

Restorative dentistry – treatment of dental caries I.

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Ph.D.

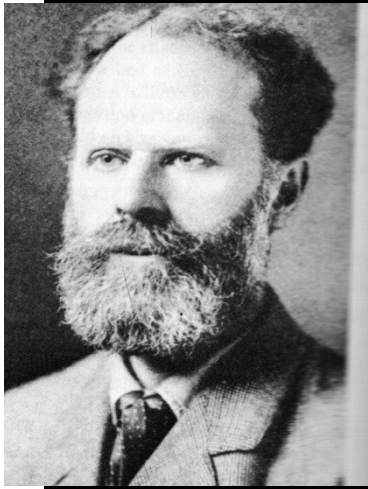


Antony van Leeuwenhoek

(1632 – 1723)

Microscop, microscopic
investigation, microbes in oral
cavity

Jako první pozoroval a popsal mikroby v ústech
17.století



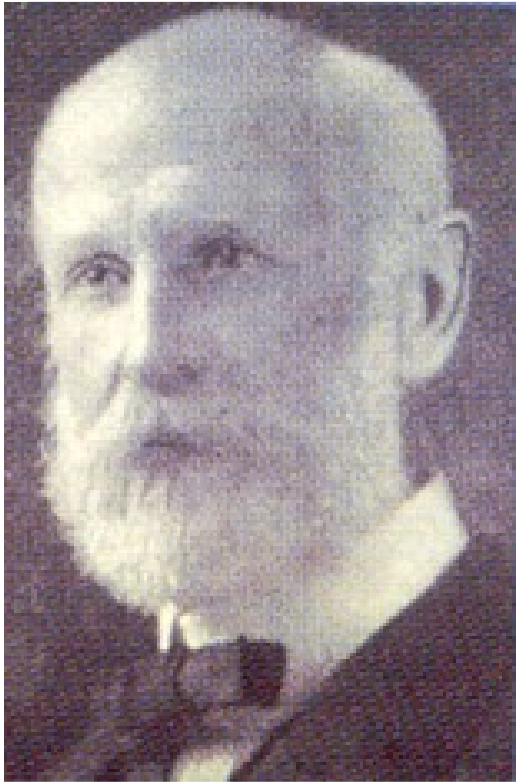
Willoughby Dayton Miller (1853 -1907)

4,,Die Mikroorganismen der Mundhöhle“, - „The Micro-Organisms of Human Mouth“.

Theory of dental caries – chemical and parasital.

Green Vardiman Black

(1836 – 1915)



Definition of preparation

(G.V.Black 1914)

Understanding dental caries

(G.V. Black 1900)

Zubní kaz z hlediska současných poznatků

- Infekční onemocnění, je přenosný
- Je onemocnění s komplexní etiologií
- *Může být ošetřen na molekulární úrovni
- kalcium, fosfáty, stroncium, fluoridy*

Microbiom



Human body
 10^{14} Living cels
10%cells of human body

Microbiom
Oral mikrobiom

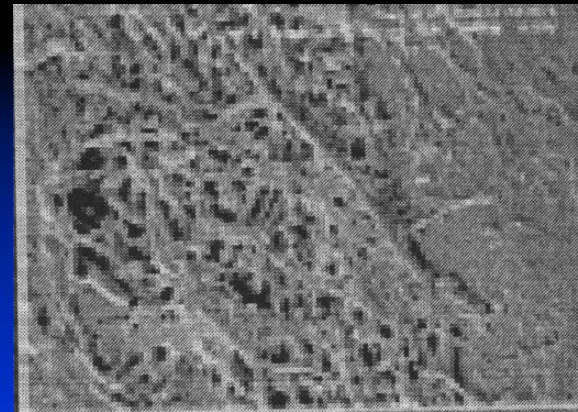
Dental biofilm

- Pelicle – monomolekular proteinic layer rich on prolin and phosphate a and glycoprotein rich on sulphate

Binden to Ca^{2+} ions of enamel

Protective effect

- *eroaion*
- *Dentin hypersensitivity*
- *Key role by remineralization*

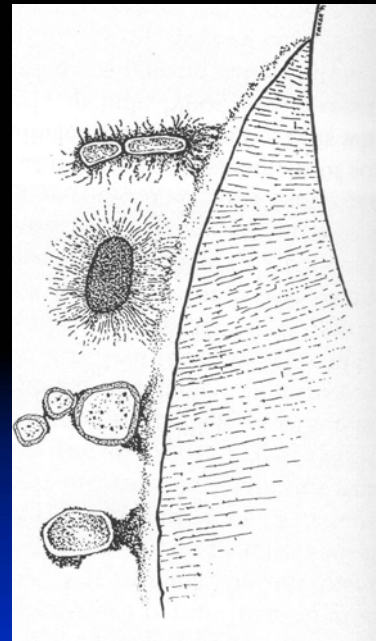
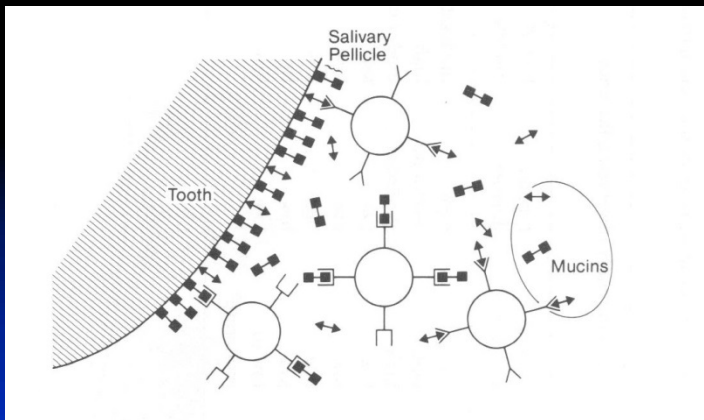


Biofilm

- Adherence

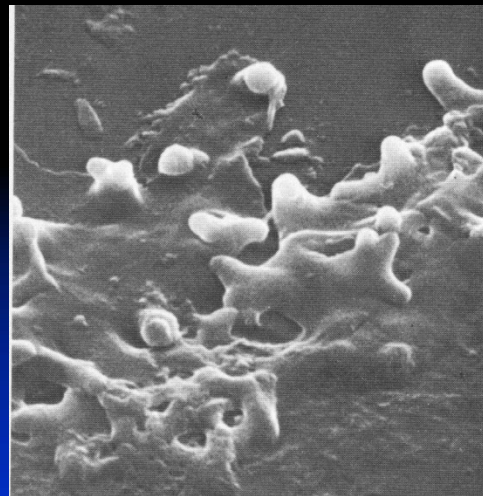
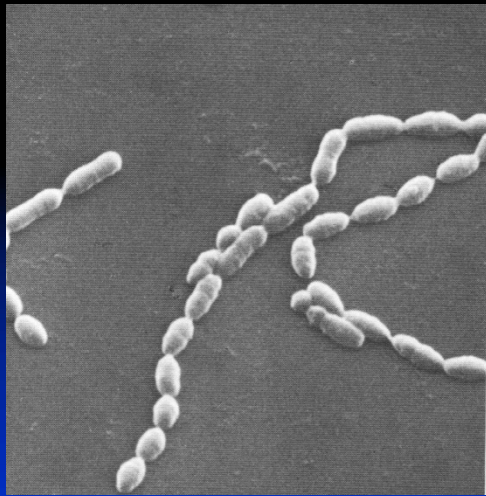
Adhezins

Fimbriες



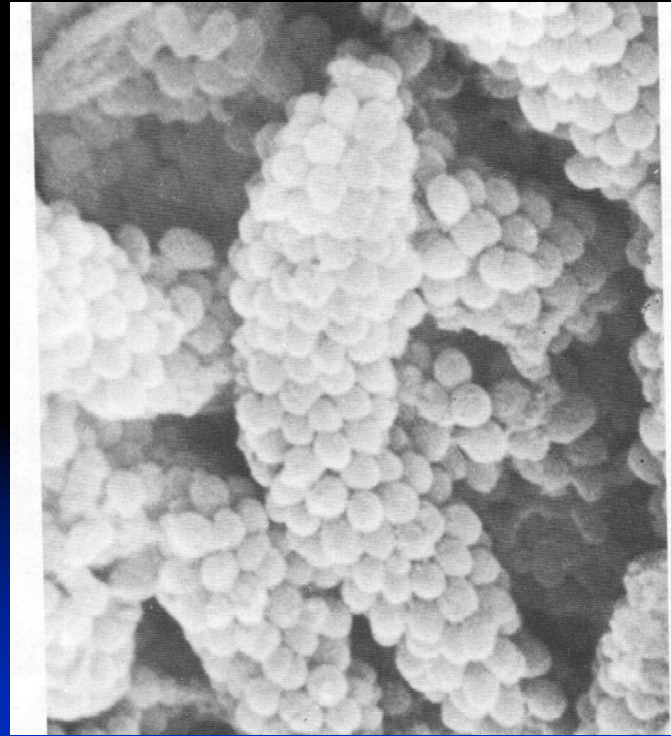
Biofilm

- Colonization
 - *multiplication*
 - *koagregation*

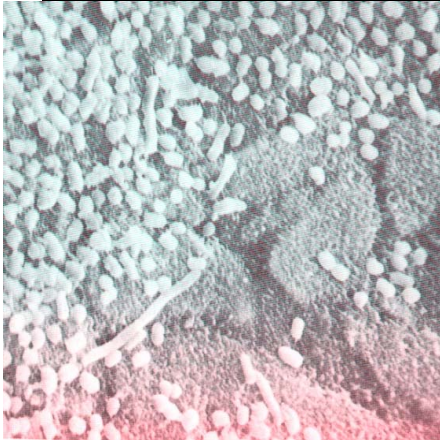


Biofilm

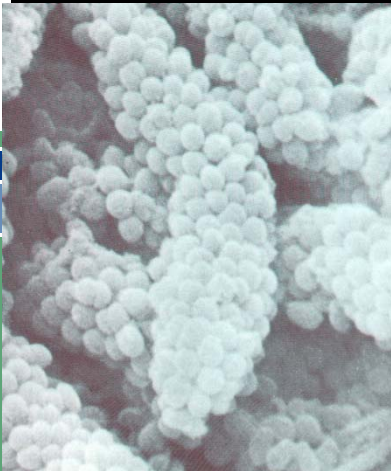
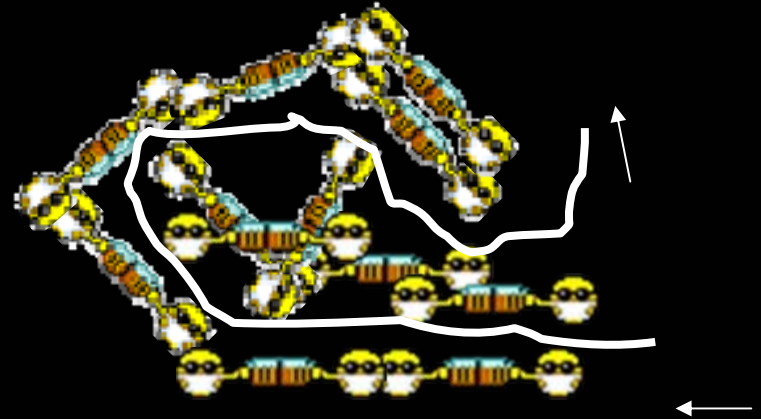
- Maturation



Dental biofilm



■ Komunity

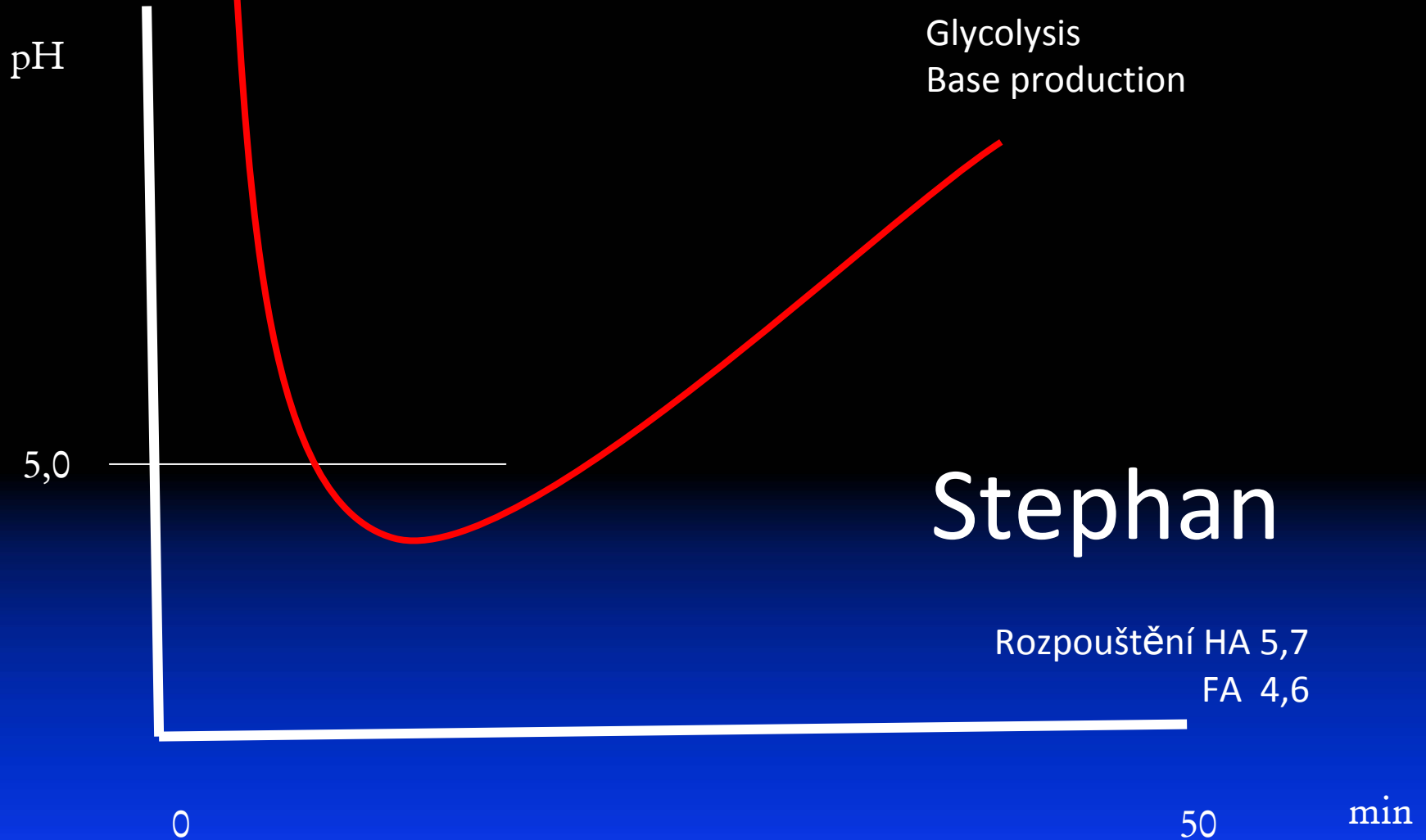


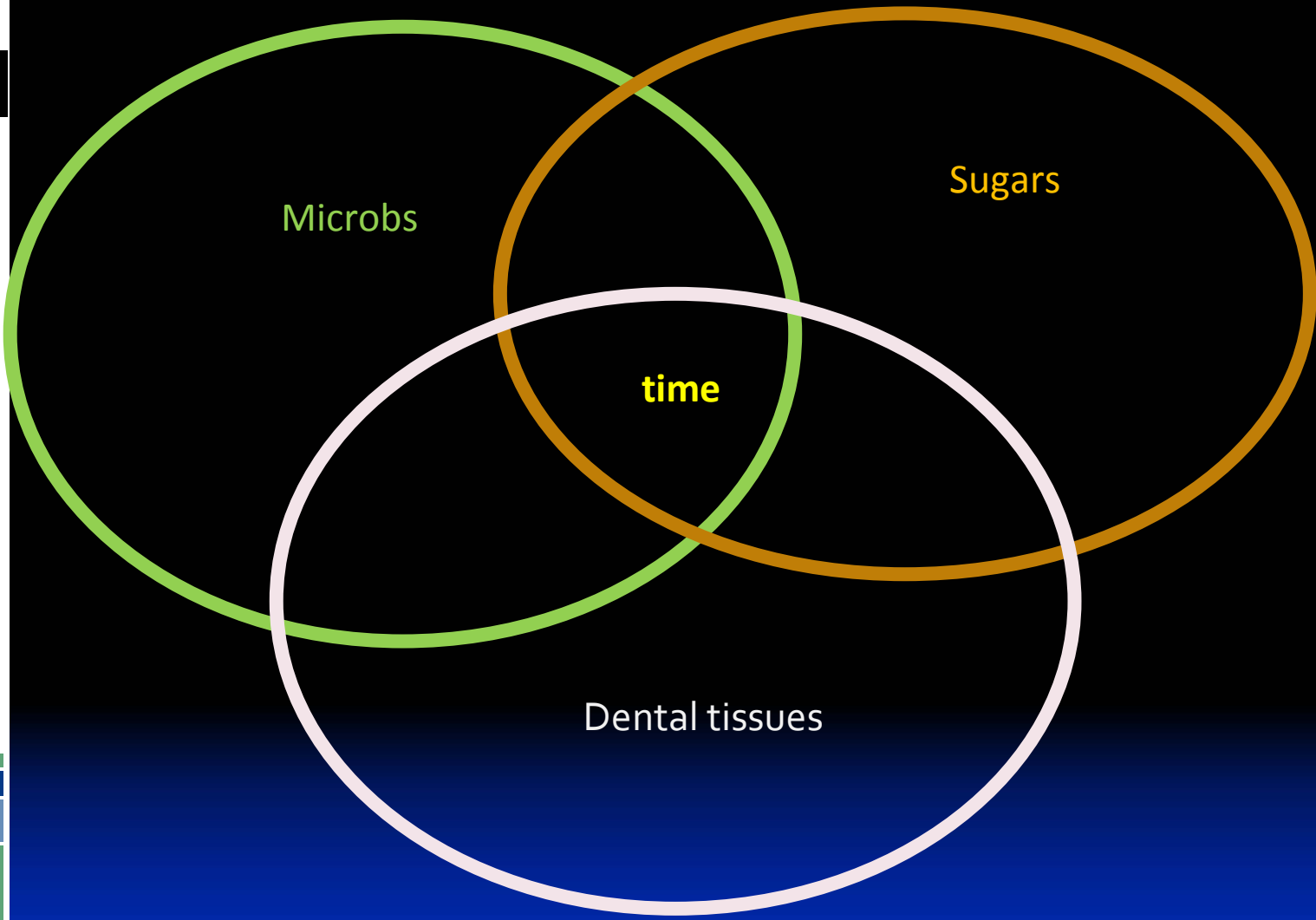
Higher metabolic activity
Higher resistency
(CHX 300x, AF 75x)
Higher virulency
Good conditions for survival

Cariogenicity

- Streptococci: mutans, sanguis, mitis, sobrinus.
 - Laktobacily
-
- *Production of acids (acidogenity)*
 - *Production of extra aand intracelullar polysacharids*
 - *Survival in acidic environment (aciduricity)*

Metabolic procedures in dental biofilm





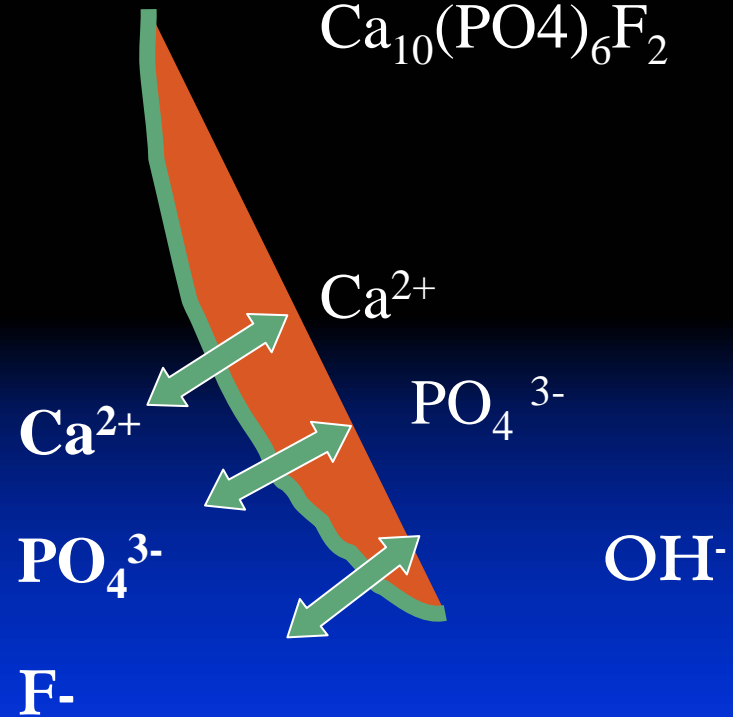
Microbs

Sugars

time

Dental tissues

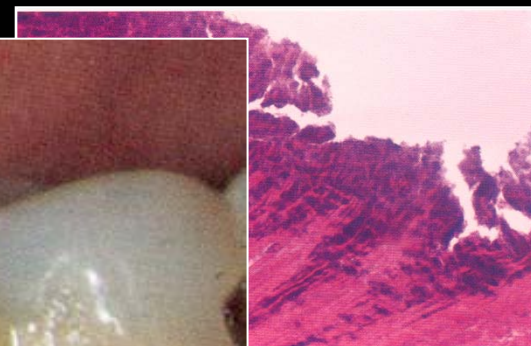




Demineralization

Reverzibil

Ireverzibil -cavitated lesion



Time

Plaque = biofilm

- **Nespecific hypothesis**



Plaque is always the reason

- **Non specific hypothesis**



Only pathogenic plaque is the causal factor

Saliva and dental caries

- 700 – 800 ml. (0,3ml), stimulated (1ml).

Clearance

- Microbs
- Rests of food

Saliva and dental caries

- Minerals

Calcium and phosphates – oversaturated solution remineralization

Proteins

Glykoproteins - pellicle, barrier against overgrowing of crystals on the surface

Buffer capacity of saliva

- Bicarbonate system
- Phosphate system
- In saliva not in plaque

Slina

- Klíčová role v maturaci skloviny
- V remineralizaci iniciálních kazivých lézí
- V remineralizaci demineralizovaných okrsků skloviny

Inicial caries lesion



Porosity



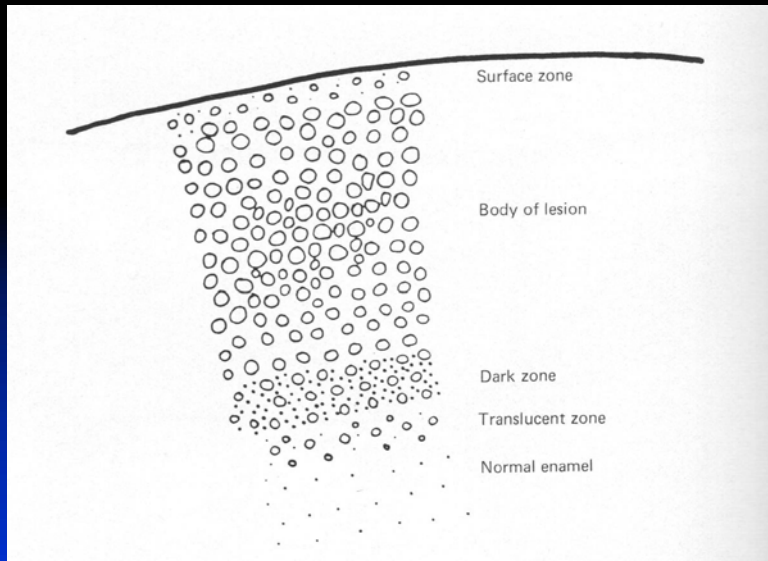
Superficial zone
5 %

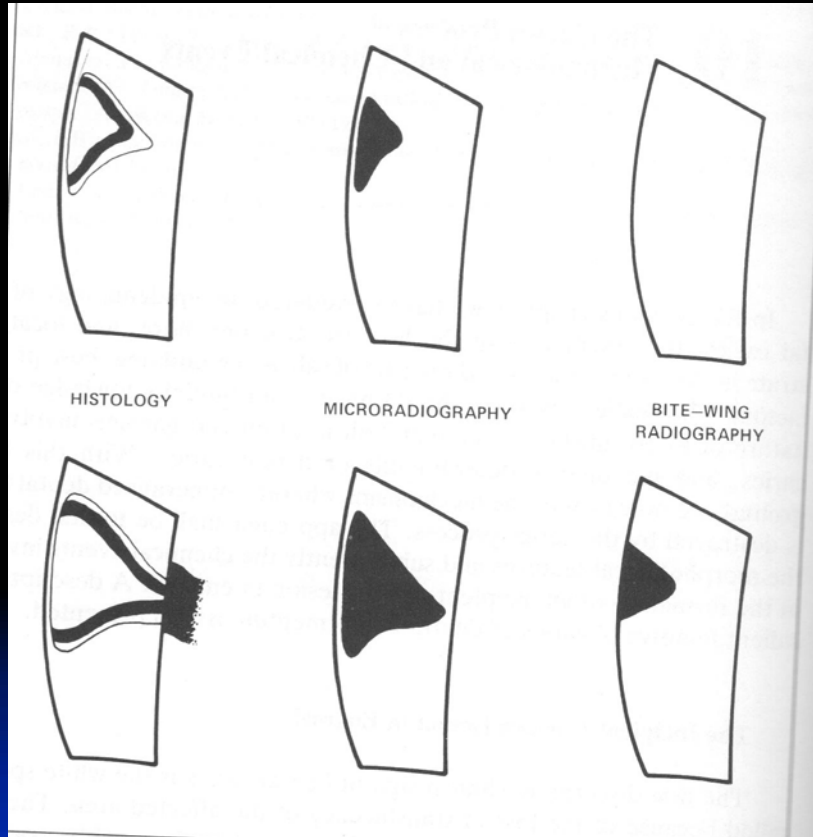
Body of lesion
AŽ 25%

Dark zone
2 – 4%

Translucent zone
1%

Normal enamel
0,1%





Histology x microradiography x BW

Principles of approach

- **Identify** – all potentially risk factors, eliminate or minimize them

prevent

Restore

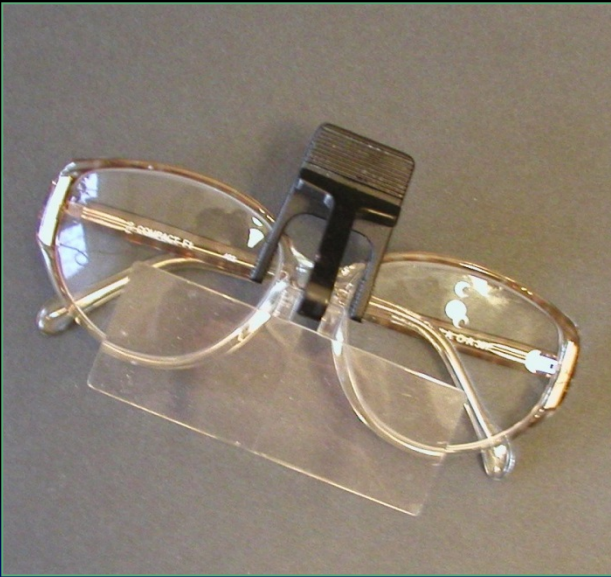


Diagnosis

- Visual inspection (ICDAS)
- Radiography
- Photography
- Optical nonfluorescent methods
- Optical fluorescent methods
- Transillumination
- Measurement of electrical impedancy

Diagnosis

- ICDAS – INTERNATIONAL CARIES DETECTION AND ASSESSMENT SYSTEM



Vizal inspection (ICDAS)

- ICDAS (2002)– 6 code, později ICDAS –II – 4code
- Caries lesions in pit and fissures, smooth surfaces, roots are next to– CARS (Caries Associated with Restoration and Sealants)
- Blunt probe
- clean and dry surfaces, time of observation 5 s.
- <http://www.icdas.org/courses/english/index.html>

ICDAS – criteria

- 0 – zdravé zubní plošky



Code 0 before sectioning tooth



Code 0 after sectioning tooth

ICDAS - criteria

- **1** – first changes that can be seen on dry tooth surface only (white, brown)



ICDAS - criteria

- 2 – clearly seen changes visible also on moist surfaces, white, brown.



ICDAS - criteria

- **3** – demineralization , damage of structure of enamel struktury skloviny without dentin exposure, opacity and beown of black spots hnědavé nebo černé aout of pit and fissures, can be seen on moist and dry surface



ICDAS - criteria

- 4 – shadow going from depth of dentin, gray, blue, brown.



Code 4 before sectioning tooth



Code 4 after sectioning tooth

ICDAS - criteria

- 5 – clear cavitation loss of enamel.



ICDAS - criteria

- 6 – large cavitation, big part of enamel and dentin can be lost and dental pulp can be affected



















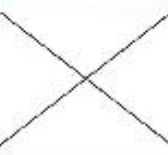



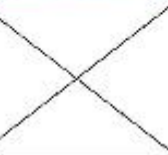
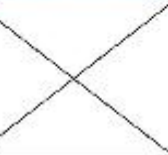


ICDAS II - modification

















0:			<p>Žádná nebo nepatrná změna v průsvitnosti skloviny po delším osušování vzduchem (>5 sekund).</p> <p>Žádná demineralizace skloviny anebo úzká opákní zóna.</p>
1:			<p>Opacita nebo diskolorace obtížně viditelné na mokřem povrchu, avšak jasně zřetelné po osušení vzduchem.</p> <p>Demineralizace skloviny omezená na vnějších 50 % vrstvy skloviny.</p>
2:			<p>Opacita nebo diskolorace jasně zřetelná bez osušení vzduchem.</p> <p>Bez rozpoznatelné klinické kavitace. Demineralizace zasahující mezi 50 % skloviny a vnější třetinou dentinu.</p>
3:			<p>Lokalizované porušení skloviny v opákní nebo diskolorované sklovině, +/- našedlá diskolorace ze spodního dentinu. Demineralizace zasahuje prostřední třetinu dentinu.</p>
4:			<p>Kavitace v opákní a diskolorované sklovině ohrožující spodní dentin.</p> <p>Demineralizace zasahuje vnitřní třetinu dentinu.</p>

UniViss – universal scoring system (okluze)

- Active/non active lesion

Universal Visual Scoring System for pits and fissures (UniViSS occlusal)						
Second step: Discoloration Assessment	First step: Lesion Detection & Severity Assessment					
	First visible signs of a caries lesion	Established caries lesion	Microcavity and/or localised enamel breakdown	Dentin exposure	Large cavity	Pulp exposure
	Score F	Score E	Score M	Score D	Score L	Score P
Sound surface (Score 0)	No cavitations or discolorations are detectable.					
White (Score 1)						
White-brown (Score 2)						
(Dark) Brown (Score 3)						
Greyish translucency (Score 4)						

UniViss (smooth surfaces)

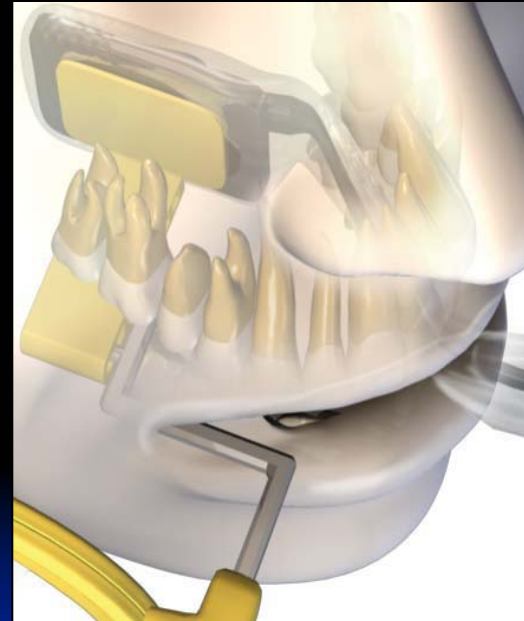
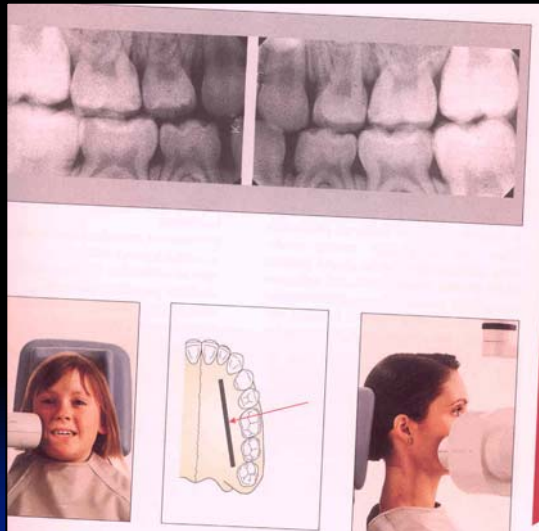
Universal Visual Scoring System for smooth surfaces (UniViSS smooth)						
Second step: Discoloration Assessment	First step: Lesion Detection & Severity Assessment					
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Sound surface (Score 0)	No cavitations and/or discolorations are detectable					
White (Score 1)						
White-brown (Score 2)						
(Dark) Brown (Score 3)						
Greyish translucency (Score 4)						

Photography

- Good documentation and evaluation of lesion
- Flash and light can misrepresent



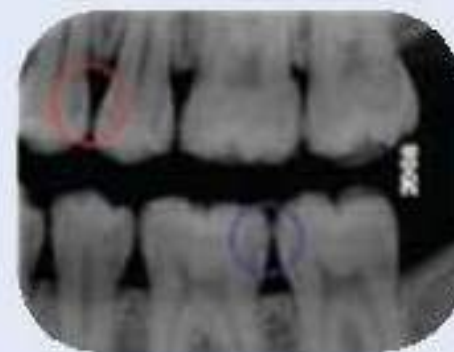
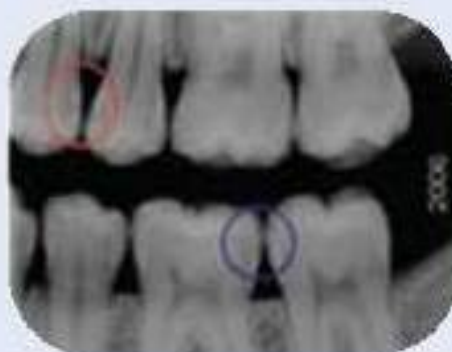
Bitewing



Grading

Klinické: **Identifikace** - Vyšetření: Bitewing rtg

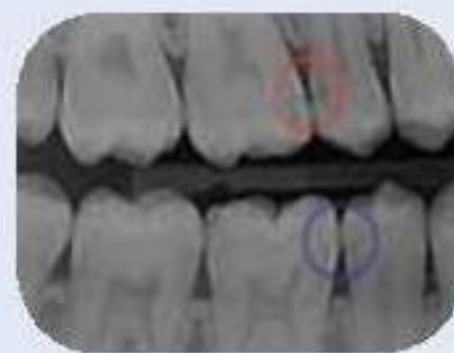
Léze skloviny		ICDAS
E1	Vnější polovina skloviny	0, 1
E2	Vnitřní polovina skloviny	1
Léze dentinu		ICDAS
D1	Vnější třetina dentinu	2
D2	Prostřední třetina dentinu	3
D3	Vnitřní třetina dentinu	4



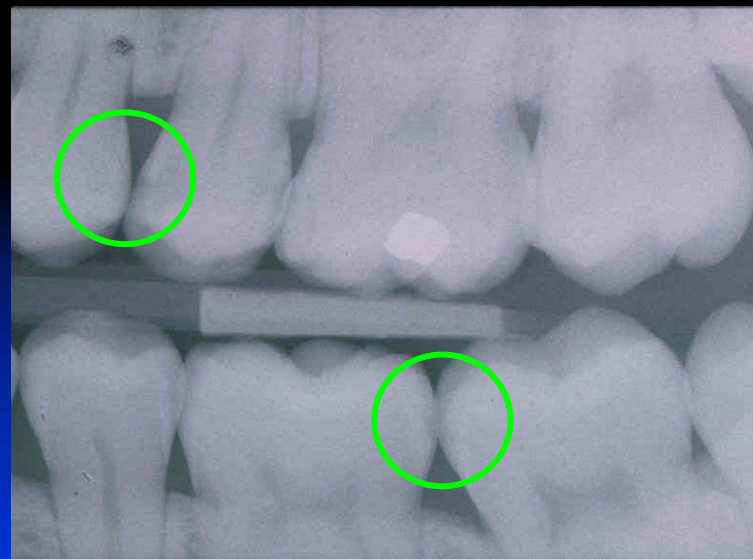
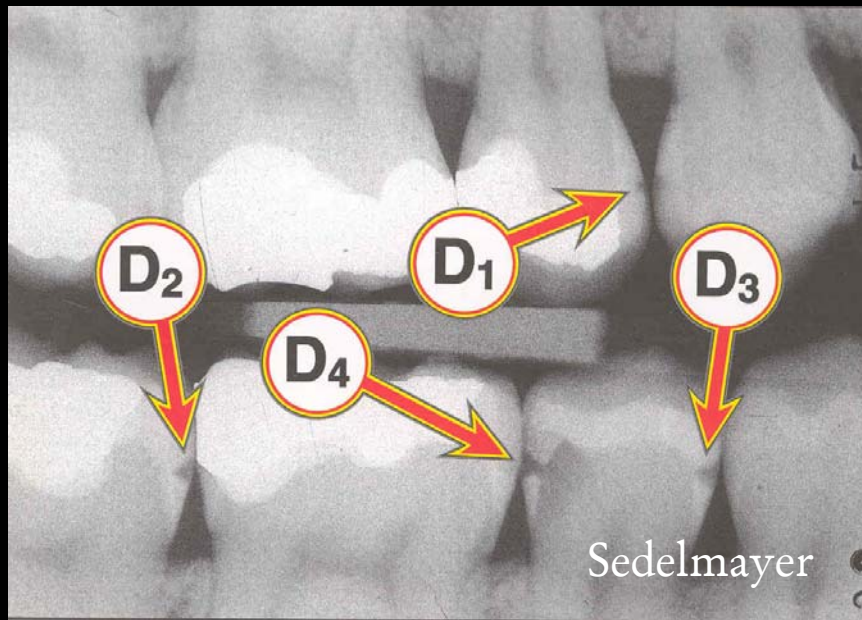
Kontrola za 2 roky u počátečních lézí D-1 (modrá) a D-2 (červená)



D-3



D-1 a D-2



RTG vyšetření - Bite Wing

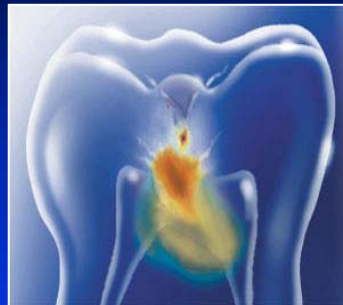
Optical non fluorescent methods

- Optickým Caries monitorem (OCM)
- **Distortion of light**

Optical fluorescent methods

Fluorescence absorption and irradiation back

- DIAGNOdent, DIAGNOdent pen, QLF, Vista Proof

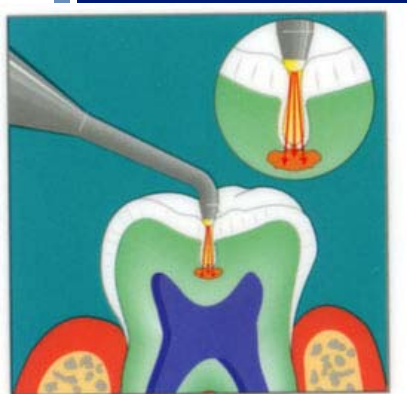




Infrared laser fluorescence

- DIAGNOdent, DIAGNOdent pen

DIAGNODENT

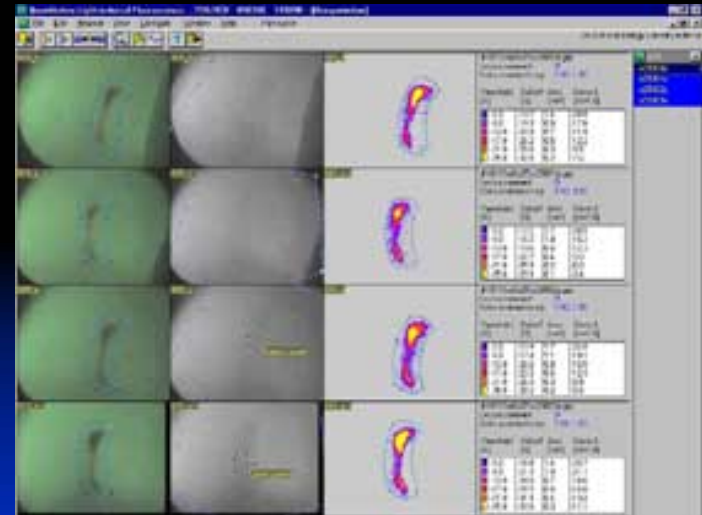


DIAGNODENT perio probe




Quantitative Light induced Fluorescence

QLF

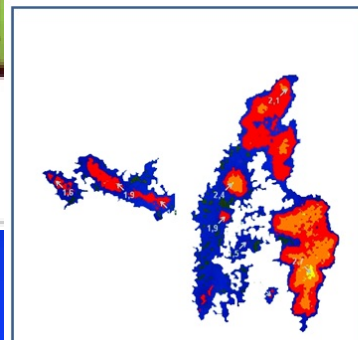
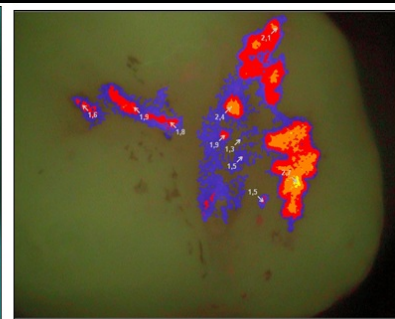
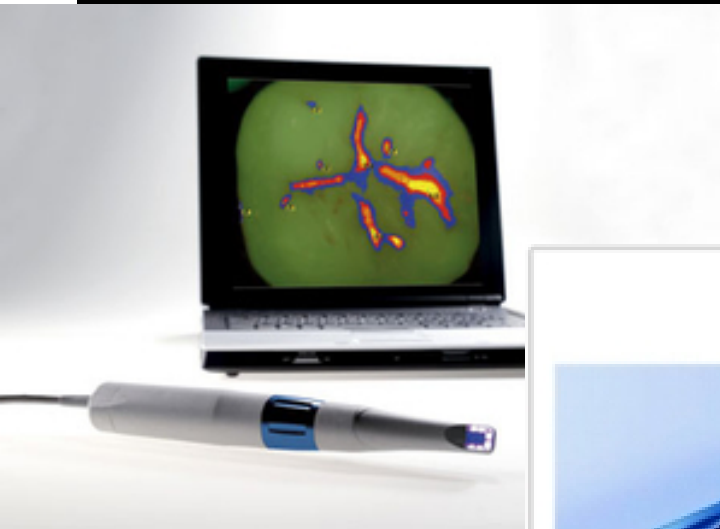




Vista Proof

- Based on fluorescence
 - Carious defect red, non carious green.
 - **Vista Cam iX**
 - **SoproLife**
- 

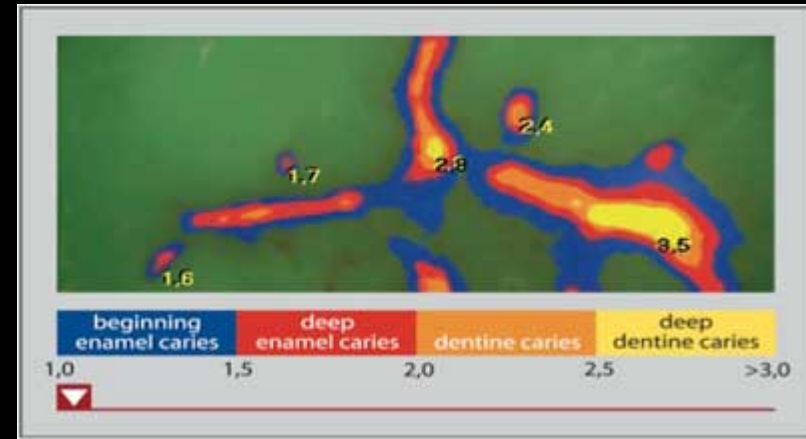
Vista Proof



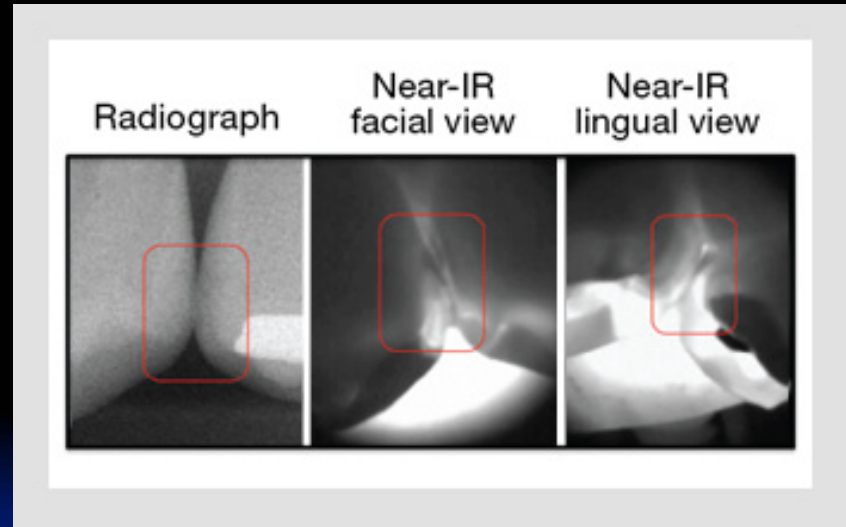
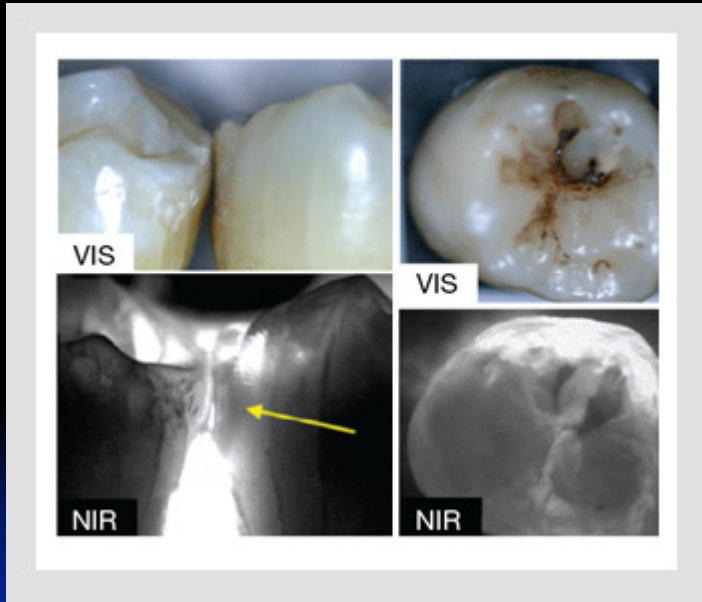
Vista Cam iX



SoproLife



FOTI - fibre optic transillumination



DIFOTI

(D i g i t a l F i b r e O p t i c
T r a n s - I l l u m i n a t i o n)

- Camera ccd sensor



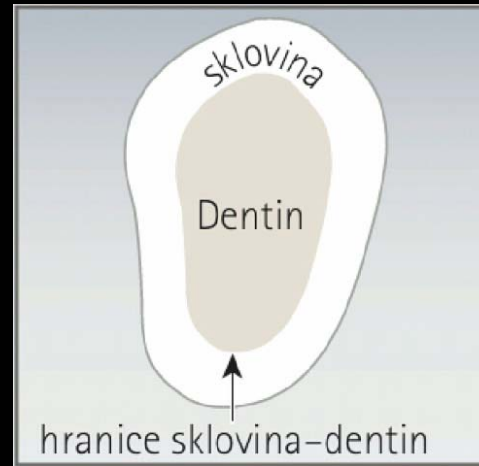
DIAGNOCam



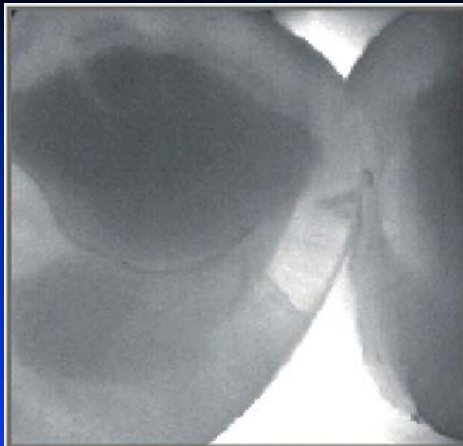
- DIFOTI (Digital Imaging Fiberoptic Transillumination)
- light (700-1400nm)
- Caries lesions and cracks –light absorption – dark spots
(kazivé léze mají větší obsah vody- velká absorpce světla)
- Documentation

DIAGNOCam-clasificación

- 0 -

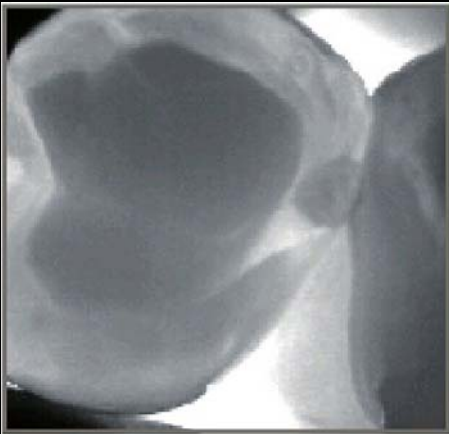


- 1 - FIRST VISIBLE SIGNS

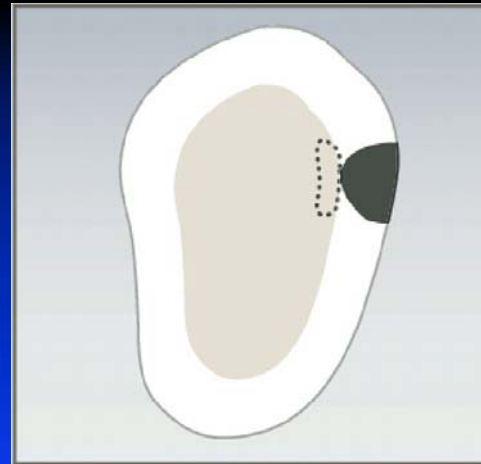
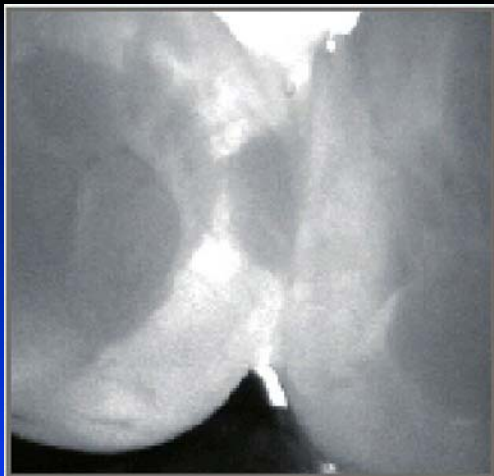


DIAGNOCam- klasifikace nálezu

- 2- enamel caries



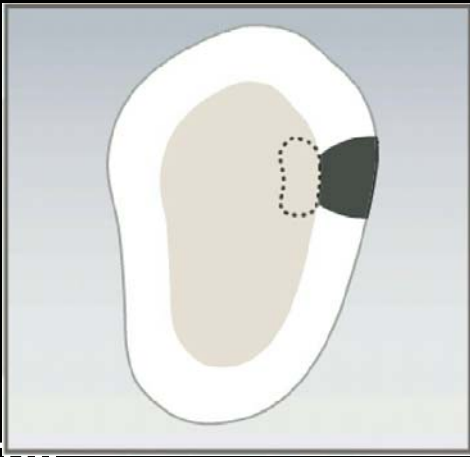
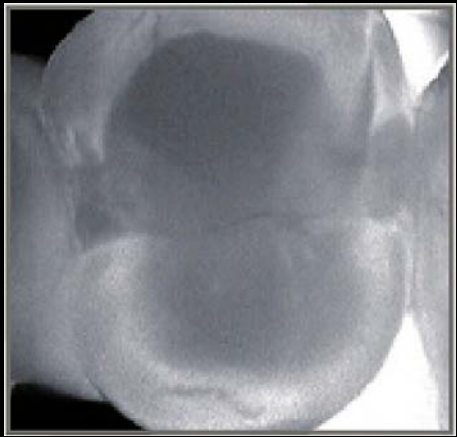
- 3 - enamel caries at the border of dentin



DIAGNOCam- klasifikace

nálezů

- 4 – caries where also dentin is affected – for minimally invasive treatment



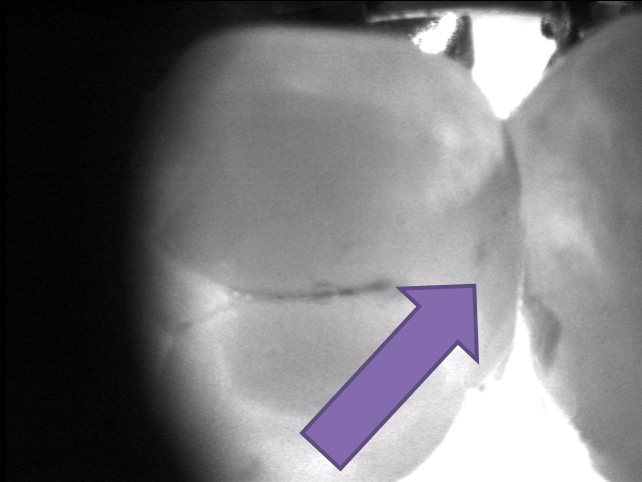
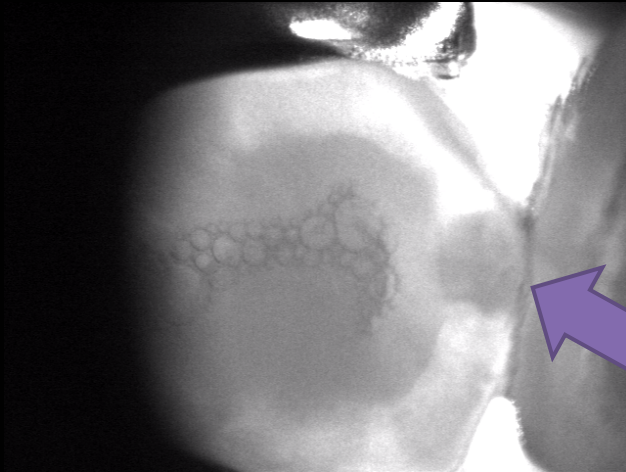
- 5 – caries in dentin – drill and fill



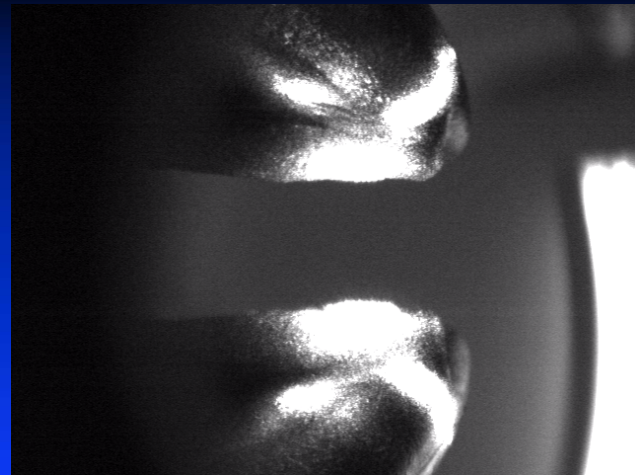
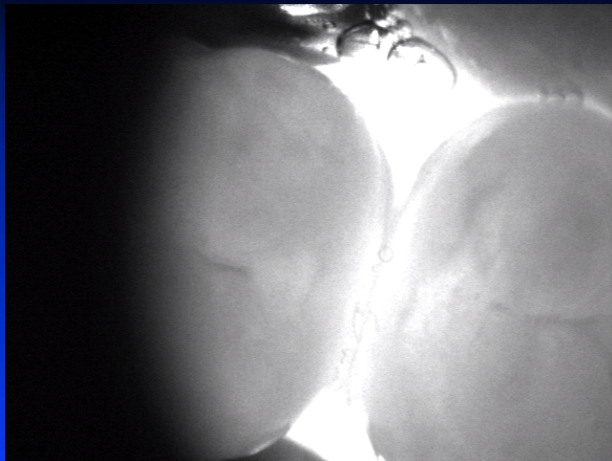
DIAGNOCam



- **Nález kazu**



- **???**

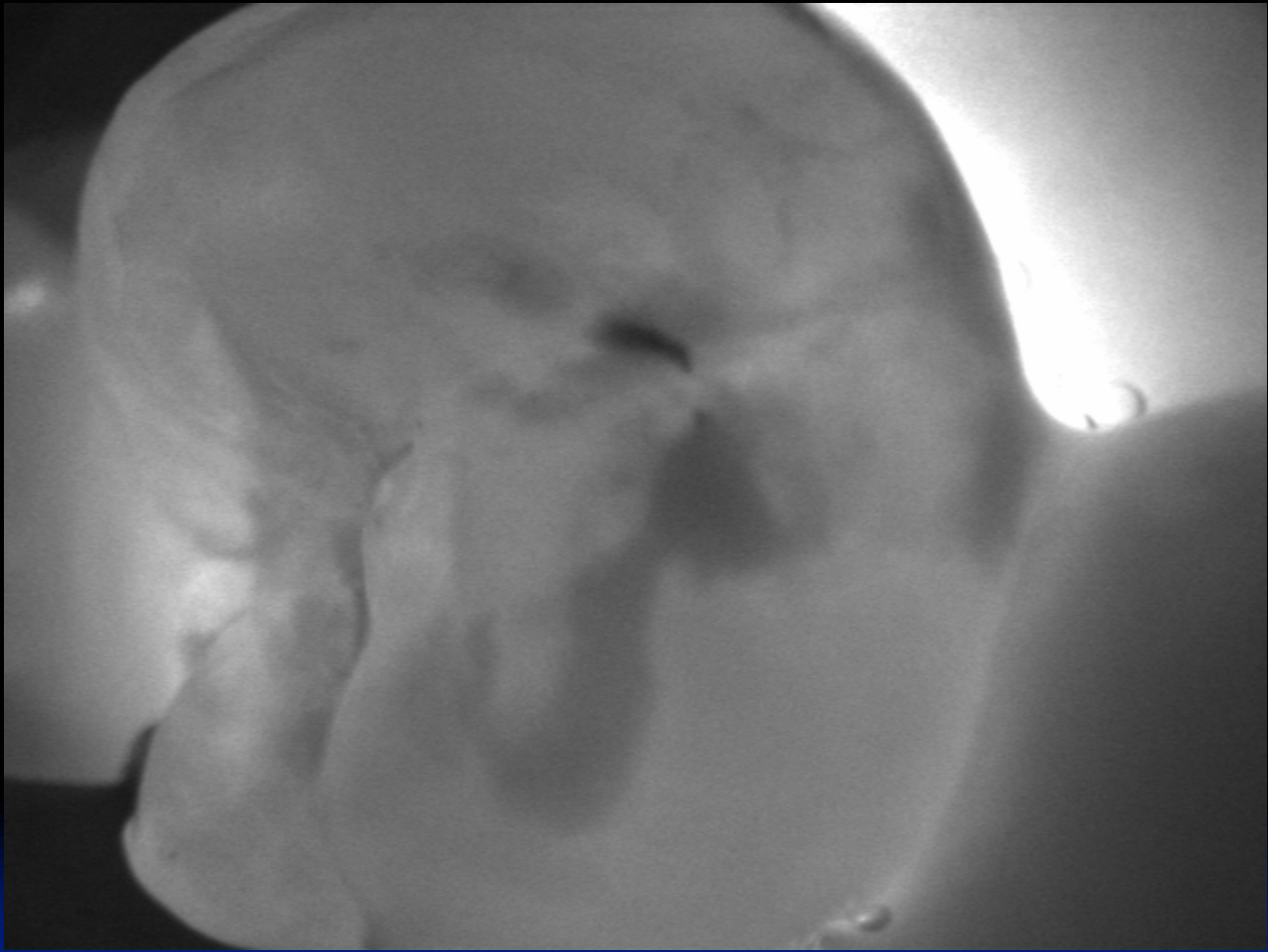


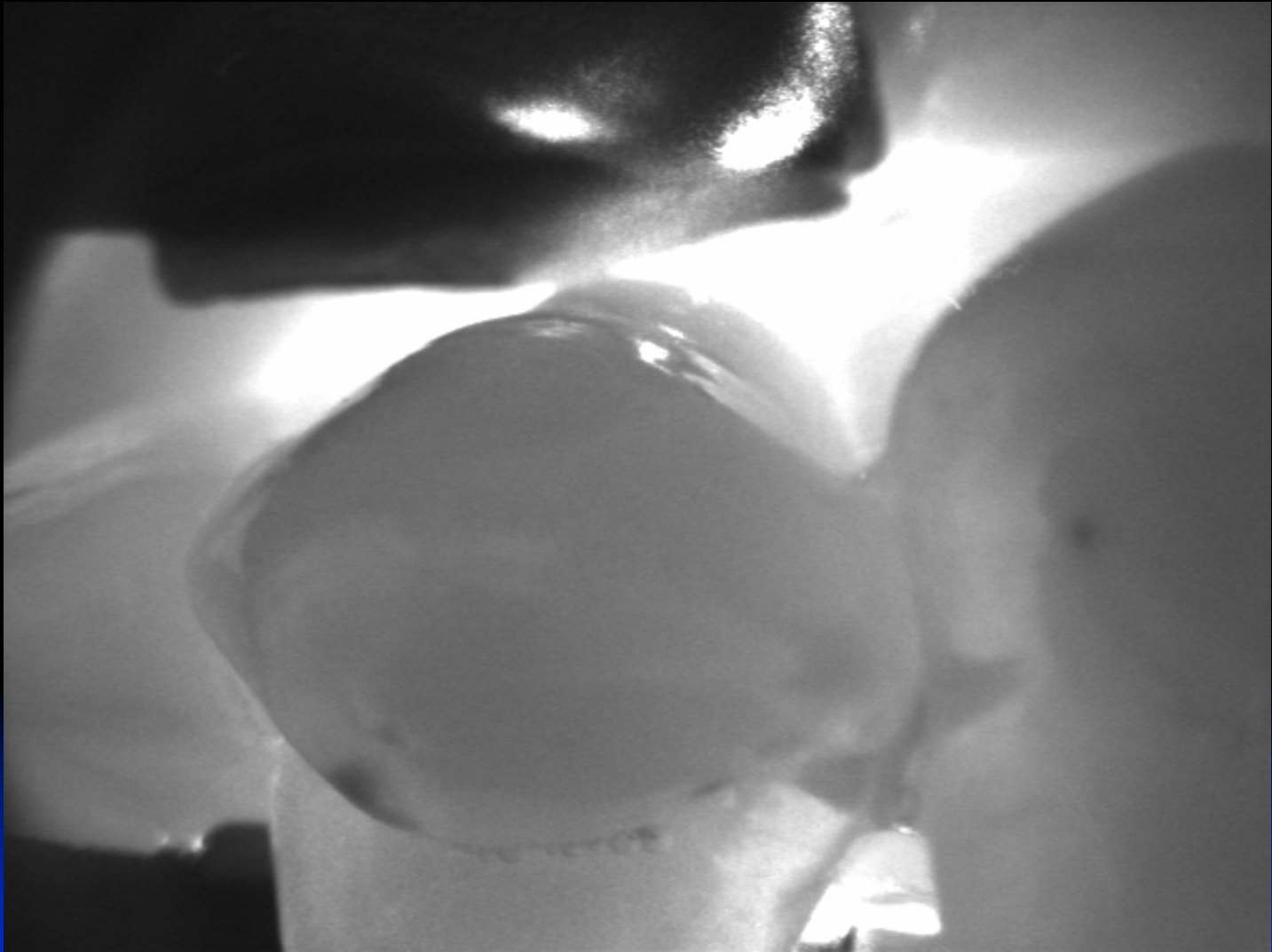


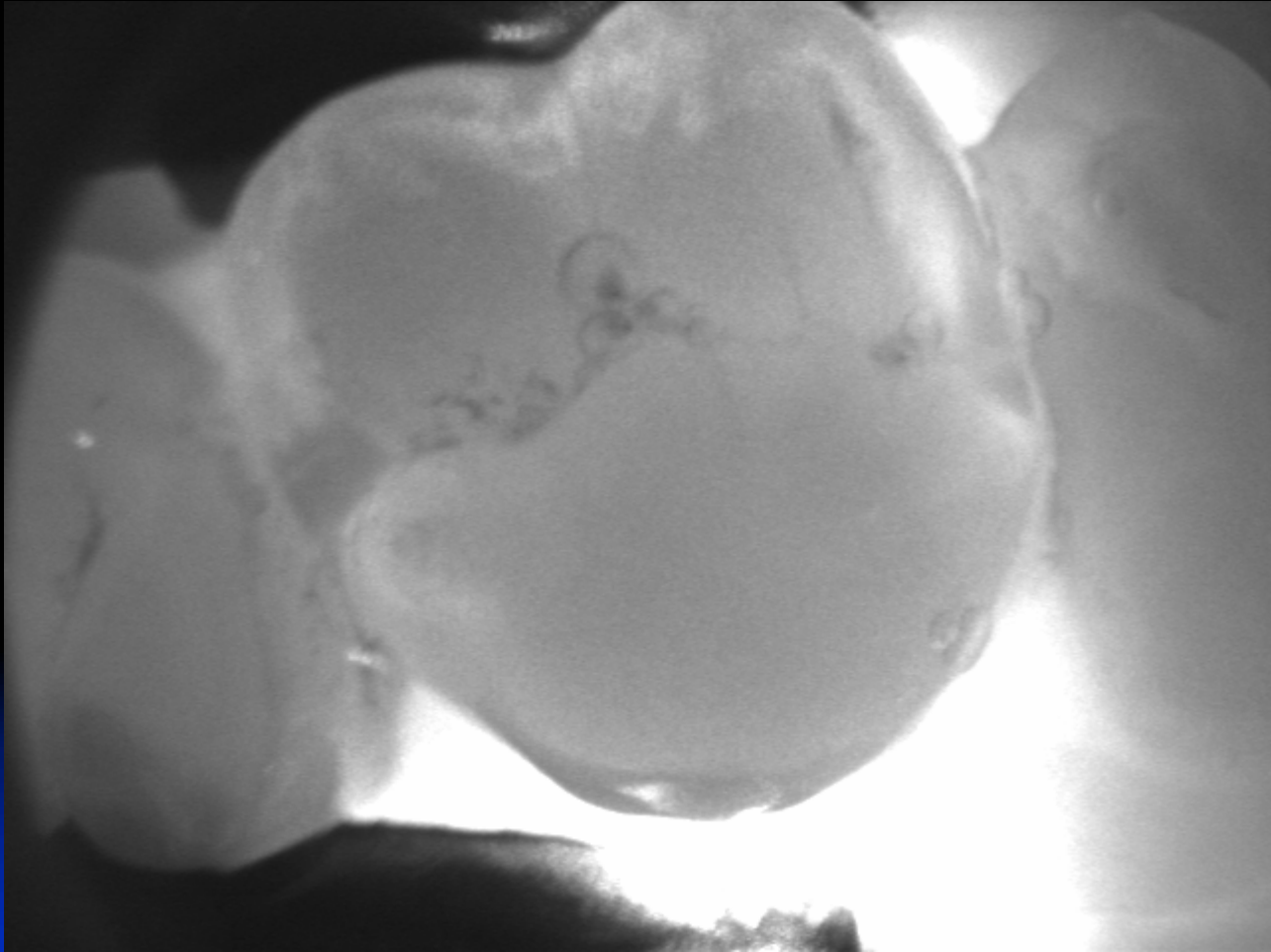
Diagnocam



Bitewing







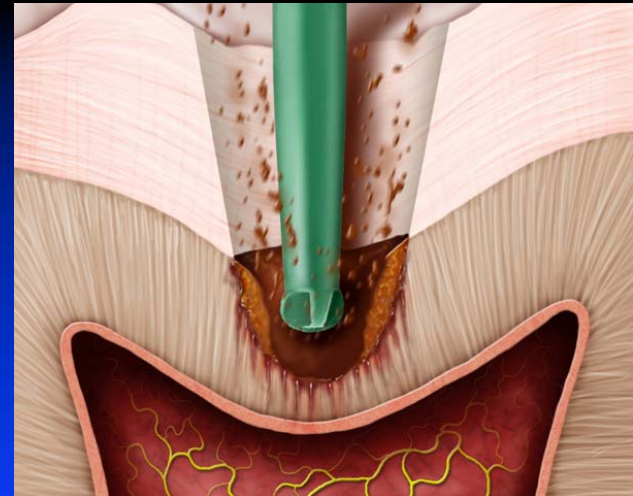
Transiluminace pomocí optického vlákna- FOTI

- Přístroje k diagnostice aproximálních kazů (KaVo DIALux probe)
- + vyšší senzitivita než RTG snímek a opakovatelnost vyšetření
- - necitlivost přístroje na léze kolem výplní a nemožnost zhotovovat snímky a dokumentovat stav



Měření elektrického odporu

- Ztráta vápníku a fosfátů - zvyšování elektrické vodivosti skloviny
- CarieScan Pro – měření impedance střídavého proudu vyslaného skrze zub, impedance zdravé zubní tkáně je vyšší, než demineralizované
- Sensor (hrot) – manžeta – retní háček slouží k uzavření elektrického obvodu – software (barevné kódování + číselná hodnota 0-100)



Combination of diagnostic method gives best results

- Occlusal caries ICDAS + BW snímky
- Okluzní kazy dentinu – ICDAS + fluorescenční vyšetření
- Léze skloviny – laserová fluorescence + ICDAS + BW


Další možné techniky diagnostiky kazu...z praxe

- **Užití zubní nitě**- diagnostická pomůcka na detekování proximálních kazů a posouzení bodů kontaktu
- **Dočasné separace**- běžně užívané v orthodontické praxi, rychlá, levná neinvazivní metoda
- V případě nejisté diagnózy pomáhá rozhodnout
- - 2 návštěvy- nasazení a za 24 hod(či více dní) vytáhnutí



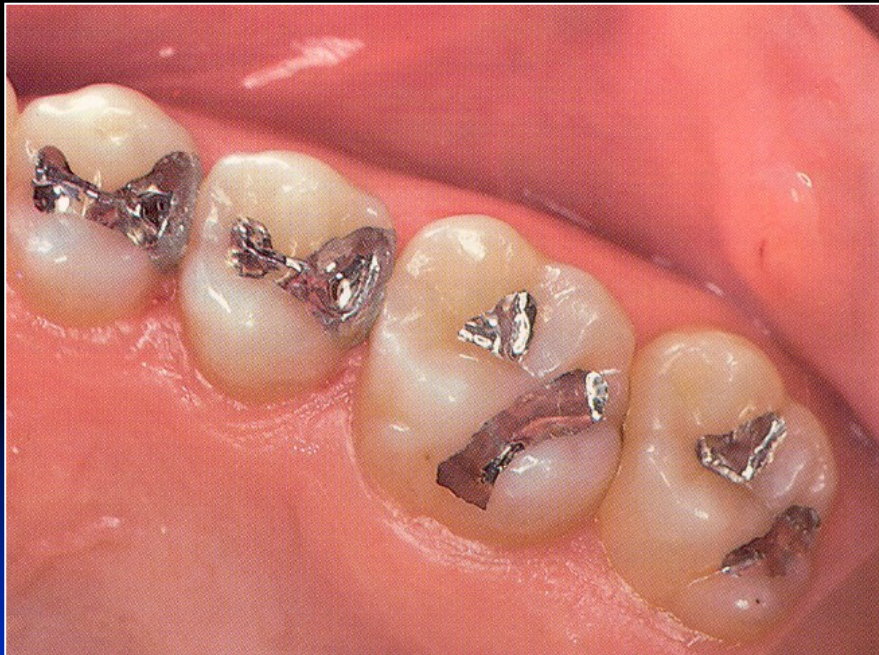
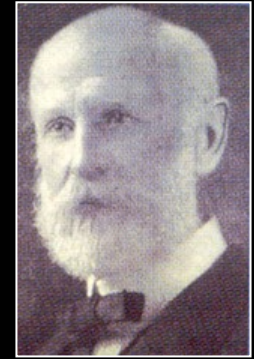


RESTORATIVE DENTISTRY II. 3. YEAR

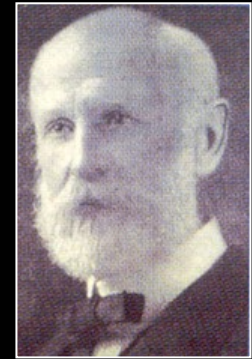


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lroubalikova@gmail.com

Extension for prevention

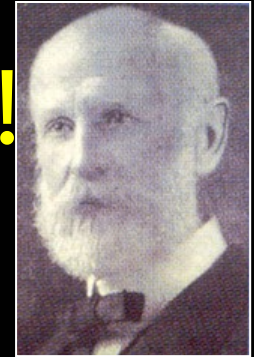


Preparation



Preparation is an instrumental treatment of carious tooth that leaves the rest of the tooth that is restorable, resistant and that prevent the origin of dental caries at the same surface.

Prevention of extension !



After good understanding of reasons of dental Caries we will be able to treat it effectively.

(G.V. Black 1900)



Classification of dental caries acc to Black

Classification of dental caries

Mount and Hume

- Location

1. Occlusal
2. Proximal
3. Cervical

- Size

1. Small
2. Medium
3. Big
3. Large

Classification acc. to Black

- Class I.

Pit and fissure caries



Classification acc. to Black

- Class II.

Proximal surfaces in premolars and molars



Classification acc. to Black

- Class III.

Proximal surfaces of incisors and canines without lost an incisal ridge



Classification acc. to Black

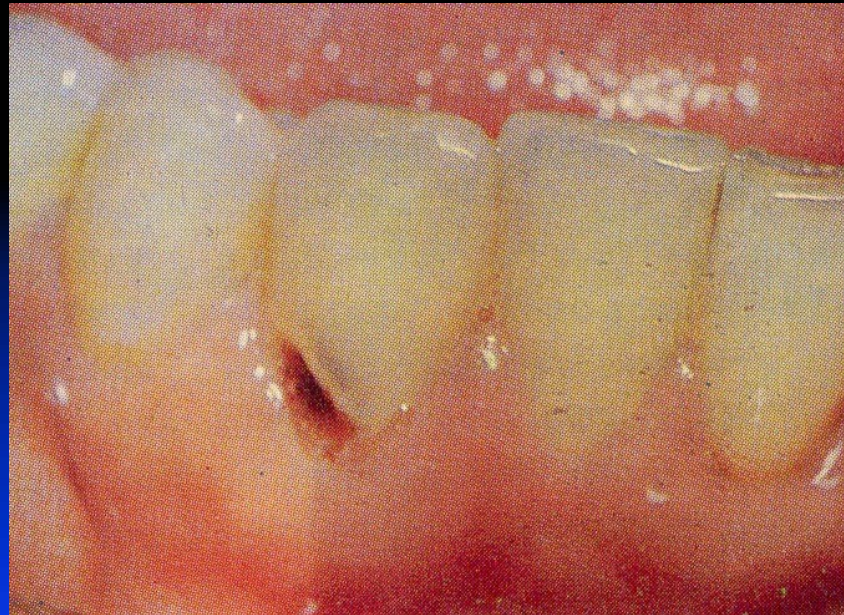
- Class IV.

Proximal surfaces of incisors and canines with lost an incisal ridge

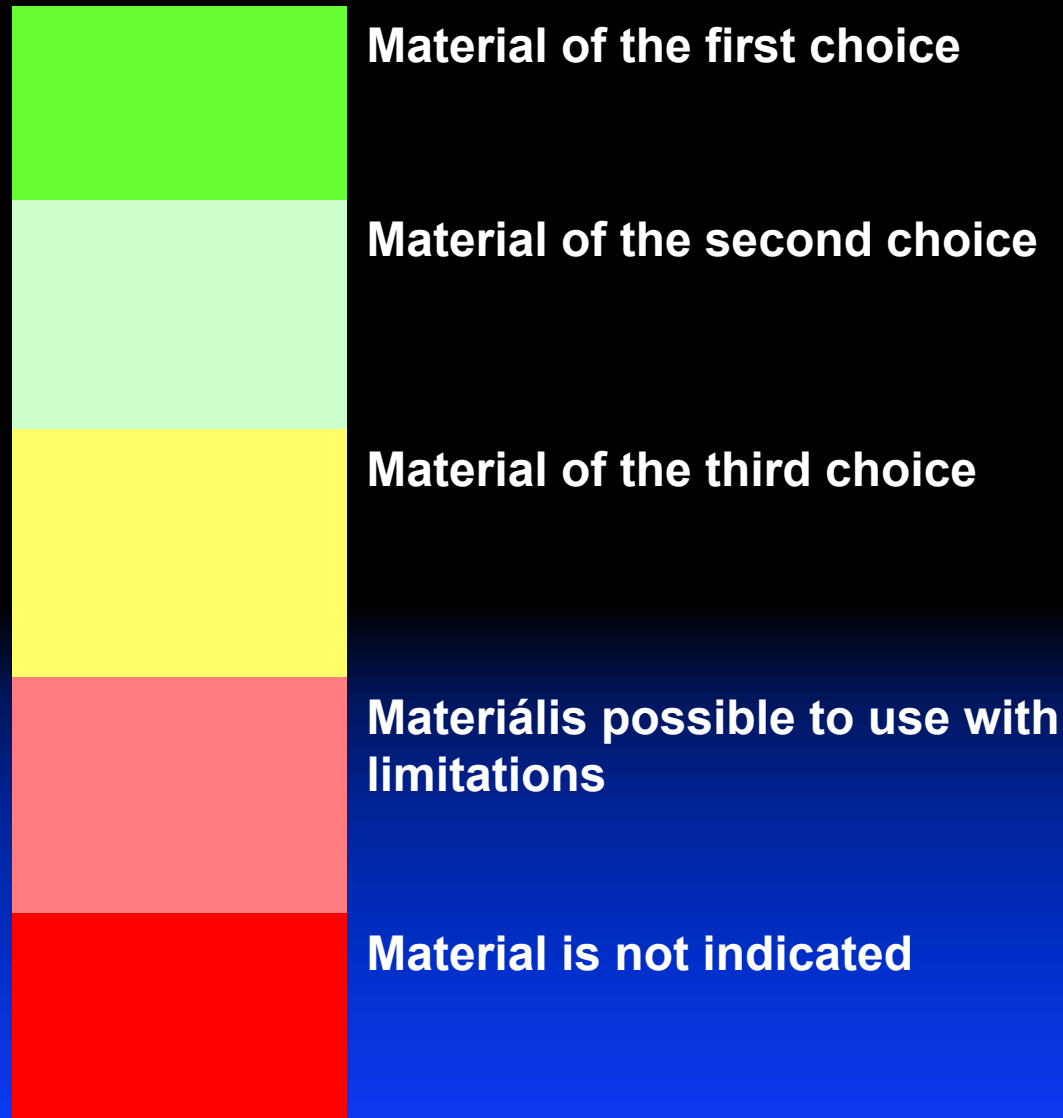


Classification acc. to Black

- Class V. cervical lesions



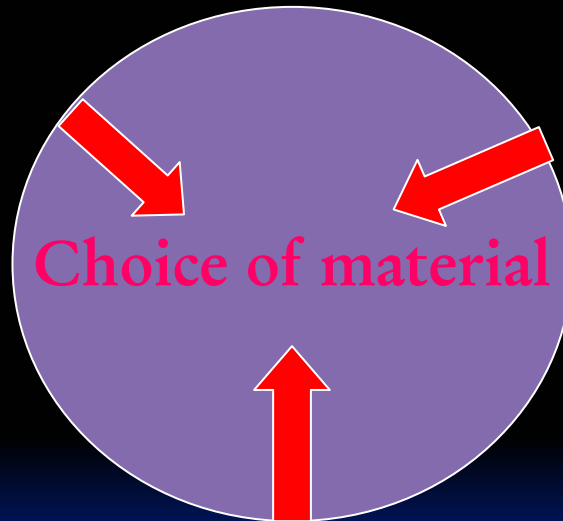
Indication of filling materials výplňových materiálů



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	Yellow	Yellow	Green	Green
Composite	Green	Green	Yellow	Yellow
Glassionomer	Light Green	Light Red	Dark Red	Red
Indirect restoration aesth.	Red	Red	Light Green	Light Green
Inlay metal	Red	Red	Light Green	Light Green

Indications of filling materials class III.

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

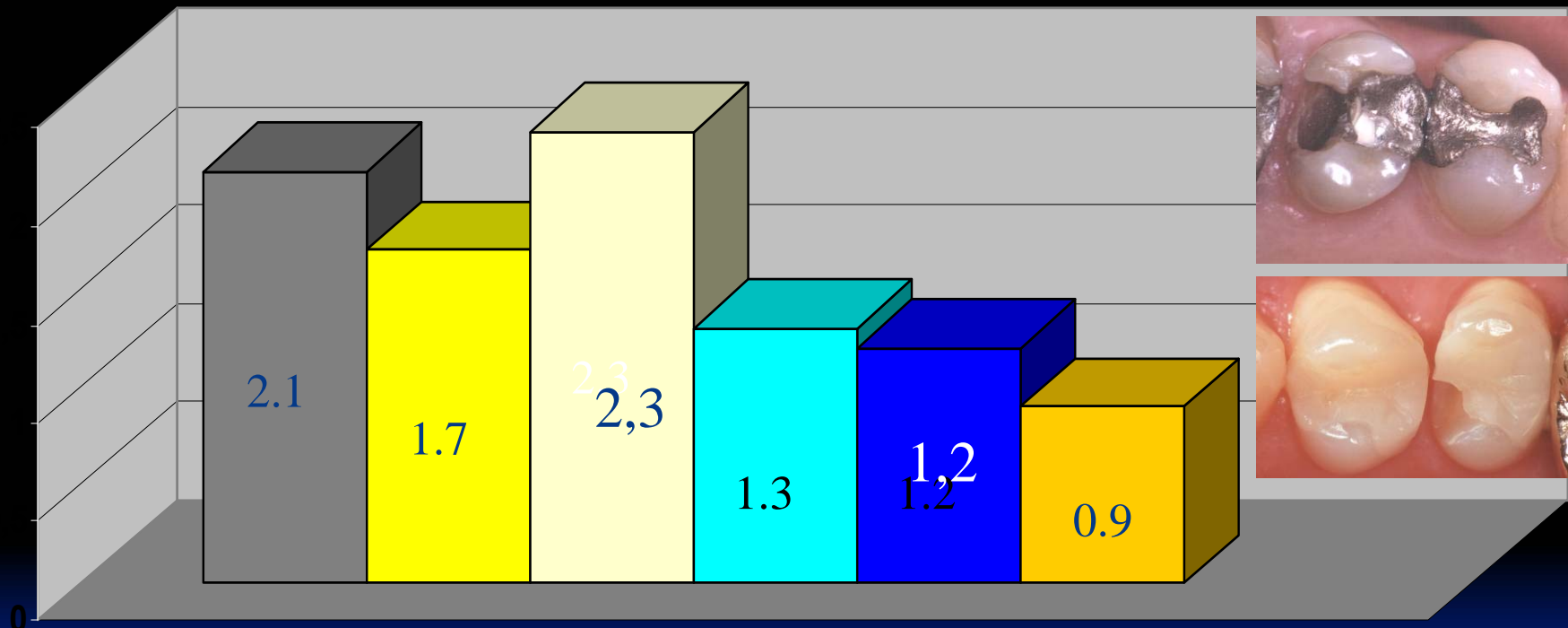
Longevity of restorations in posterior teeth

Private
Dentist



Failure

(≥ 2 roky)



Amalgam

Kompozit

Mikrofilní-inlay

Kermická -inlay

CAD/CAM-inlay

Zlatá-inlay

Ama1gám

Indikace



- ✓ 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

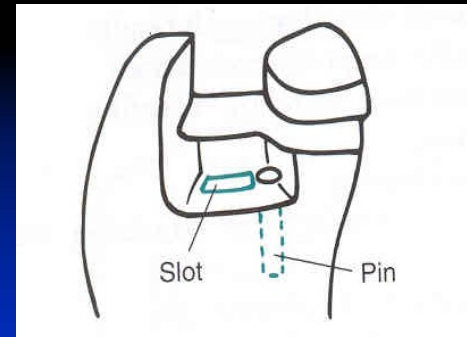
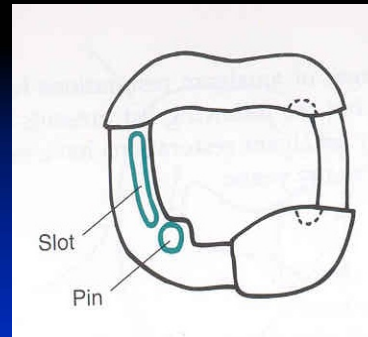
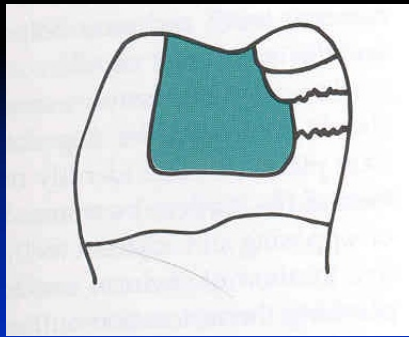
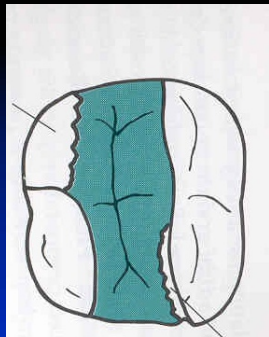
- ✓ Big reconstruction (core)
- ✓ *Temporary fillings*
- ✓ *(intermittent excavation).*

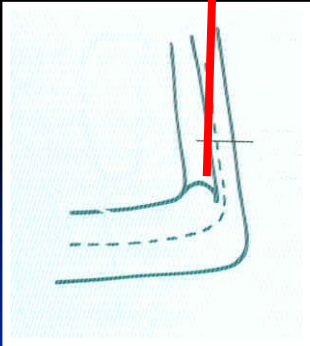
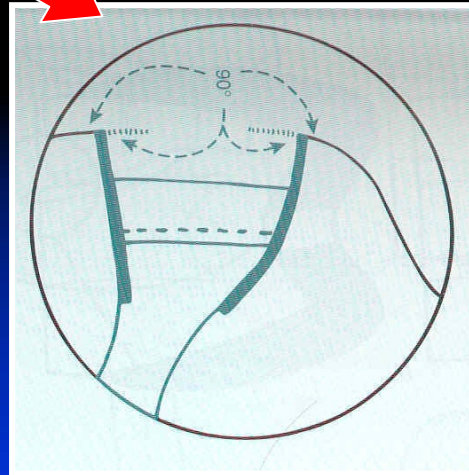
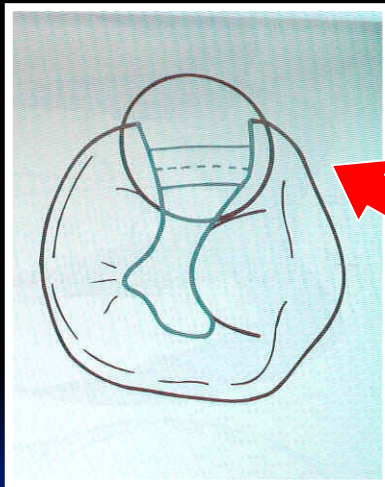
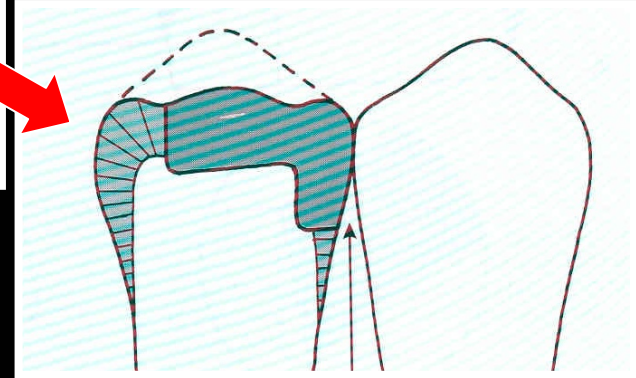
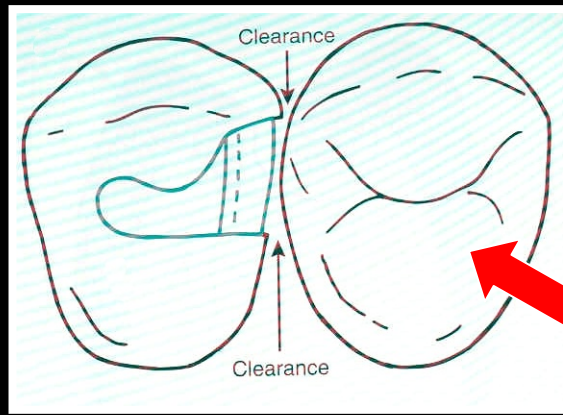
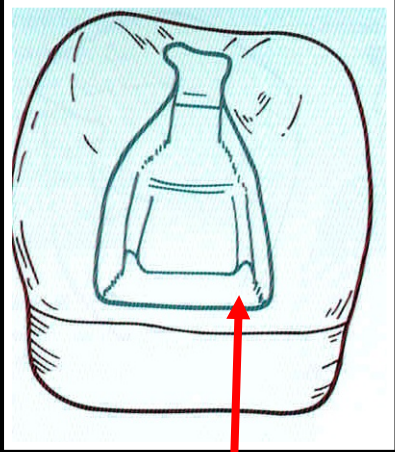


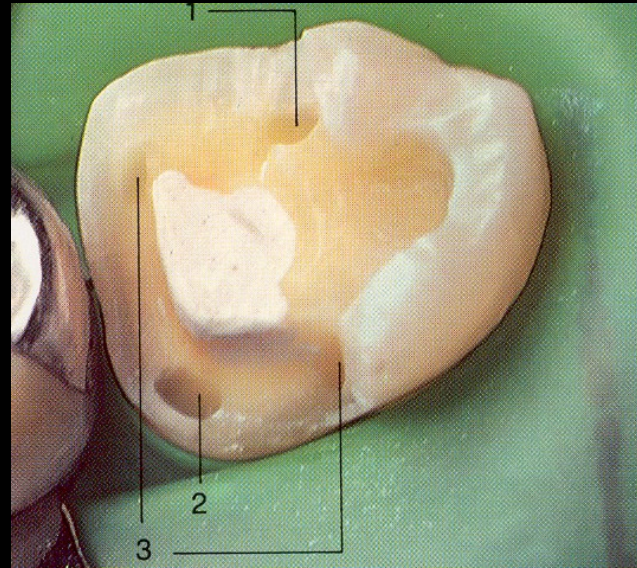
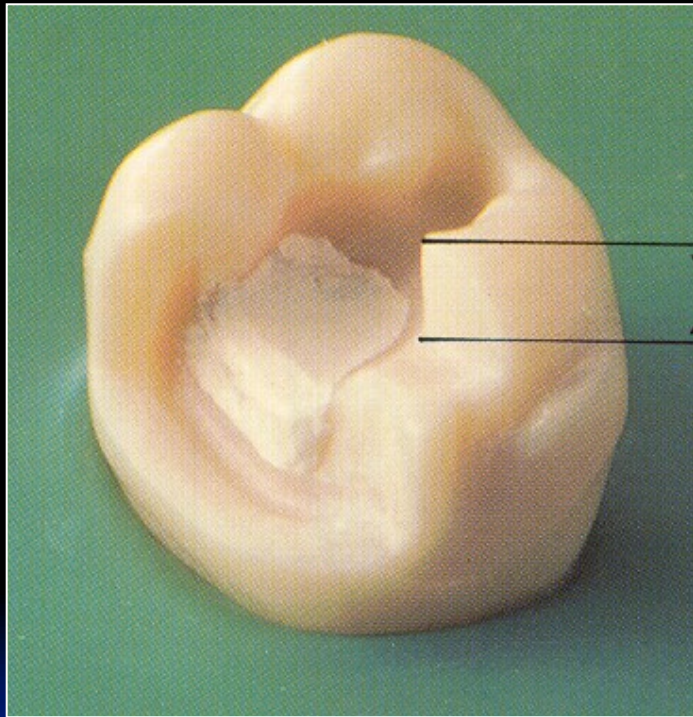
*Sturdevandt's Arto of Ecience of Operative
Dentistry*

Amalgam

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

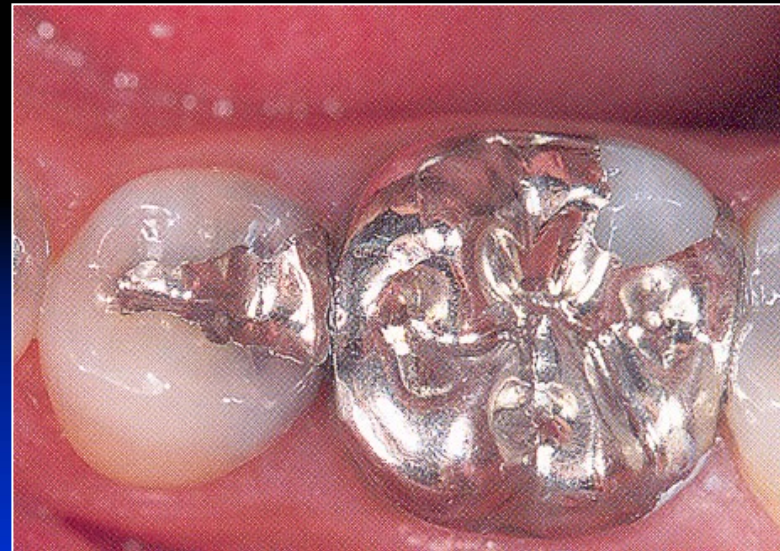








Sedlmayer J. Amalgám – zapomenuté řemeslo.



The most common mistakes

Preparation

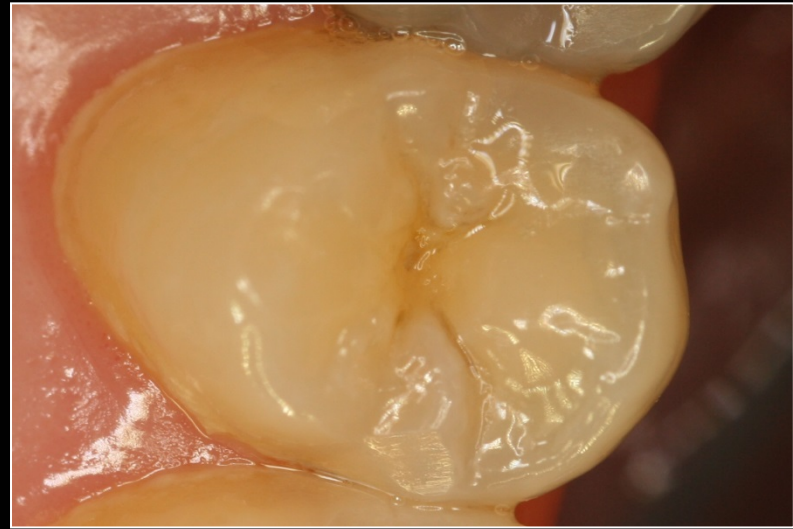
- *Sharp edges*
- *Bad configuration of the gingival wall*
- *Rough margins*
- *Weakening of the proximal ridge*



Manipulation

- Trituration – rpm, time.





Loss of resistance – 63% MOD cavity

*Ferrari, Scotti:
Fibre reinforced posts. Milano,
Masson 2001*

Contemporary trends in treatment of dental caries

- Miniinvasion
- Adhesive techniques

Indications

- Aesthetically prominent areas of posterior teeth
- Small - moderate classes I. that can be well isolated
- 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.



COMPOSITES IN POSTERIOR TEETH

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.

Indications

- Aesthetically prominent areas of posterior teeth
- Small - moderate classes I. that can be well isolated
- 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 fissure bur (or diamond burs)



Outline

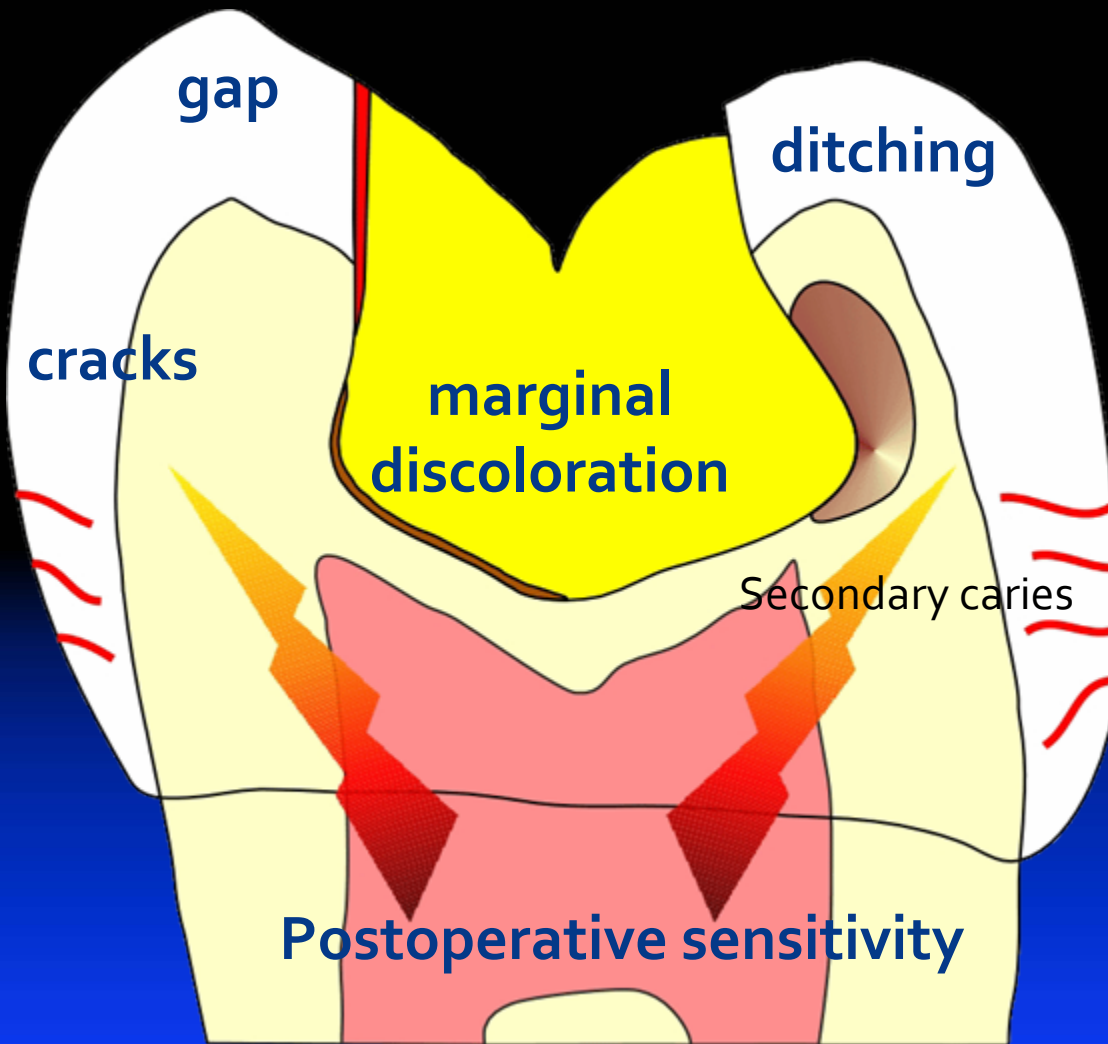
- Outline includes the caries lesion only
 - Fissures going into the caries lesion can be open and sealed.
- 

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 inly.

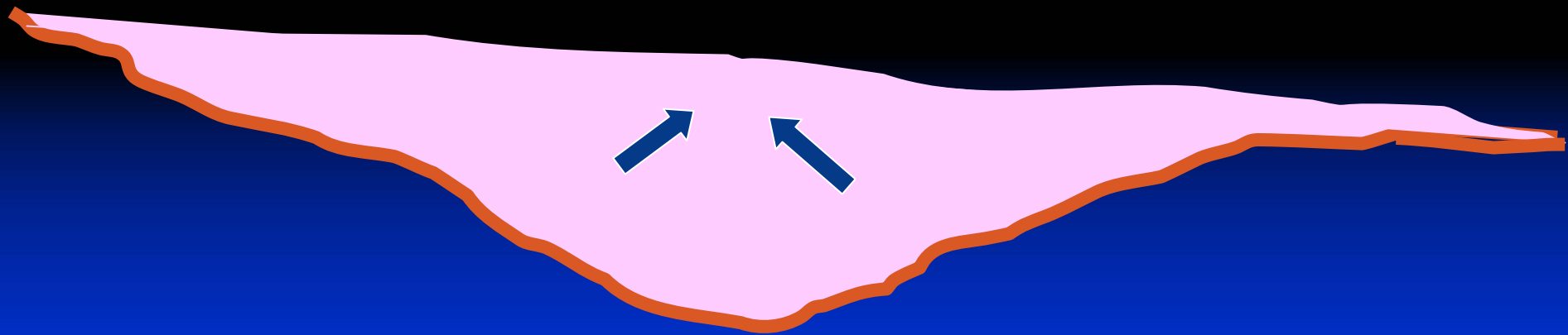
Removal of carious, infected, dentin and remaining defective enamel.

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



C - factor

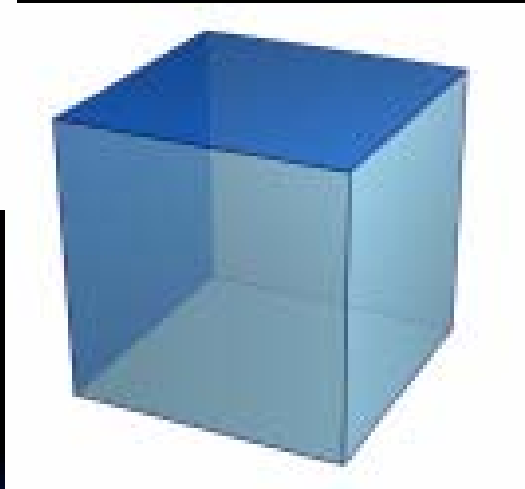
Surface of adhesion/free surface of the filling



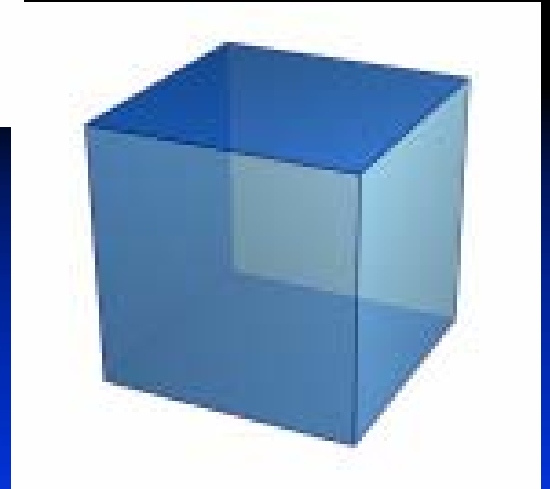
1/1 and less is optimal




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

Composite material (content of filler)
High content of the filler causes bigger stress
Flowable composites – low stress


depend on (polymerization stress)





Forces of polymerization
shrinkage
depend on


Geometry of the cavity (C-factor)

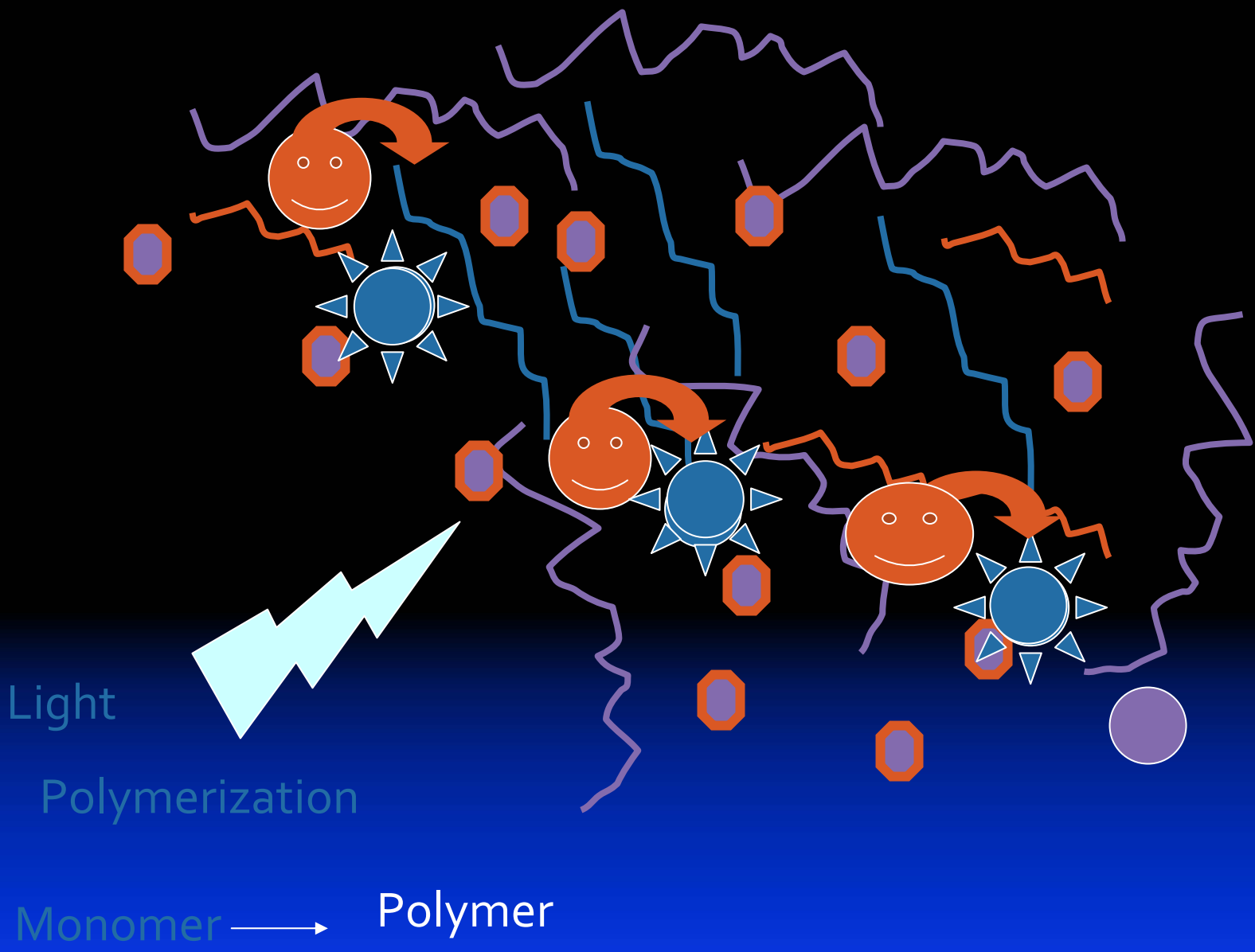


Forces of polymerization shrinkage depend on

- Mode of polymerization

Phases

- Pre-gel
 - G-point
 - Post -gel
- 

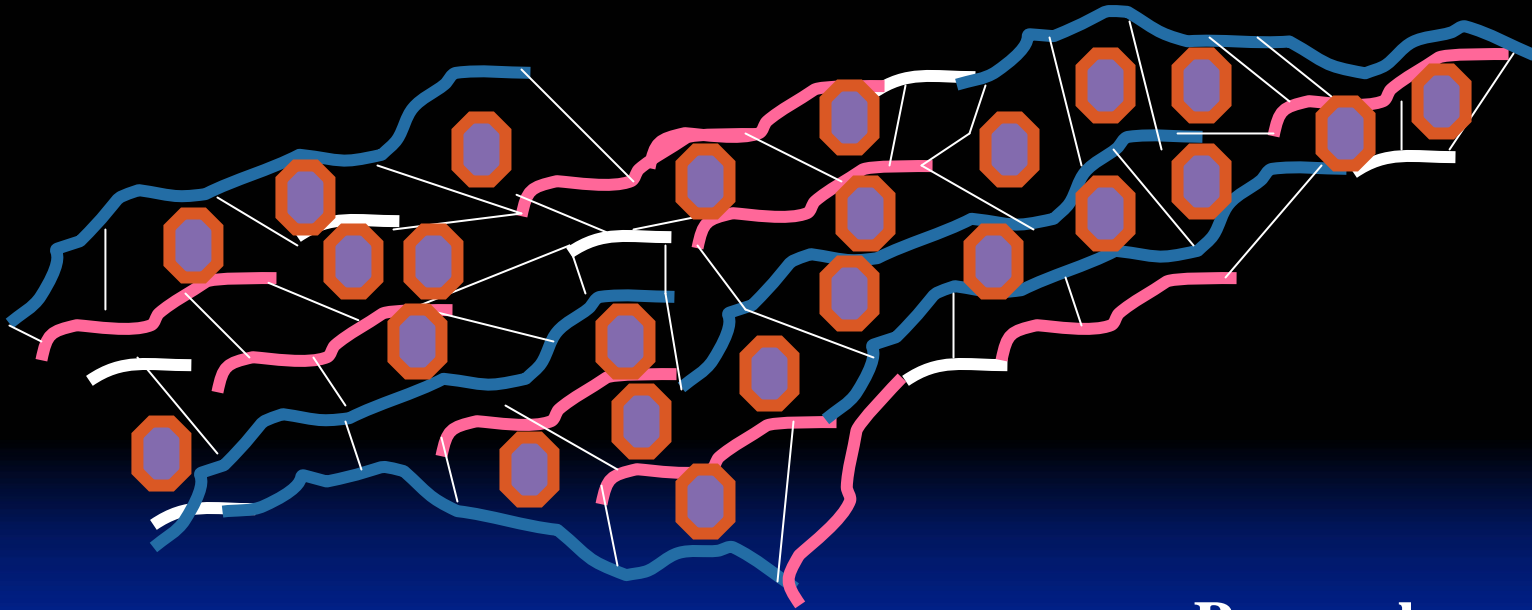


Light

Polymerization

Monomer \longrightarrow Polymer

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



Pre -gel
Gel
Post -gel

Marginal adaptation

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

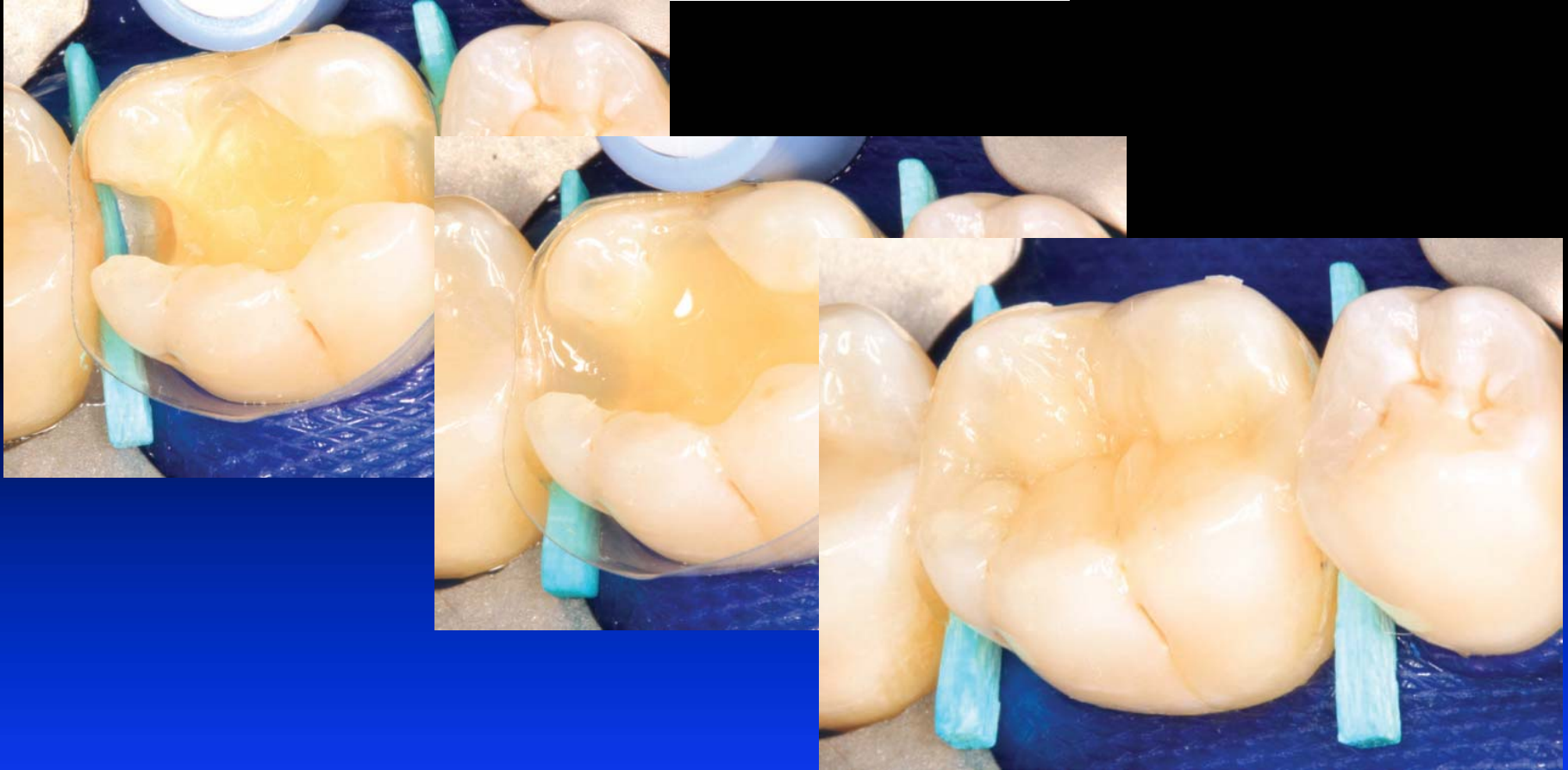


Bulk Fill composites

- Flowables



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



Bulk Fill composites

- High c viscosity



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

Sonic Fill



Sonic Fill




Bulk up to 5 mm

Sonic activation – change of viscosity

Internal light diffusion

Long term evaluation desirable



Bulk Fill materials are heterogenous group

- The problem of polymerization stress is not completely solved!
- 