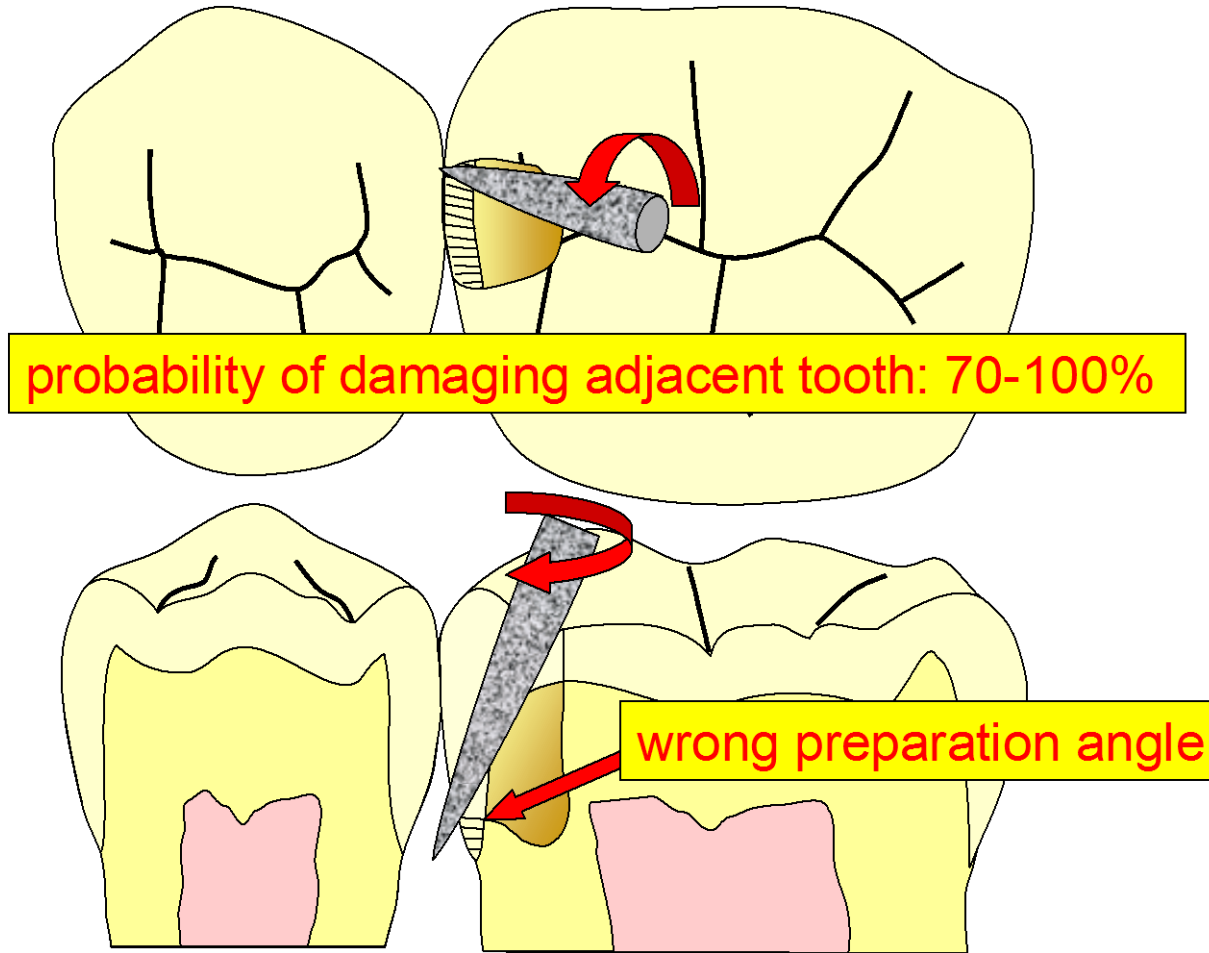


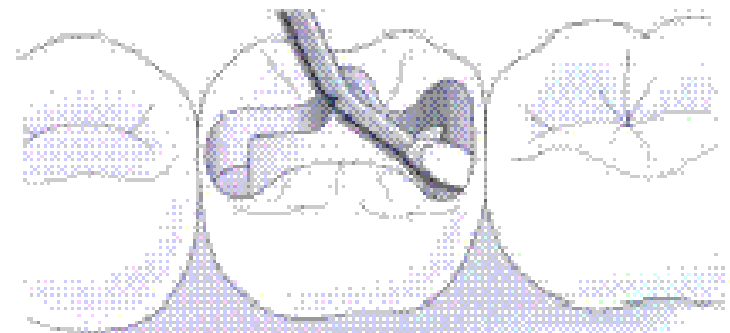
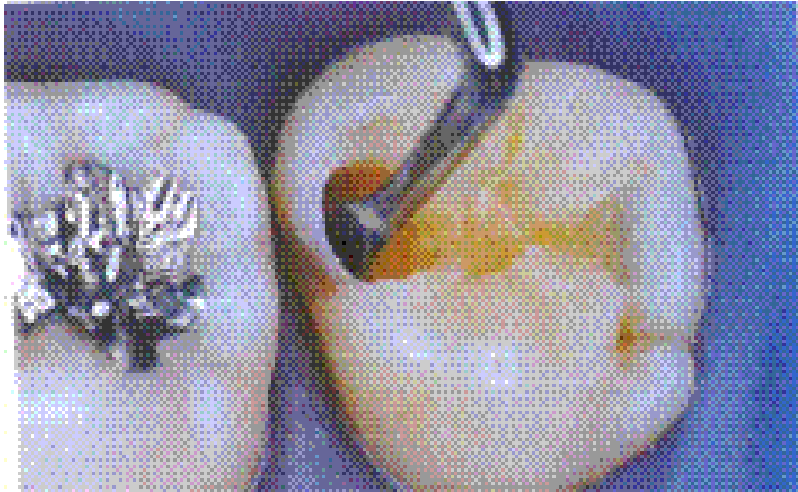
# Cervical margin

Out of enamel



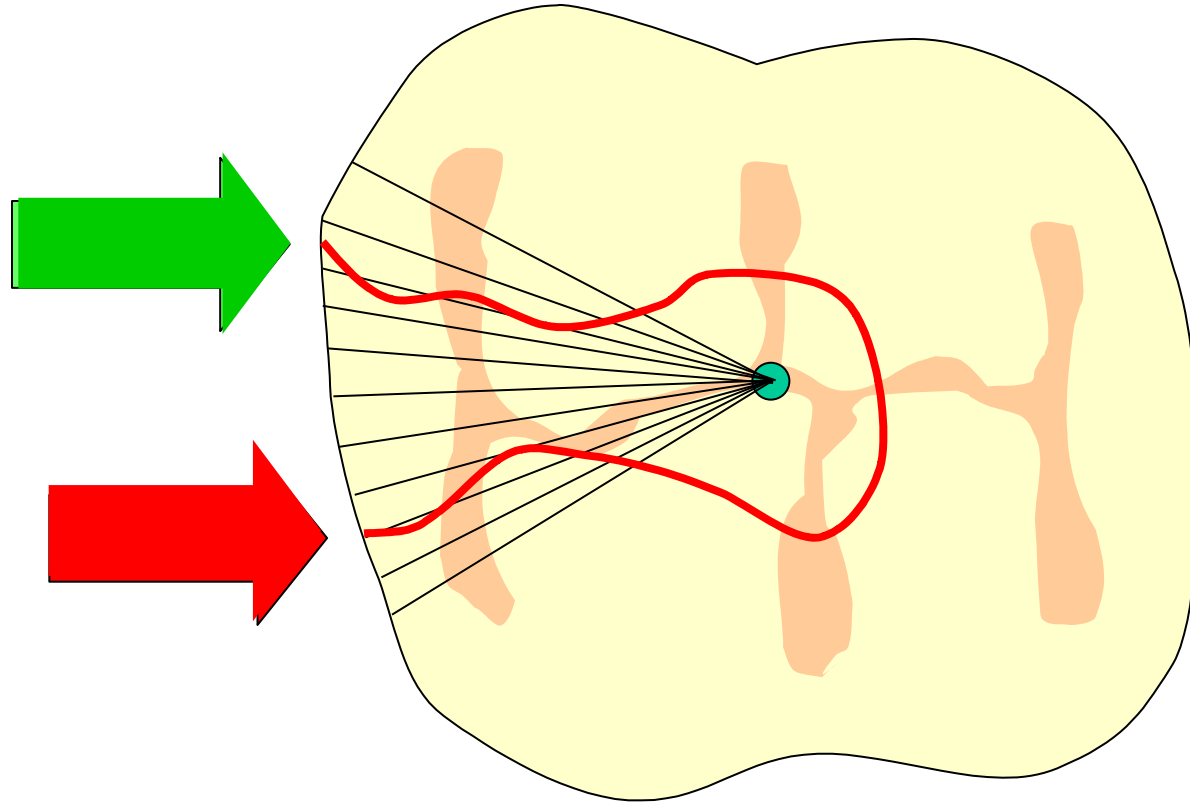
# Preparation technique







# Interproximal vertical margins



# Proximal Preparation with oscillating instrument



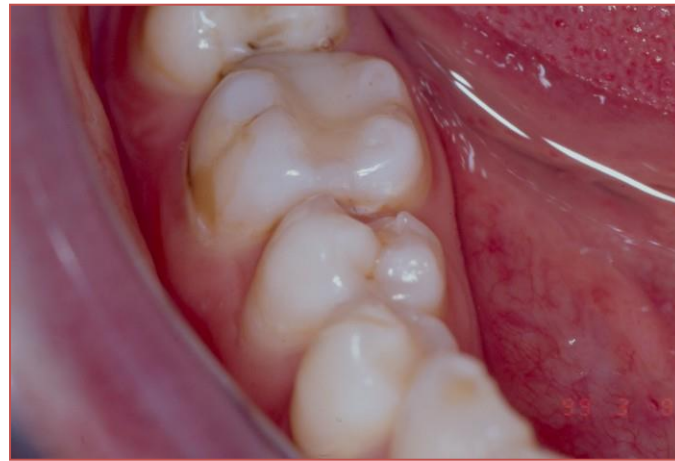
Matrices

Bands (metal,transparent)

Retainers

Hawe Neos (0,03 mm)

Optra (thin matrices – 10 micrometers)











Sectional matrices  
With separator and wedge

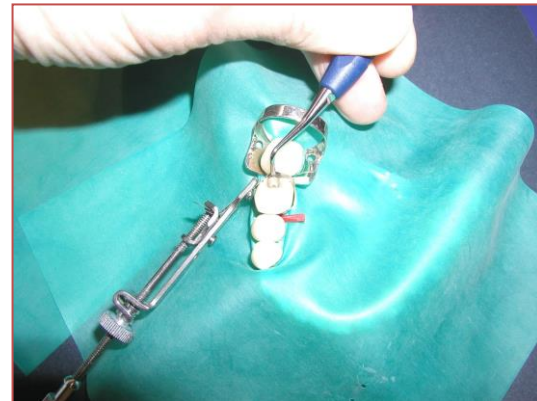
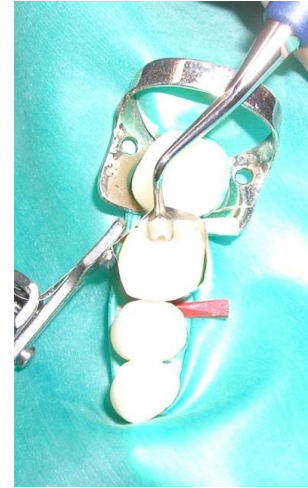




Optra contact – special instrument

OR

Contouring of the matrix band using a ball condensor













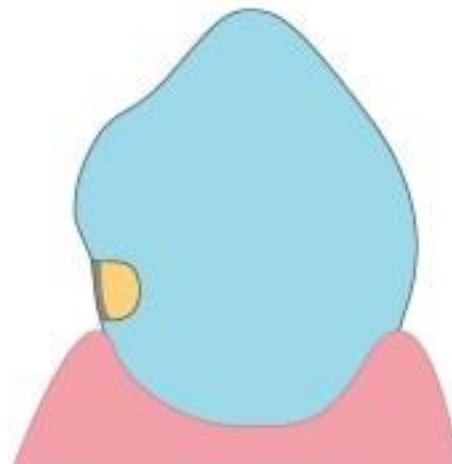
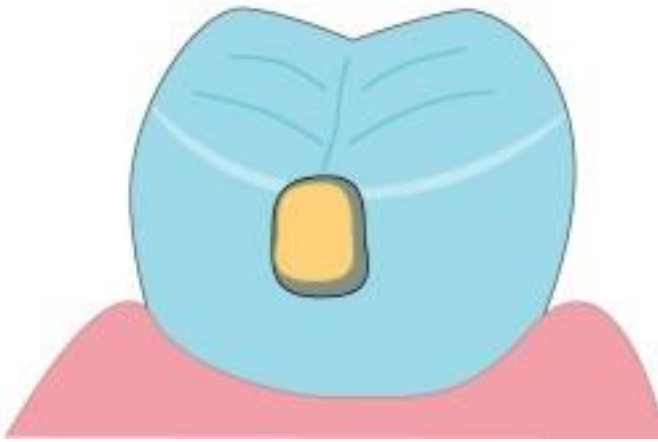




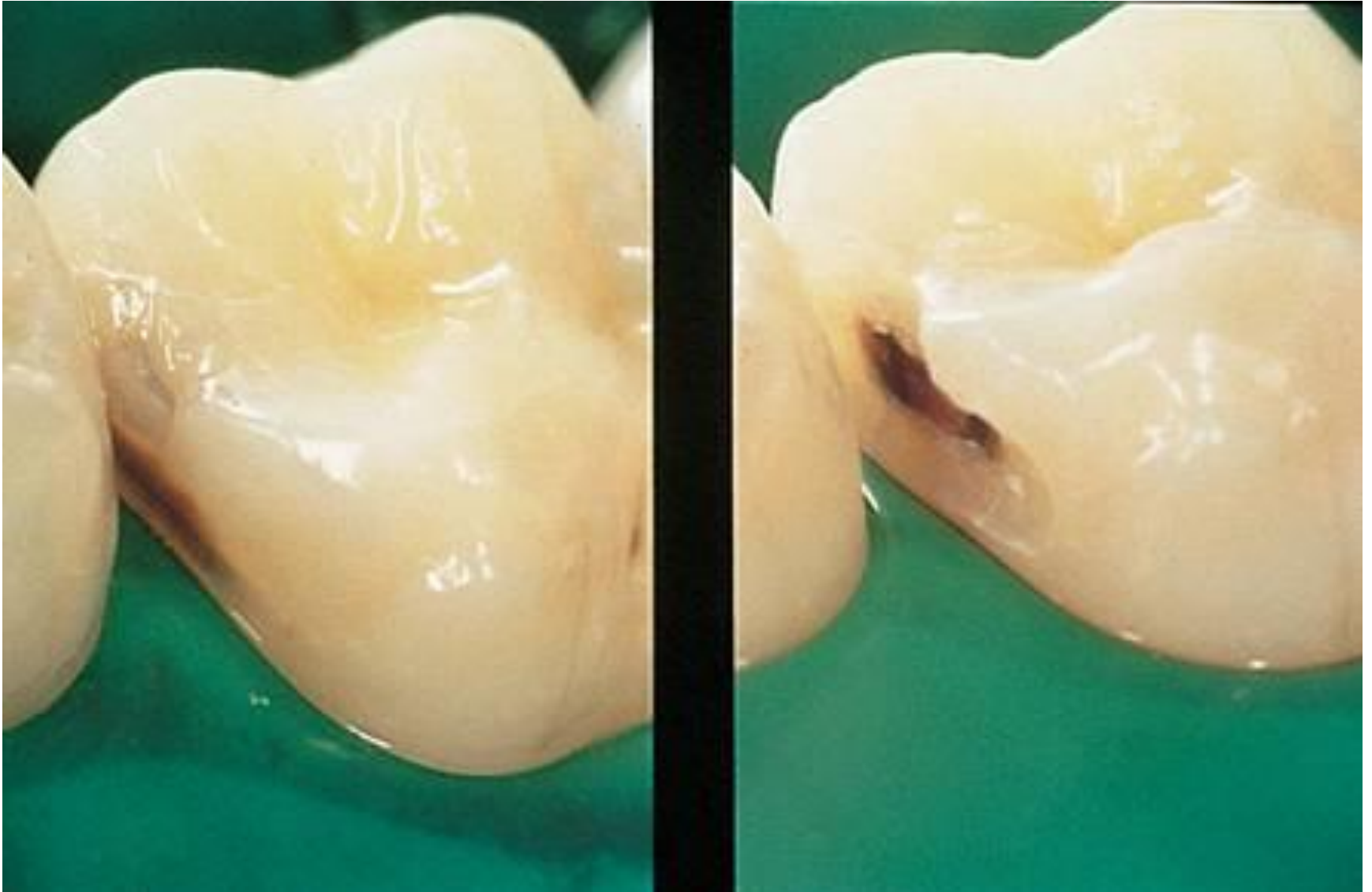
# Miniinvasive techniques

- Adhesive slot
- Tunnel

# Adhesive slot preparation

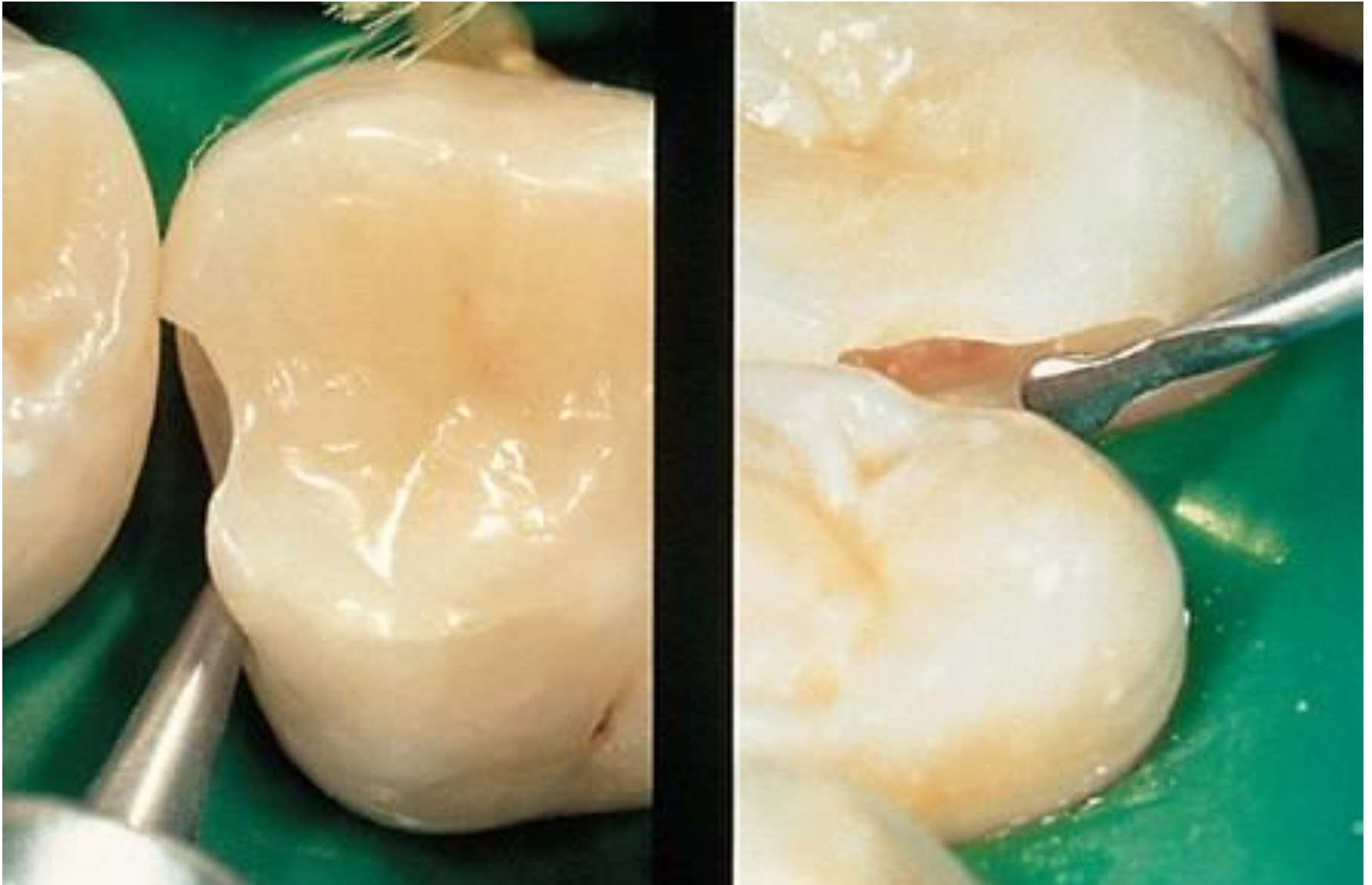


# Horizontal slot



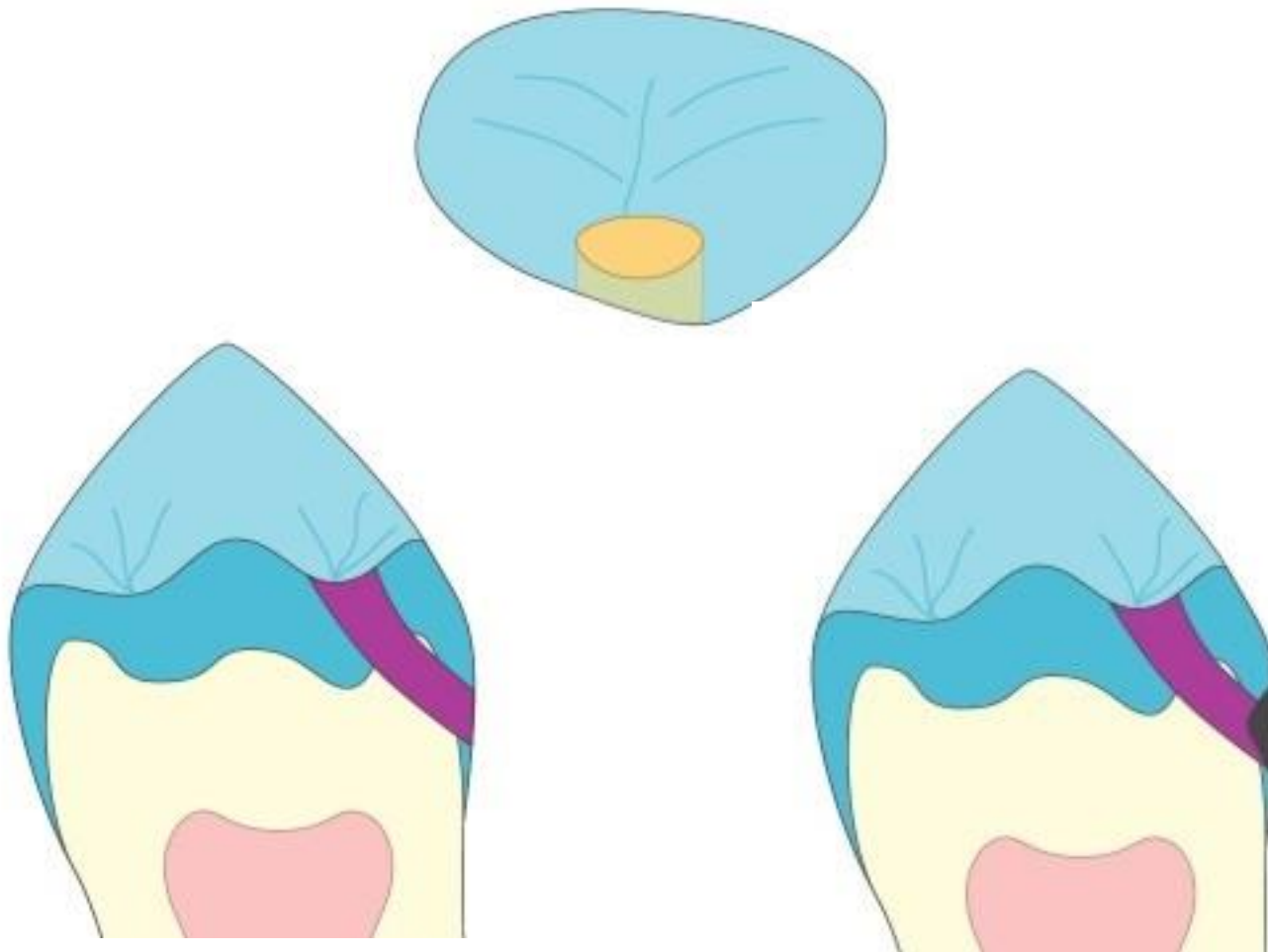


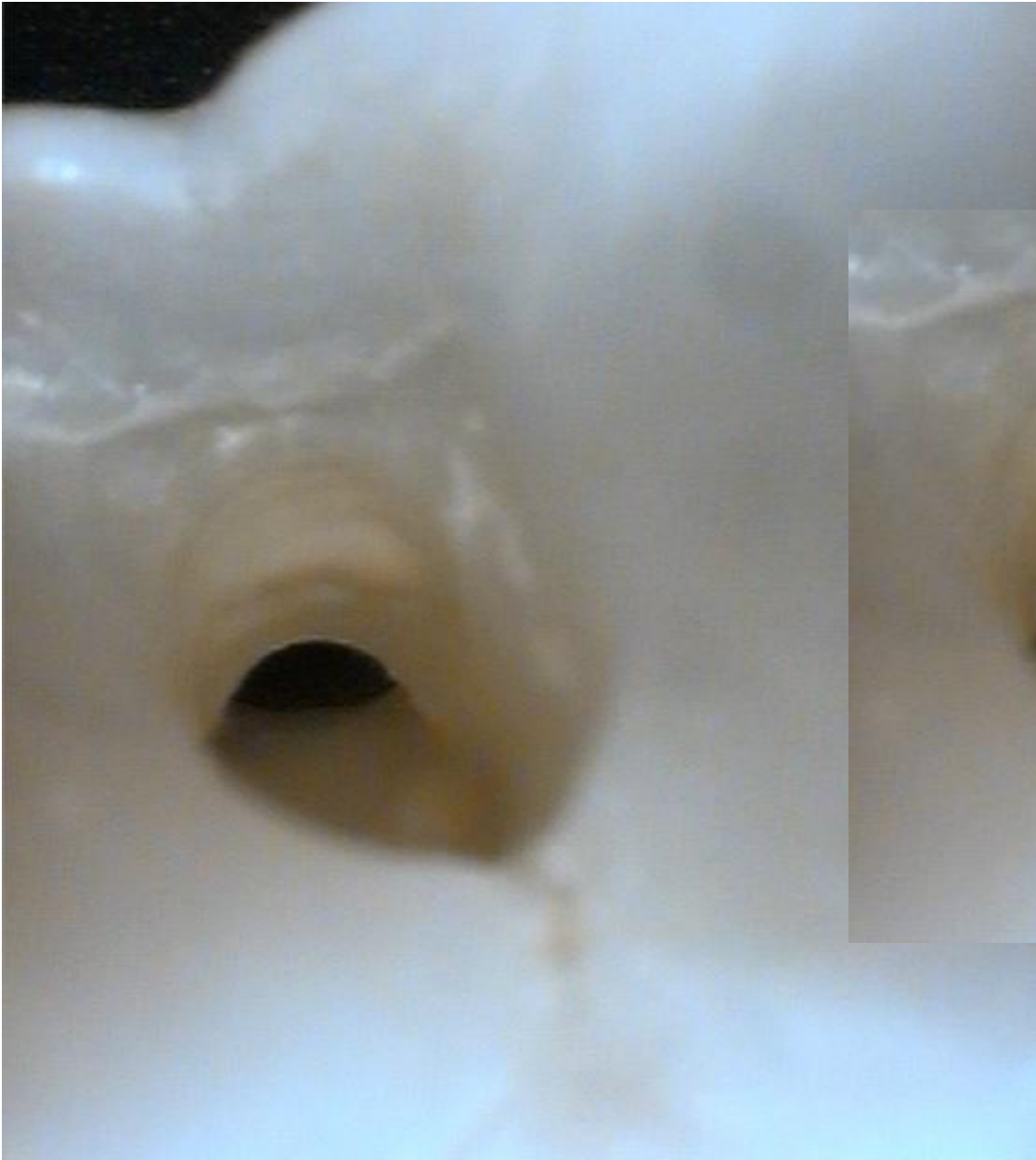
# Horizontal slot – oscillating instrument

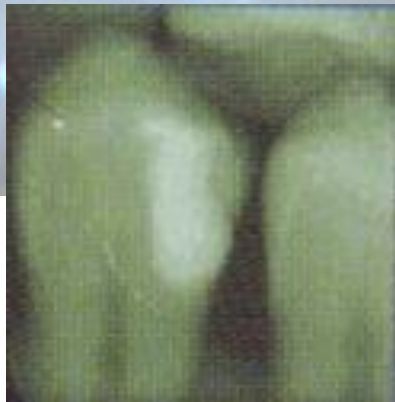
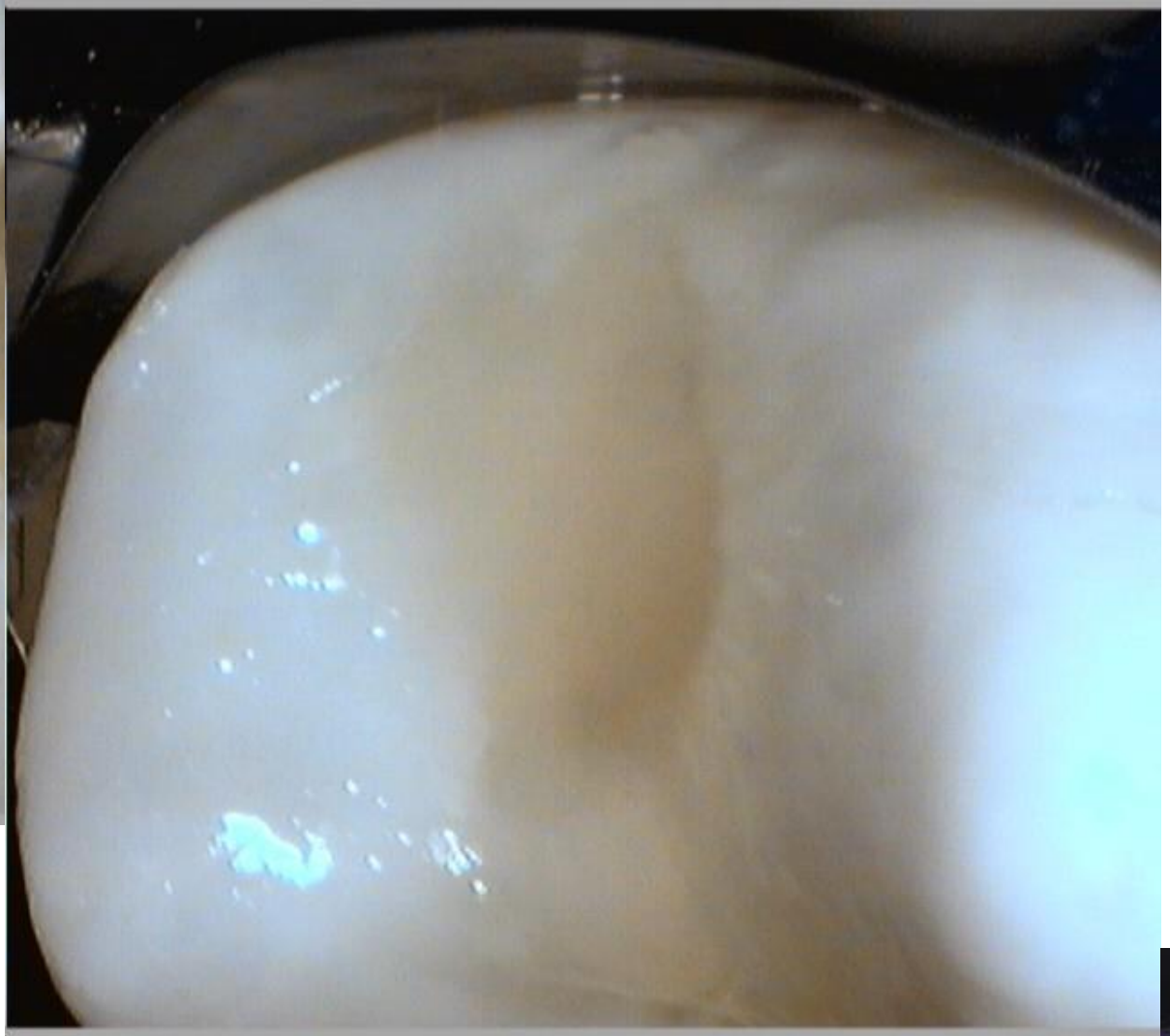




# Tunnel preparation







## Success of the tunnel

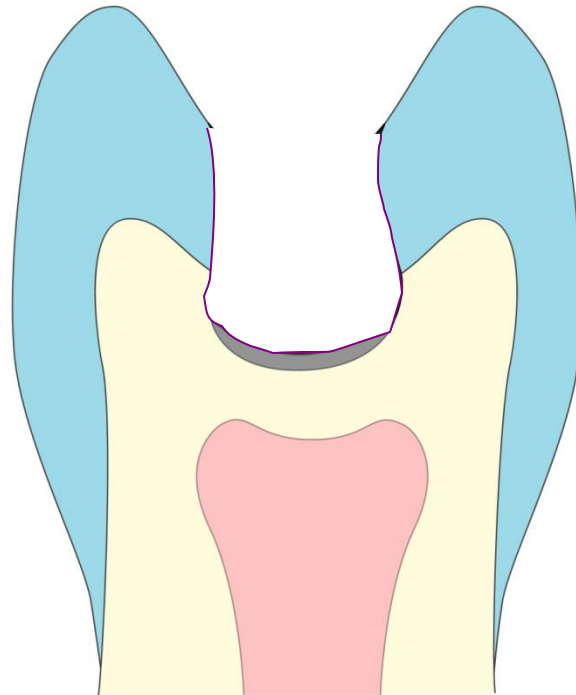


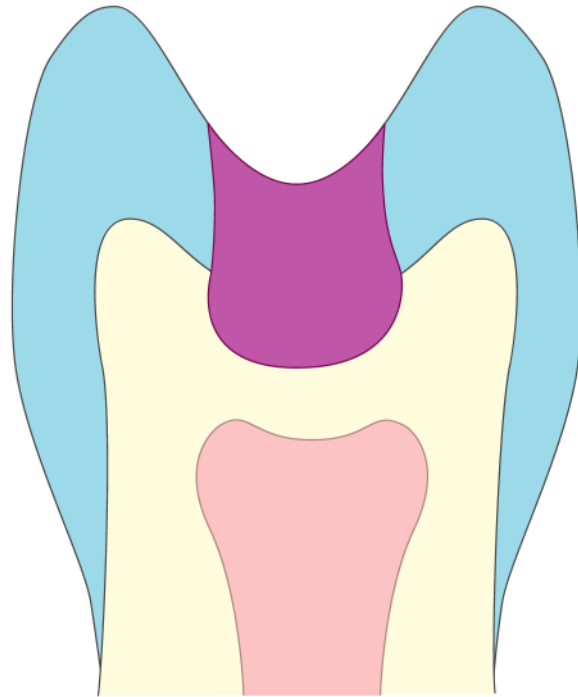
1. Low caries risk
2. Good cooperation of the patient
3. Marginal ridge without any infraction

1. Loupes or microscope
2. Miniinstruments
3. Capsulated GIC or composite
5. BW post op



ART









# Bulk fill composites

Placement and curing in one layer 4 mm

1. Flowables – SDR Flow (Dentsply), Venus Bulk Fill (Heraeus Kulzer), X-tra fill (VOCO), Filtek Bulk Fill (3M ESPE).
2. Bulk high density composites (Tetric EvoCeram Bulk Fill (Ivoclar – Vivadent) a QuiXfill (Dentsply).
3. Sonic Fill (KaVo)



# Sonic Fill

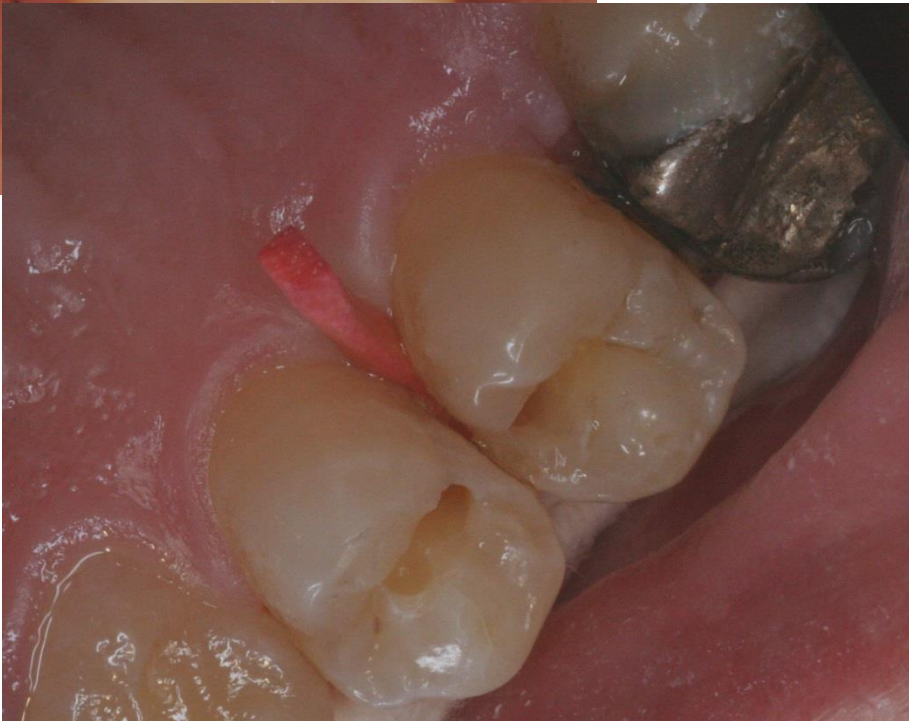


1 bulk ( 5 mm)

Sonic activation – decreasing of viscosity

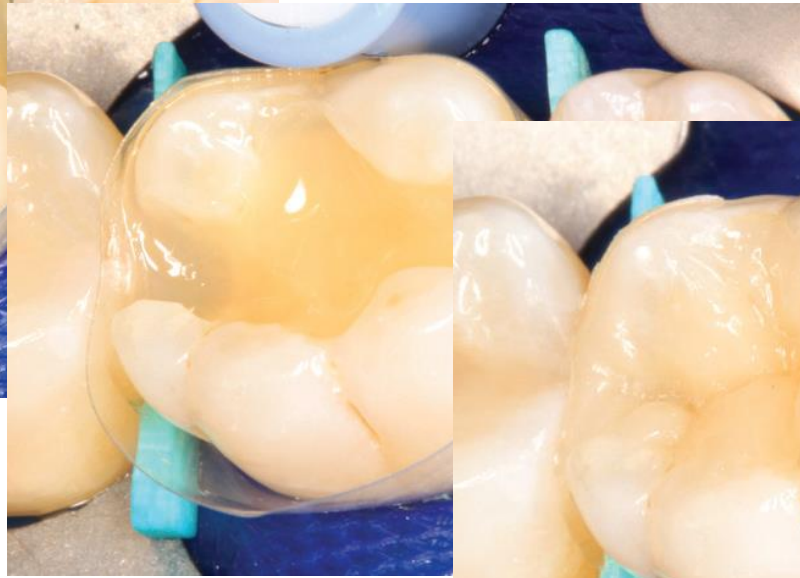
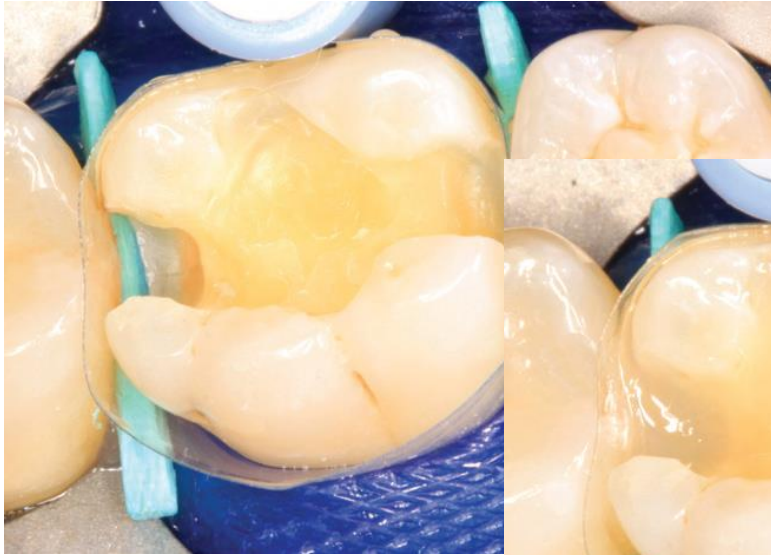
Inner scattering of light – good aesthetics

Long term experience necessary













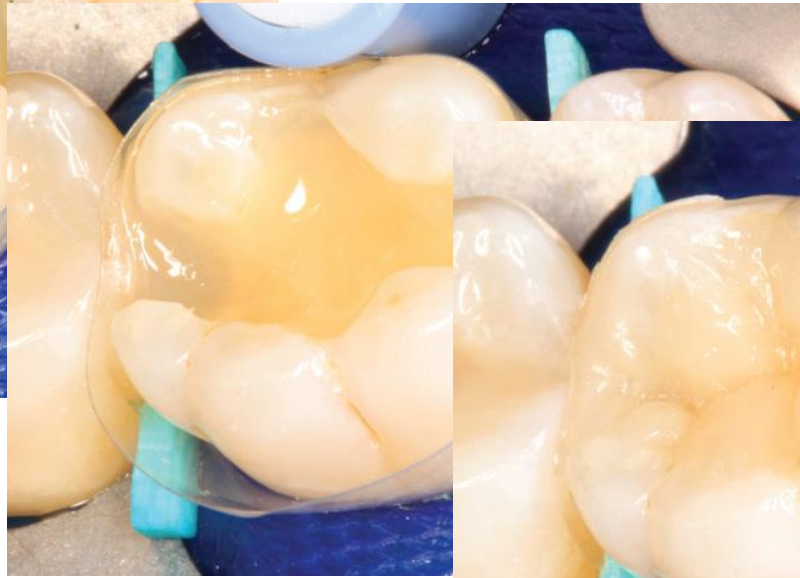
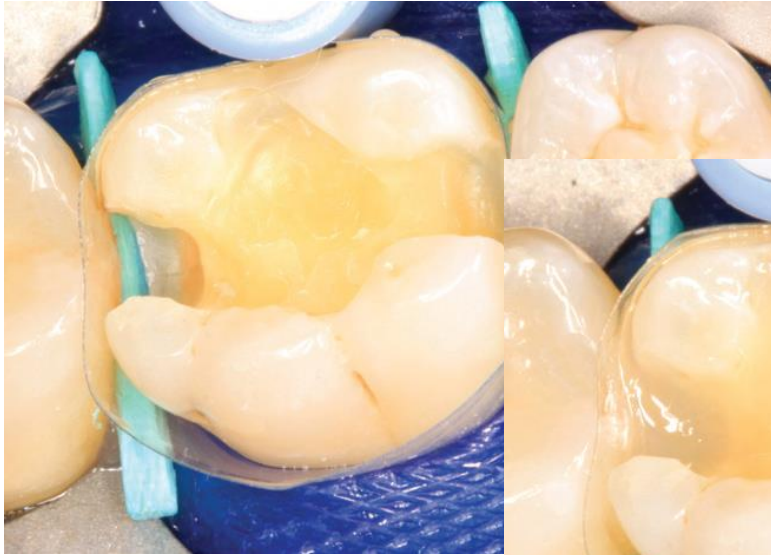


# Bulk Fill composites

- Flowables



*SDR Flow (Dentsply), Venus Bulk Fill (Heraeus Kulzer), X-tra fil (VOCO) nebo Filtek Bulk Fill (3M ESPE)*





# Bulk Fill composites

- High viscosity



*Tetric EvoCeram Bulk Fill (Ivoclar Vivadent)  
a QuiXfil (Dentsply)*

# Sonic Fill



# Sonic Fill



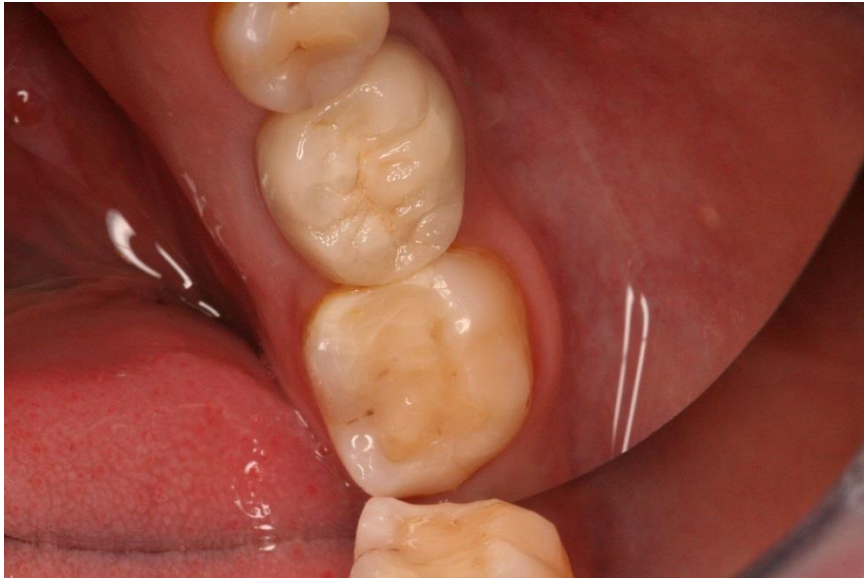
Možnost plnění kavity v jednom bloku  
(do 5 mm)

Sonická „aktivace“ – změna viskozity

Vnitřní rozptyl světla – dobrá estetika

Chybí dlouhodobé zkušenosti

Srovnatelné s jinými materiály



# Comprehension

- Bulk Fill is a new approach to posterior composite restorations
- The handling must follow instructions
- Maximum layer is 4 mm
- Aesthetics is acceptable but not so high as composite fillings made by incremental technique

Problems – can we solve them?

