

Dental microbial plaque and Oral hygiene

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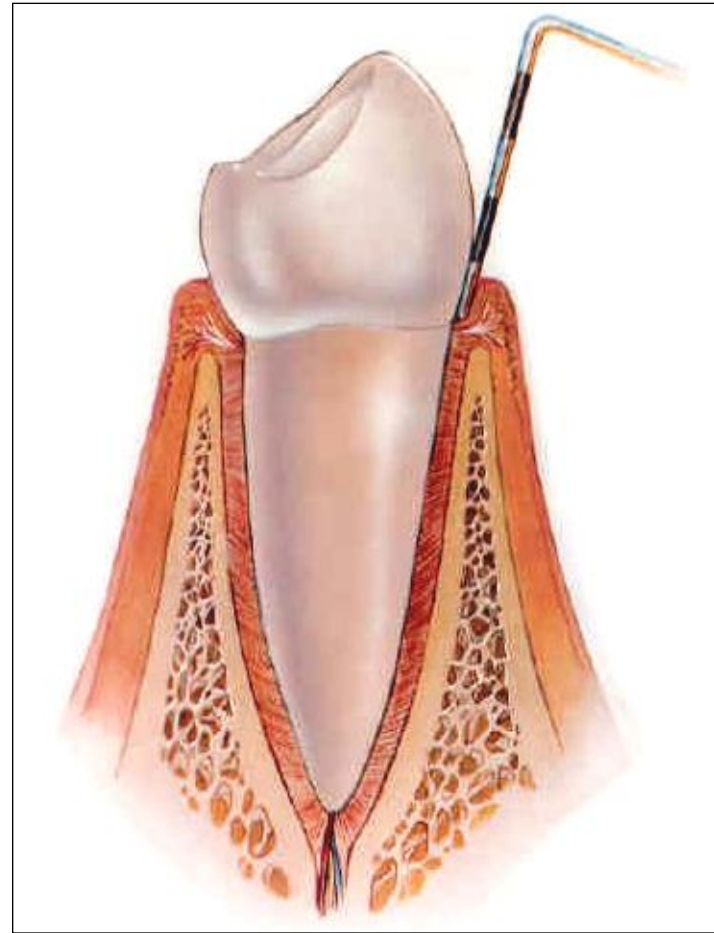
FAKULTNÍ
NEMOCNICE
U SV. ANNY
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M U N I

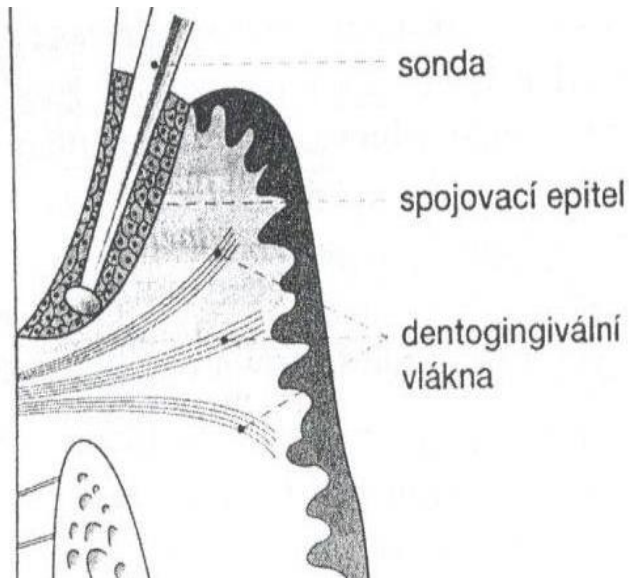
Healthy periodontal tissue

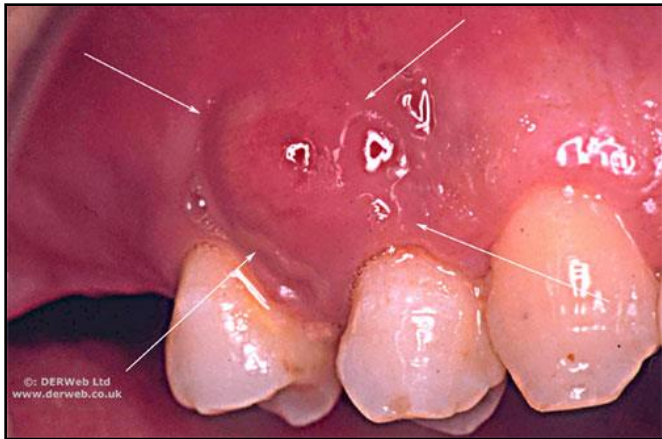
- **Gingiva**
 - pink, pale, firm
 - does not bleed (even after stimulus, PBI under 15/28)
 - stippling
 - attached gingiva sufficient amount



Healthy periodontal tissue

- Probing depth max 3 mm
- RTG (X-ray)
 - lamina dura is present
 - distance CEJ - margin of alveolar bone 1-2 mm





**Healthy
gums ?**



Etiology of perio diseases

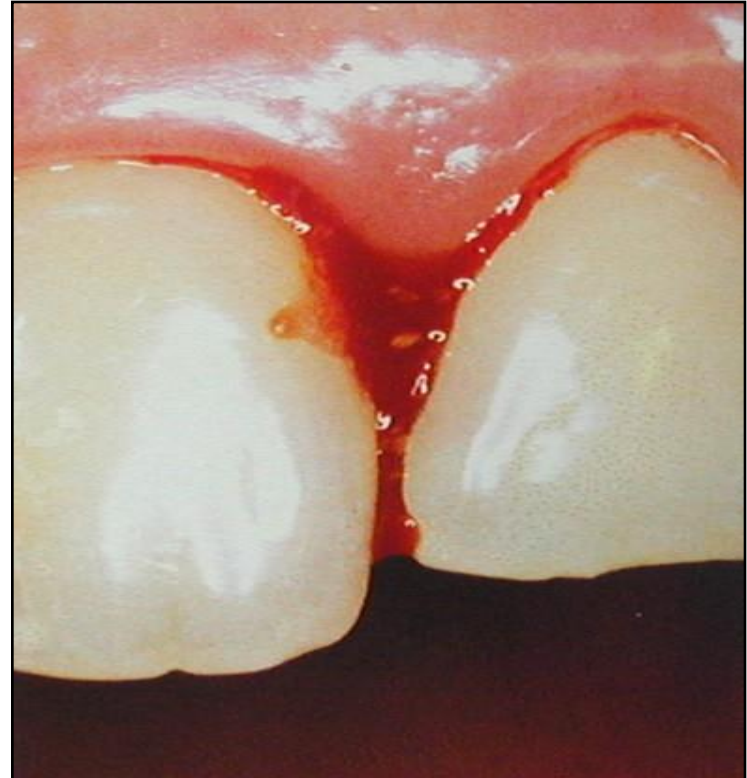
- Etiologic factor and causative agent **DENTAL microbial PLAQUE**
- **Contributing factor**
 - dental calculus
 - local irritant factors
- **Risk factors** (smoking)
- **Host factors** (immunity, systemic diseases)

Prevalence of Dental diseases

- Dental caries



- Periodontal diseases





**DENTAL
microbial PLAQUE**

DENTAL microbial PLAQUE

- soft deposits (bacterial mass) that form the **biofilm** adhering to the tooth and other intraoral surfaces
- may be removed by mechanical means only



DENTAL microbial PLAQUE

- Composed of **bacteria** in a **matrix**
- **Microorganisms** (75 %) a their products
- **Matrix** (25%)
 - **bacterial** (extracellular polysacharids) and **salivary** origin (salivary glycoproteins and mucopolysacharids)
 - calcium, phosphates (mineralization of plaque)

- DENTAL microbial PLAQUE

- microbial community

- coexistence of different populations in the biofilm

- bacteria communicate in different ways

(coaggregation, adherence, provide nutrients, exchange of genetic material)

- this symbiosis gives new features and greatly increases the resistance of dental plaque

- can be removed by mechanical means only

Materia alba

- Collection of debris
- A white cheeselike accumulation of **food debris, microorganisms, desquamated epithelial cells, and blood cells** deposited around the teeth at the gumline



Plaque Retention factors

- Dental calculus (plaque carrier)
- Faulty restorations
 - overhanging fillings
 - non-fitting crowns
- Orthodontic anomalies - crowded teeth
- Orthodontic appliances
- Partial Dentures



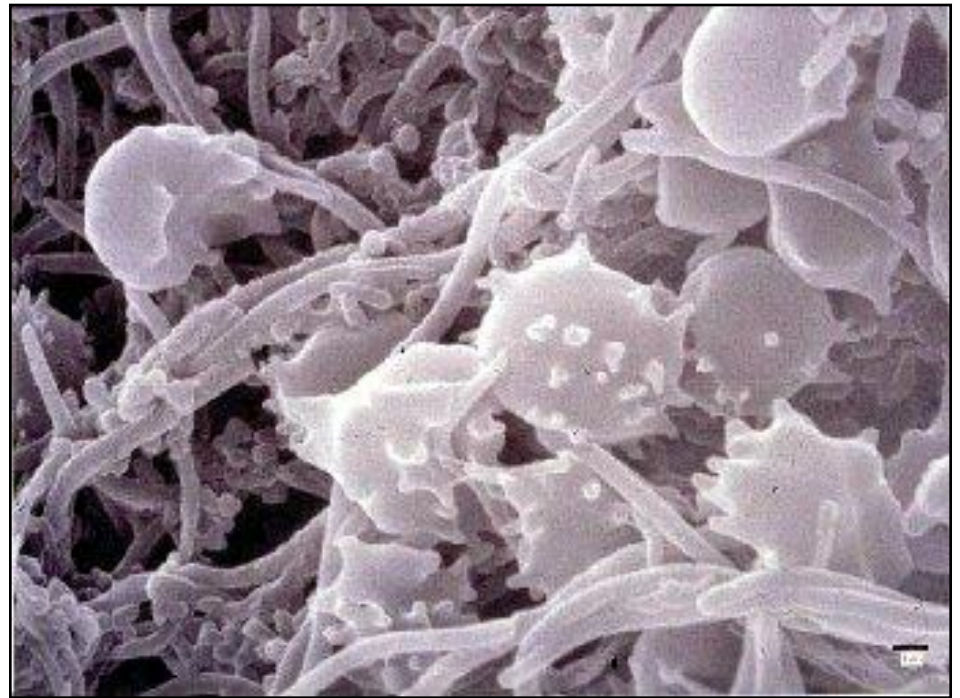
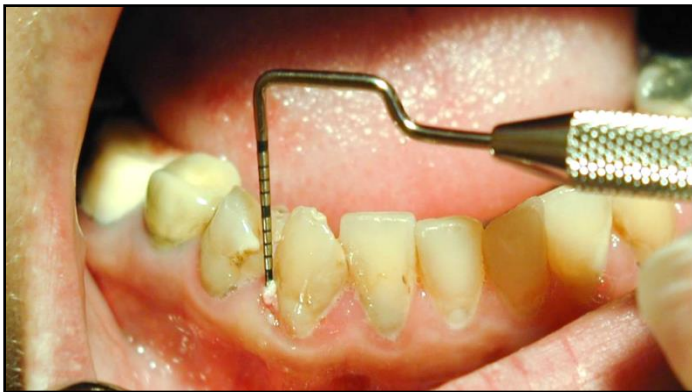
These factors impair hygienic conditions

- Anatomical deviations of mucous membranes
 - lip frenula - shallow vestibulum,
 - gingival recessions
- Mouth breathing, Tobacco use



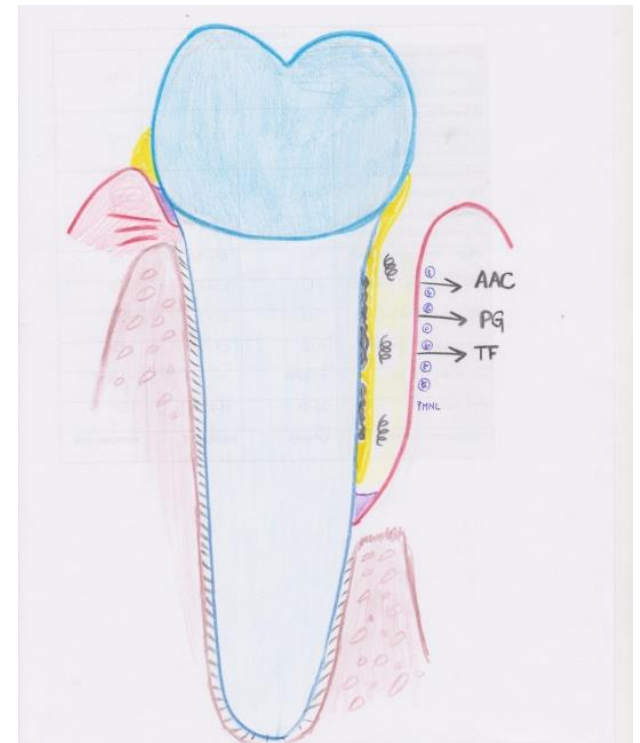
DENTAL microbial PLAQUE

- Composition and formation rate depends on
 - quality of OH
 - quality of saliva
 - food, smoking
 - immunity



DENTAL microbial PLAQUE

- coronar, fissural
- **supragingival plaque**
 - in gingival region
- **subgingival plaque**
 - sulcus gingivalis of healthy periodontium
 - periodontal pocket



DENTAL microbial PLAQUE

Supragingival plaque

- caries
- dental calculus
- increase amount of bacterias in oral cavity



Subgingival plaque

- adherent plaque (root surface)
- non adherent plaque (swimming)
- zone of plaque near gingival epithelium

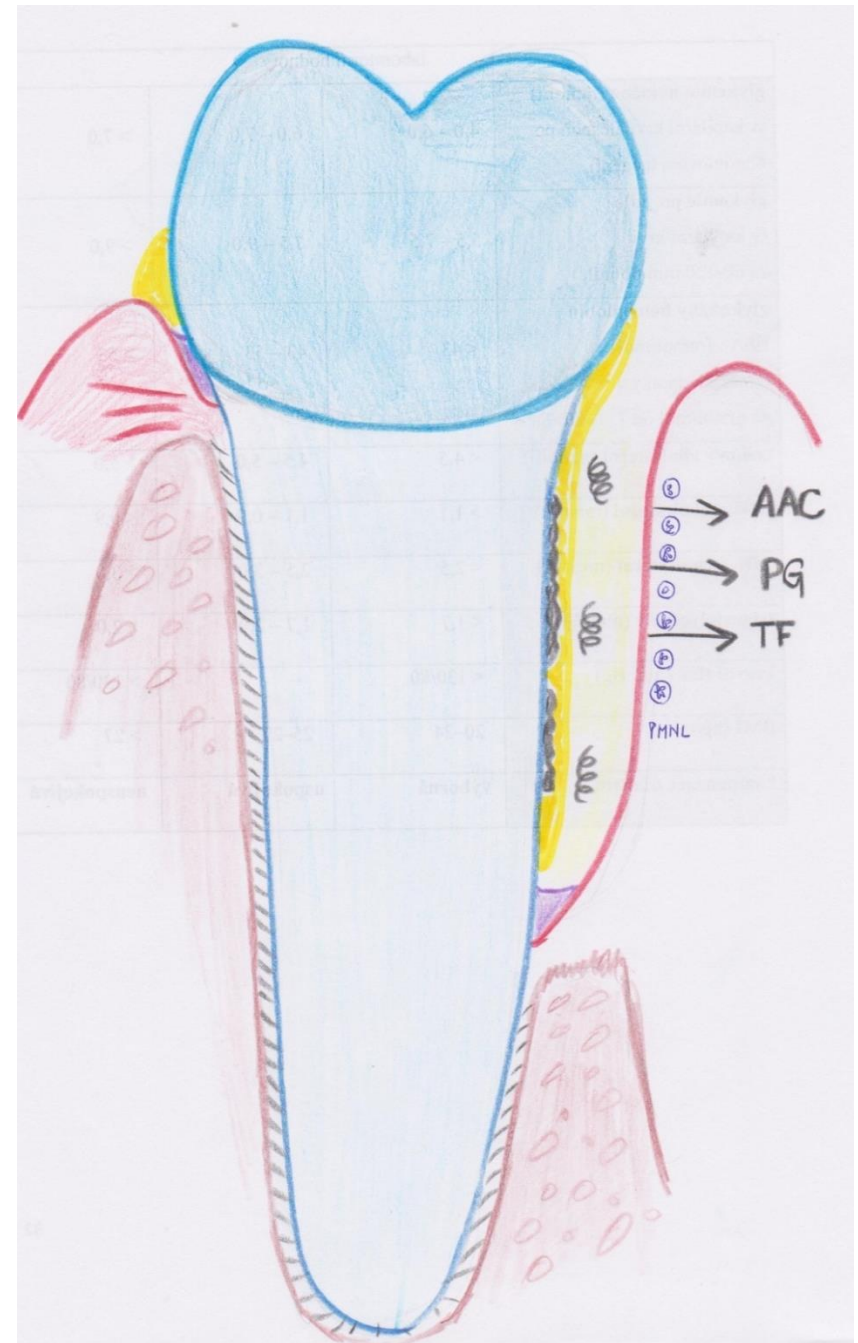
- **Subgingival plaque (sulcus × pocket)**

Adherent plaque (enamel, root surface)

- composition resembles the supragingival plaque (G+ and G-cocci, Actinomyces sp., rods and filaments)
- can become mineralized

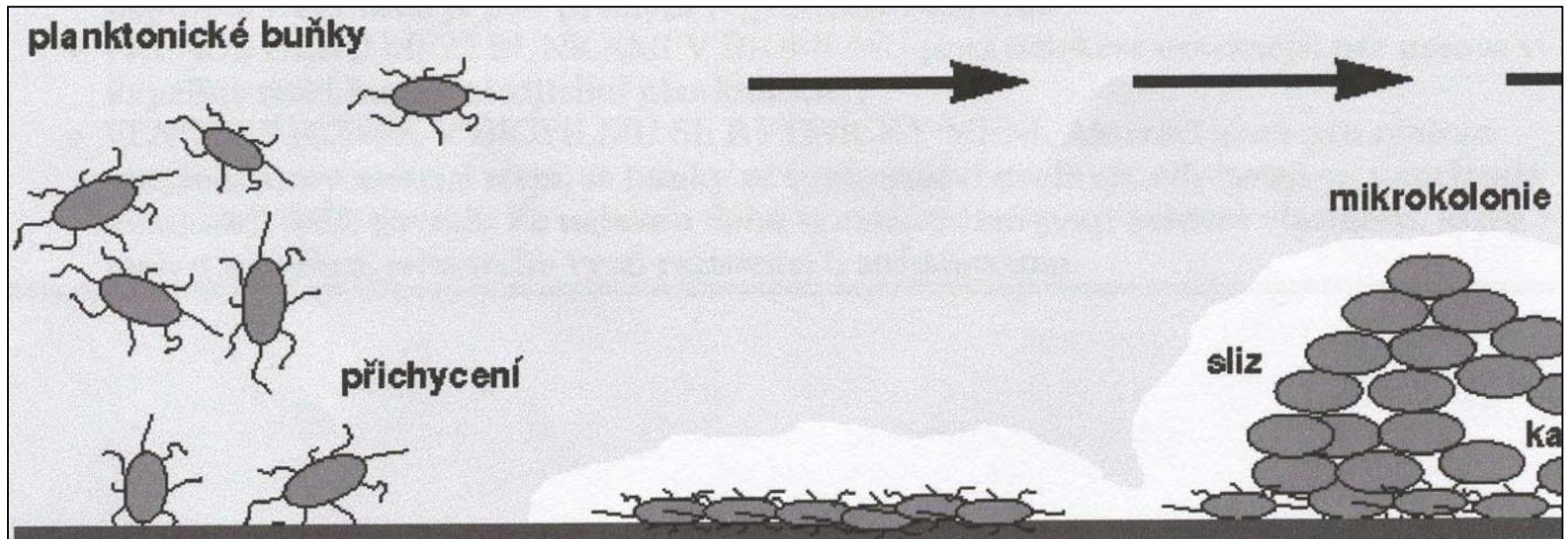
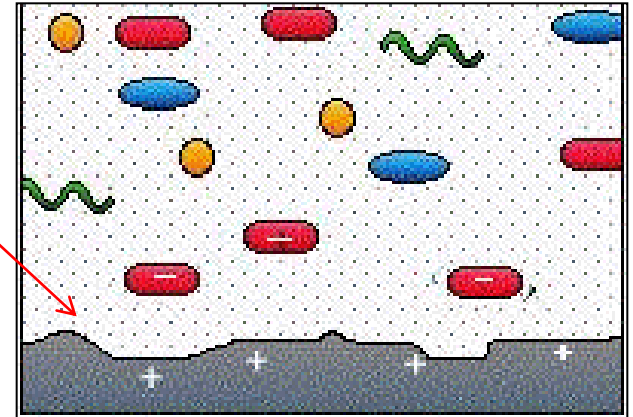
Non adherent plaque - freely moving

- G - anaerobs (motile and nonmotile rods), larger number of spirochetes,
- no intermicrobial matrix,
- important role in the progression of periodontitis,
- bacterial invasion (AAC, PG, TF)



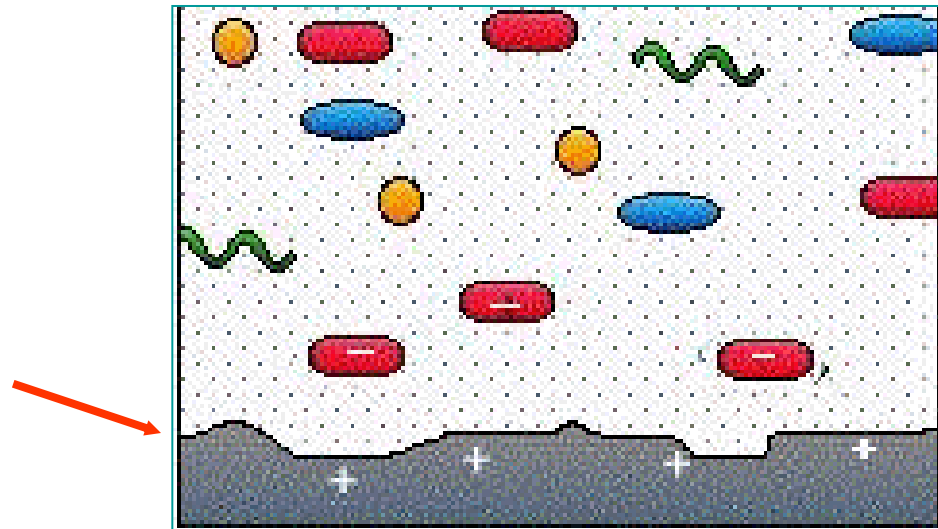
Plaque Formation

- **Acquired Pellicle** Formation
- **Primarily** Bacterial Colonization
- **Growth** of Plaque (sec. colonization)
- Maturation of Plaque



1/ Plaque Formation

- **Acquired Pellicle Formation**
 - minutes, 1-2 microns thick
 - amorphous film from **salivary glycoproteins**
 - increases the efficiency of bacterial adhesion



2/ Plaque Formation

- **Primarily Bacterial Colonization**
 - bacterial **adhesion by single microorganisms**
 - extracellular polymeric substances and fimbriae, enable them to attach rapidly upon contact
 - become established within 24 hours
 - **G+ aerobs**, cocci (*Streptococcus sanguis*), G+ rods, G+ fillaments (*Actinomyces sp.*)
 - **immature plaque** - less adherent

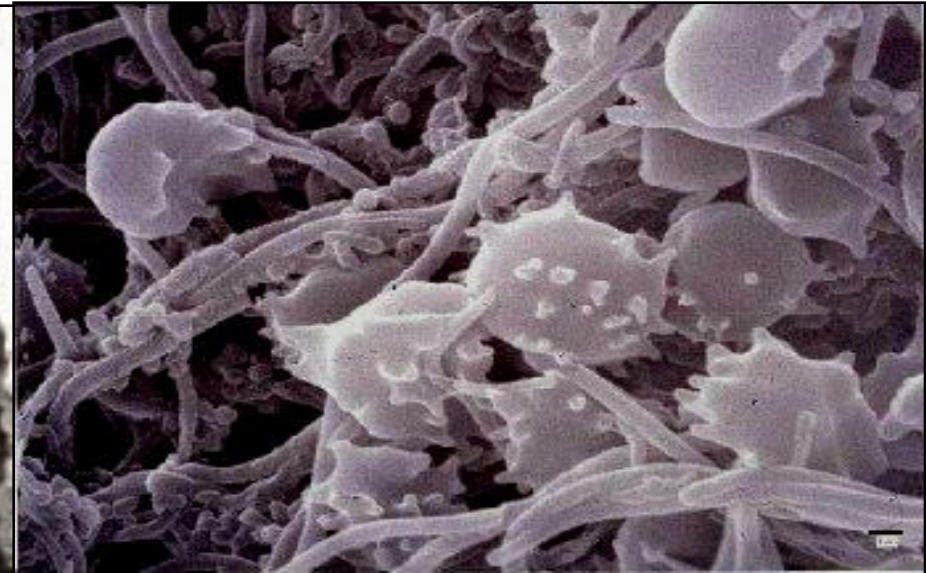
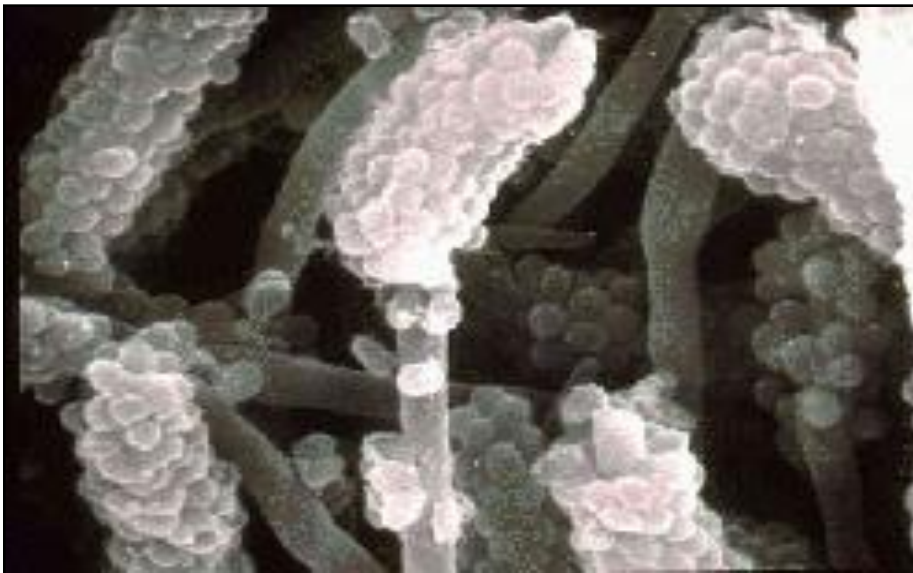
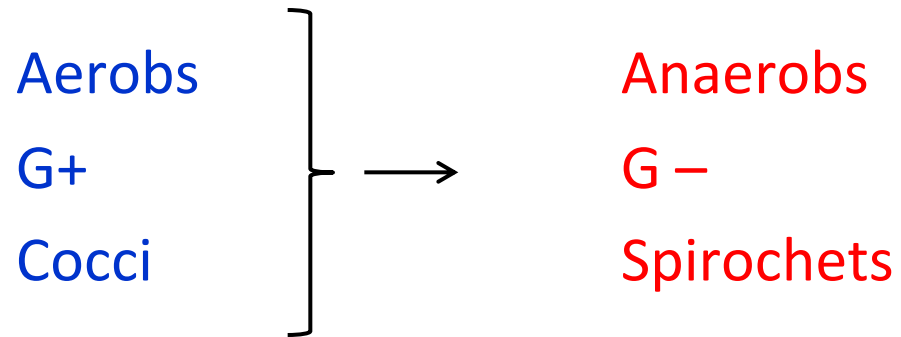
3/ Plaque Formation

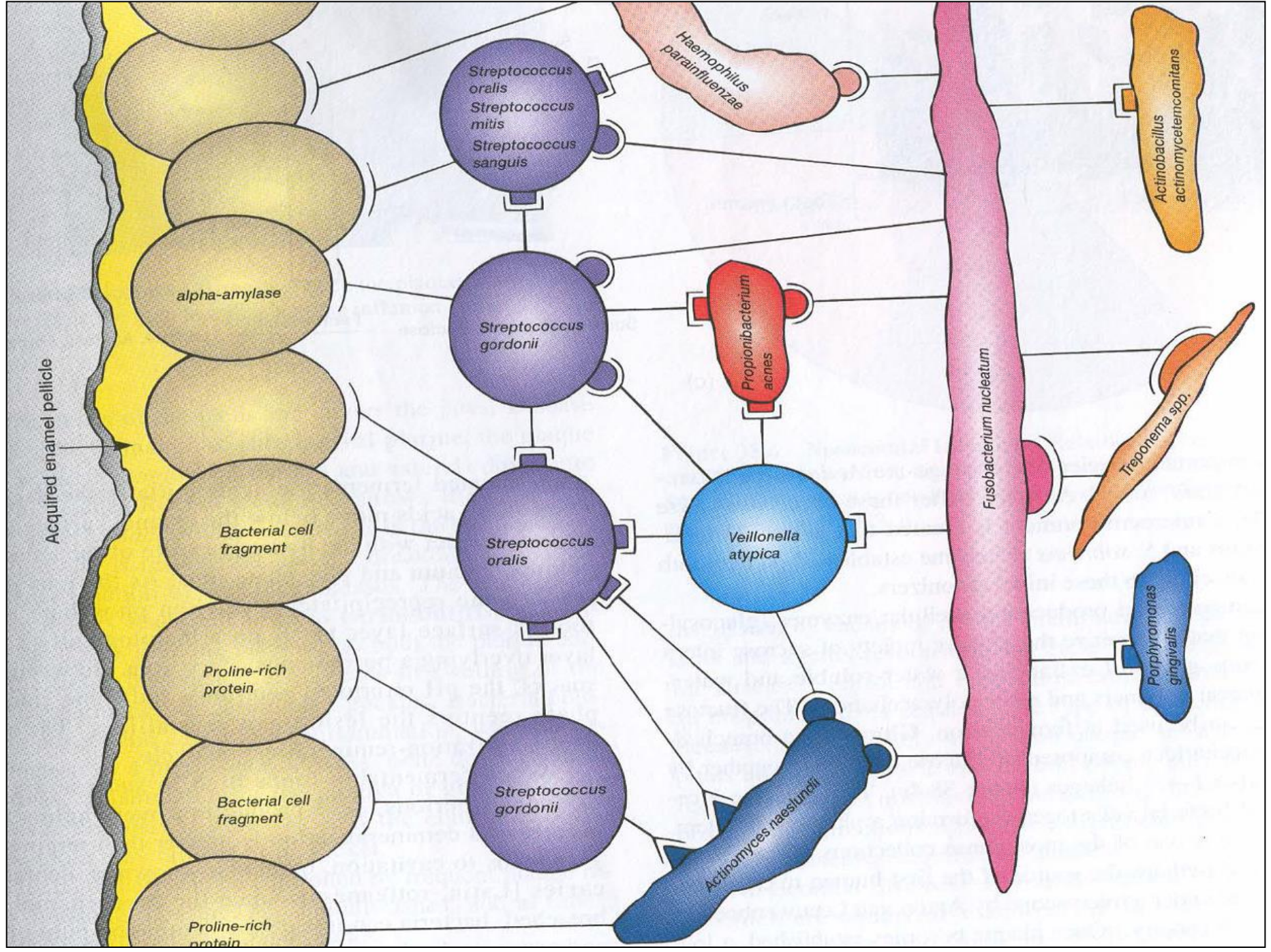
- **Growth of Plaque** in next few days (sec. colonization)
- bacterial mass increases in quantity due to adhesion of **new bacteria** (surface receptors on G+ cocci and rods allow adherence of G- (*Fusobacterium nucleatum*) and synthesis of **extracellular polymers**)
- multiplication of adhering bacteria and growth of extracellular matrix
- increasing of thickness - diffusion is more difficult - poor diffusion of oxygen - **anaerobic conditions**
- G- cocci, G+ G- rods and filaments (fusobacteria), aerobs and anaerobs

4/ Plaque Formation

- **Maturation of Plaque**
 - formation of more **complex and mature biofilm**
 - stable bacterial biofilm
 - **different morphotypes** - cocci, motile rods, spirochetes (filamentous organisms predominate)
multiplication of bacteria, new bacterial species
 - **mature plaque** - very pathogenic

Plaque Formation





- DENTAL microbial PLAQUE

- microbial community

- coexistence of different populations in the biofilm

- bacteria communicate in different ways

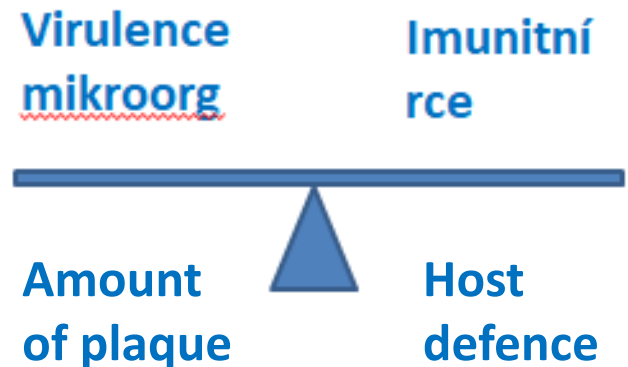
- (coaggregation, adherence, provide nutrients, exchange of genetic material)

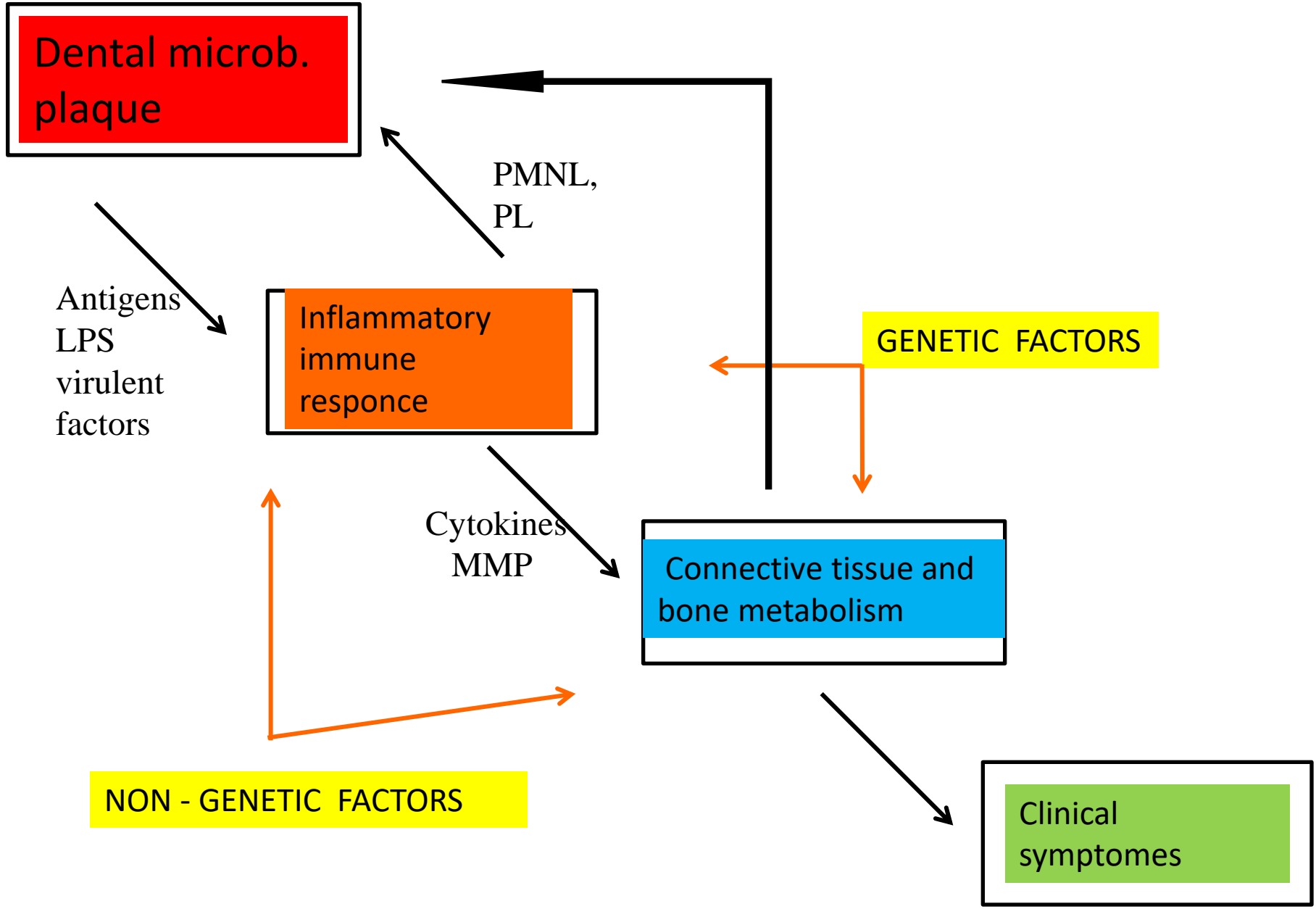
- this symbiosis gives new features and greatly increases the resistance of dental plaque

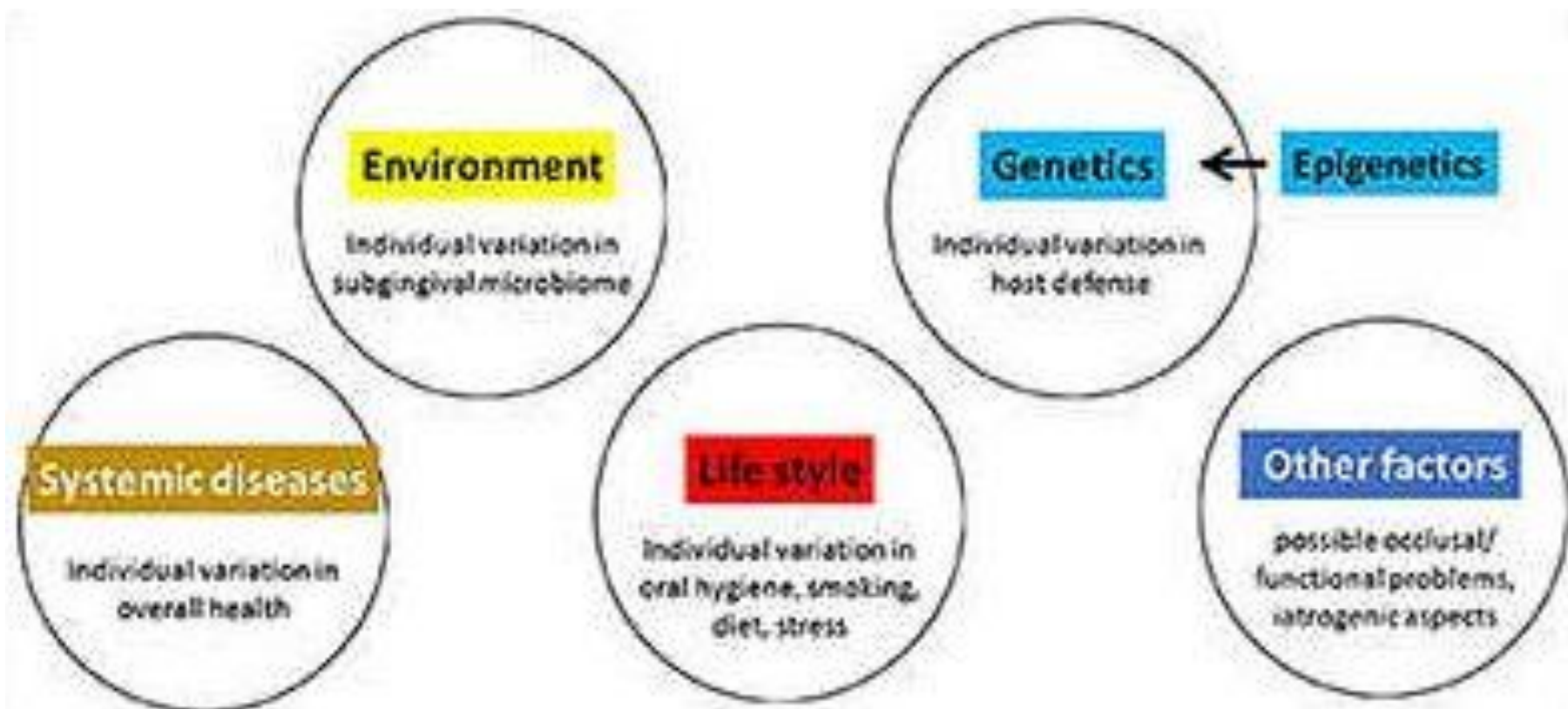
- can be removed by mechanical means only

- Nonspecific plaque hypothesis
 - plaque is regarded as a bacterial mass
 - proliferating mixed infection
- Specific plaque hypothesis
 - specific virulent bacteria in plaque cause periodontitis

- Amount of the plaque
- Virulence of the plaque
- Host defence







Bacterial complexes as described by Socransky et al :

- 5 complexes:
- Primary colonizers:

Streptococcus
species

Actinomyces
odontolyticus

- Secondary colonizers:

- Eikenella corrodens
- A.a comitans serotype a **AAC**
- Capnocytophaga species

- Fusobacterium
- Prevotella intermedia
- Campylobacter sp.

- Porphyromonas
- Tannerella forsythia
- Treponema denticola

PG

TF

TD

AAC serotype b – in the aggressive course of periodontitis

Perio pathogens

- **Aggregatibacter (Actinobacillus) actinomycetemcomitans**
- **Porphyromonas gingivalis**
- **Tannerella forsythia**
- **Treponema denticola**
- **Prevotella intermedia**
- **Fusobacterium nucleatum**
- **Peptostreptococcus micros**



**Sehr stark
pathogen/
Very highly
pathogenic**



*A. actinomy-
cetemcomitans* *b.*

P. gingivalis

*Tannerella
forsythia*



ability to invade tissue

**Stark
pathogen/
Highly
pathogenic**



T. denticola

P. intermedia

E. nodatum

**Moderat
pathogen/
Moderately
pathogenic**



P. micros

*F. nucleatum/
periodonticum*

C. rectus

E. corrodens

*Capnocytophaga
spec.*

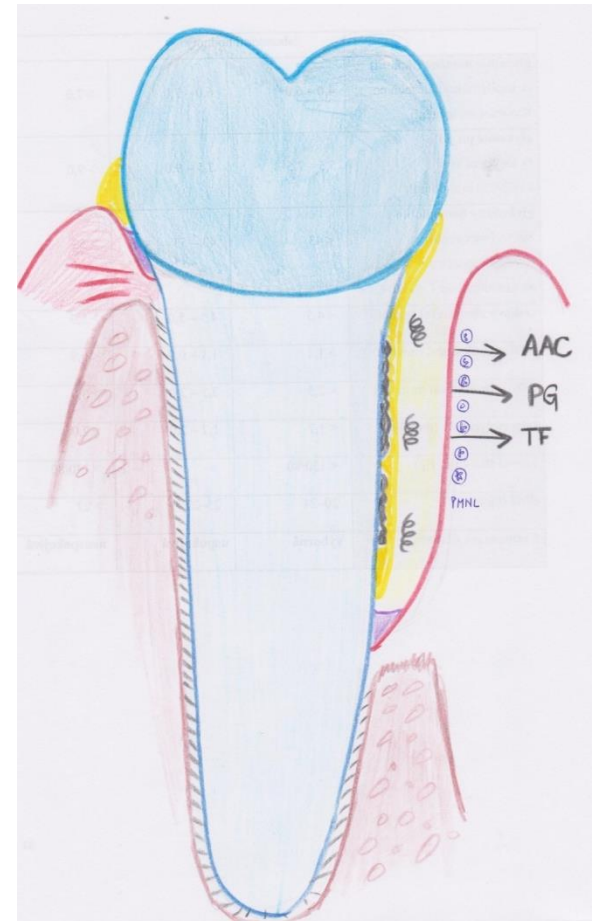
Pathogenity of plaque - hard dental tissue

- Bacteria in DP produce acids (dental caries)



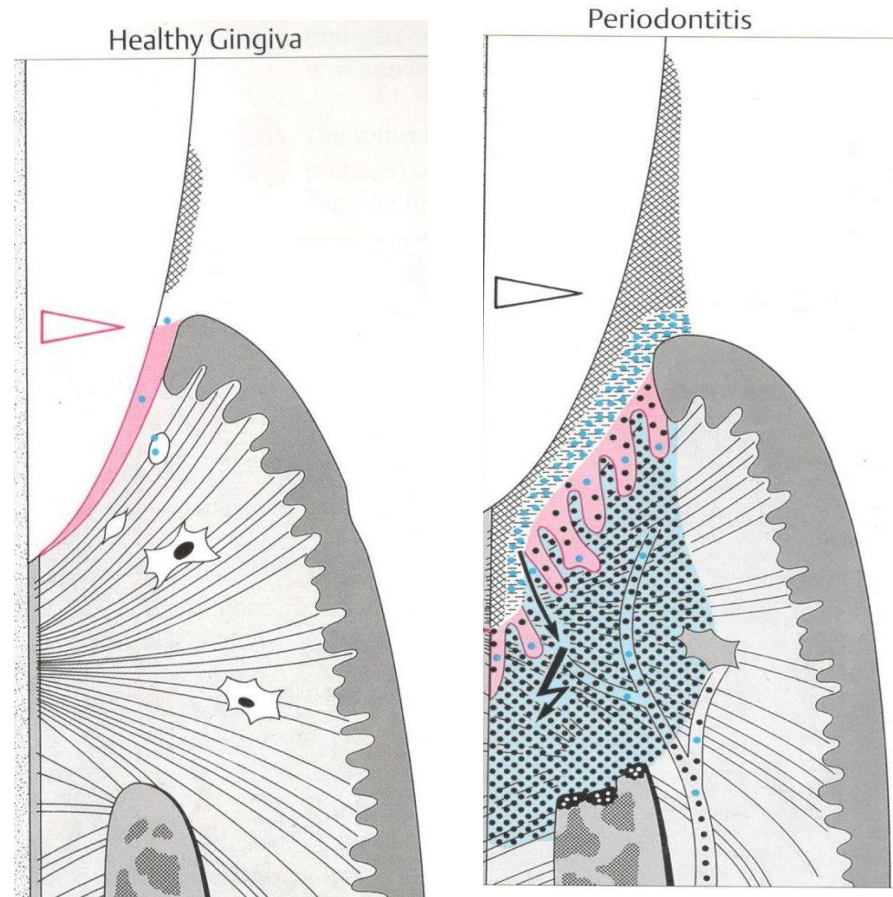
Pathogenicity of plaque – soft tissue

- Bacteria in DP produce various pathological substances (direct / indirect effect)
- Direct effect
 - **enzymes** (proteolytic enzymes collagenase, hyaluronidase)
 - **endotoxines** (LPS of bacterial wall,)
 - **exotoxines** (leukotoxin – AAC)
 - ability to **invade tissues** (AAC, PG, TF)



Pathogenity of plaque

- Indirect effect
 - bacterial chemotaxins, antigens
 - host inflammatory response to antigens of dental microbial plaque
 - regulation of production of proinflammatory mediators (IL -1,6, TNF, PGE)



Pathogenicity of plaque

- depends on
 - **amount** and composition of plaque
 - **virulence** of microorganisms
 - ability to **invade tissues** (direct invasion - true infection, AAC, PG, TF)
 - **immunity reaction of organism**

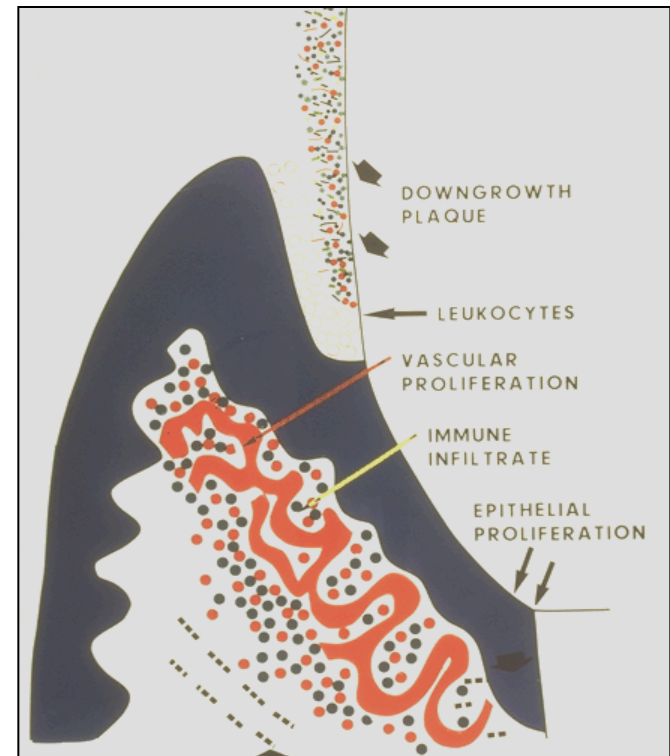
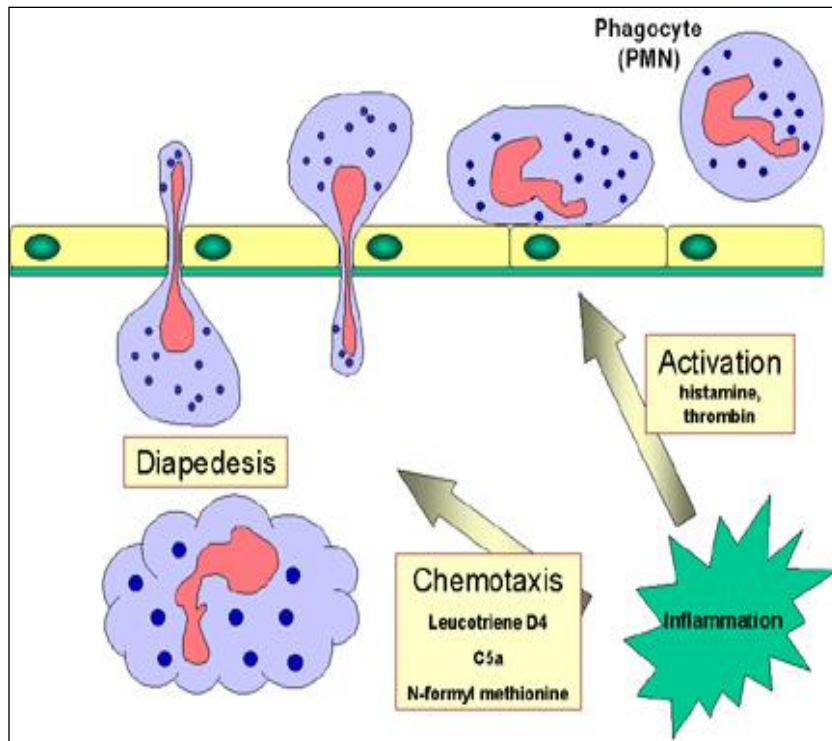
accumulation of plaque along the gingival margin leads to inflammatory reaction of the soft tissue

Host defence reaction

- Acute non-specific host response
 - first and rapid reaction
- Specific immunity reaction
 - recognition of foreign antigen
 - specific immunity reaction against this antigen

Acute nonspecific host response

- Inflammation
- PMNL - chemotaxis, diapedesis, adherence to bacteria, phagocytosis, microbicidal activity
complement system



Specific immunity reaction

- Lymphocytes

- T cells - cell mediated reaction

- B cells - antibody response

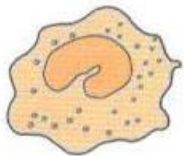
upon contact with antigen they differentiate into plasma cells (production of antibodies)

- defense cells recognize antigen

Antigen - antigen presenting cells - lymph nodes - proliferation of relevant specific cells



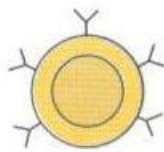
PMN



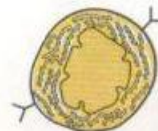
Macrophage



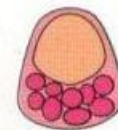
T-cell



B-cell



Plasma Cell

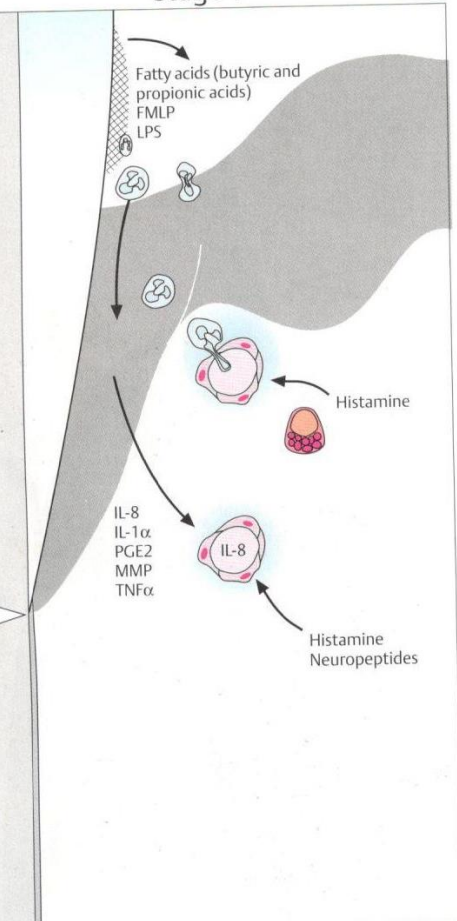


Mast Cell



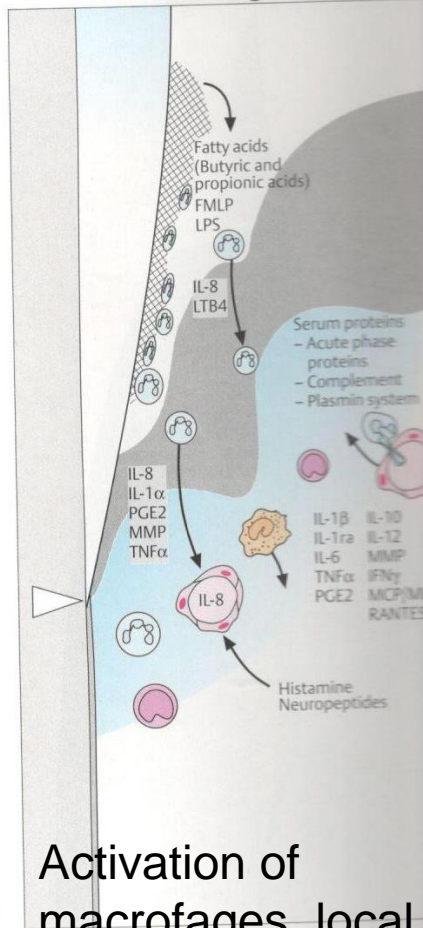
Fibroblast

Stage 1



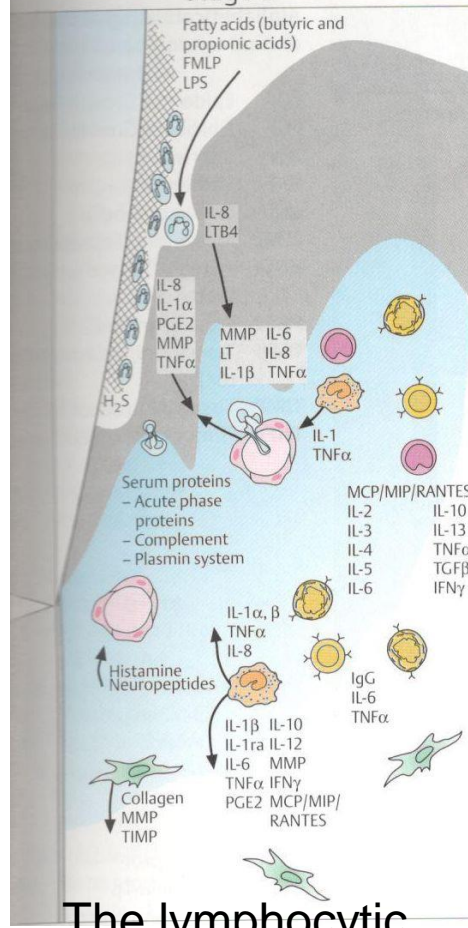
Initial phase

Stage 2



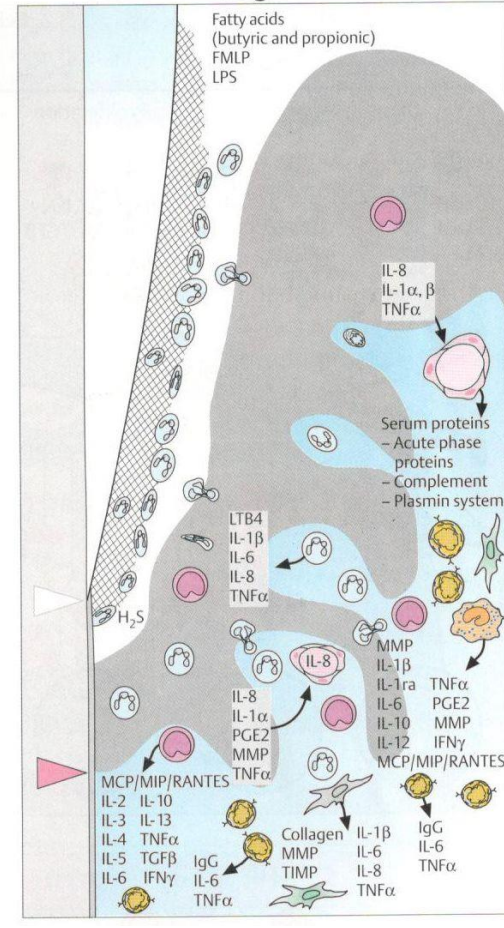
Activation of macrophages, local inflammatory reaction

Stage 3



The lymphocytic inflammatory infiltrate dominates

Stage 4

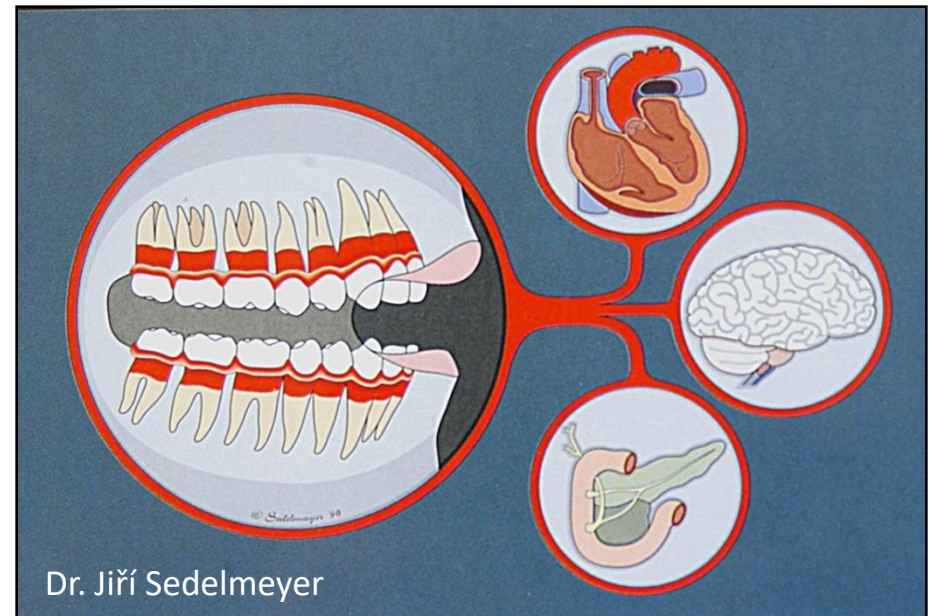


Initial periodontitis

Dental biofilm and systemic diseases

- Bacteriemia
- Inflammatory mediators

95% of atheromas had bacterial D.N.A from periodontal pathogens



<https://www.efp.org/news-events/news/oral-health-and-general-health-29938/>

Calculus - calcified dental plaque

- Calculus is formed by the deposition of calcium and phosphate salts **in bacterial plaque**
- salts are present in saliva, in crevicular fluid



Calculus - calcified dental plaque

- calculus is **always covered by** an unmineralized layer of bacterial **plaque**
- good place for plaque accumulation
- reservoir and retention web for bacteria and endotoxins



Calculus - calcified dental plaque

- inorganic compounds (40% - 80%), as well as proteins and carbohydrates, microorganisms
- the mineralization starts in centers intracellularly in bacterial colonies or extracellularly from matrix with crystallization nuclei (different crystals of calcium phosphate)
- time required for the formation of calculus is individually variable
- rate of formation depends on the quality of saliva and on the level of OH

Differences

- **Supra - gingival calculus**



- **Sub - gingival calculus**



- location
- the origin of minerals
- color
- diagnosis
- removing

Origin of minerals and Location

- Supragingival calculus

- excretion ducts of the major salivary glands
- on the lingual surfaces of the mandibular incisors
- on the buccal surfaces of maxillary molars
- origin - saliva

- Subgingival calculus

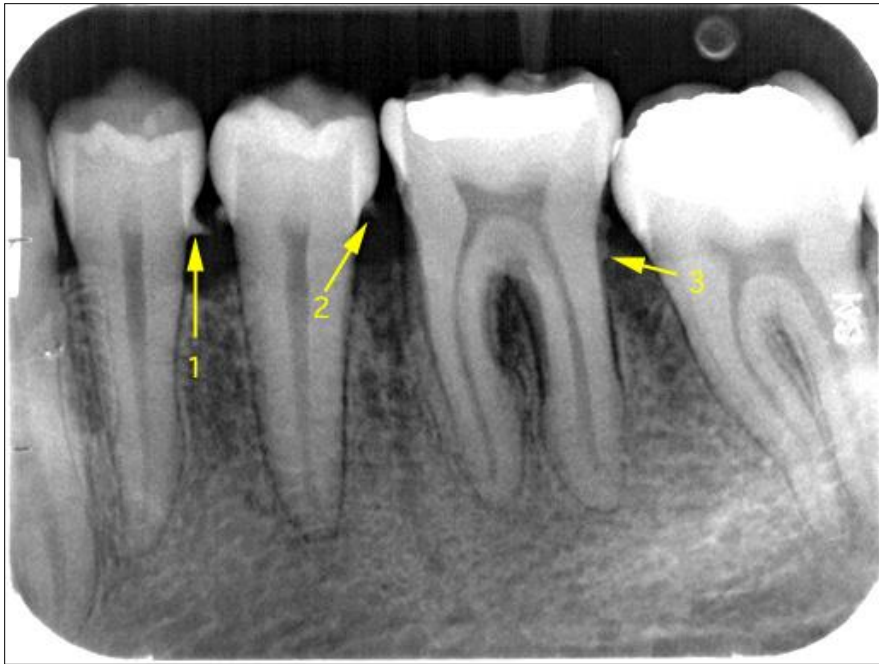
- on the root surfaces below the gingival margin
- can extend deep into periodontal pockets
- origin – sulcular fluid

- **Supragingival plaque**
coronar, fissural, gingival part



- **Subgingival calculus**

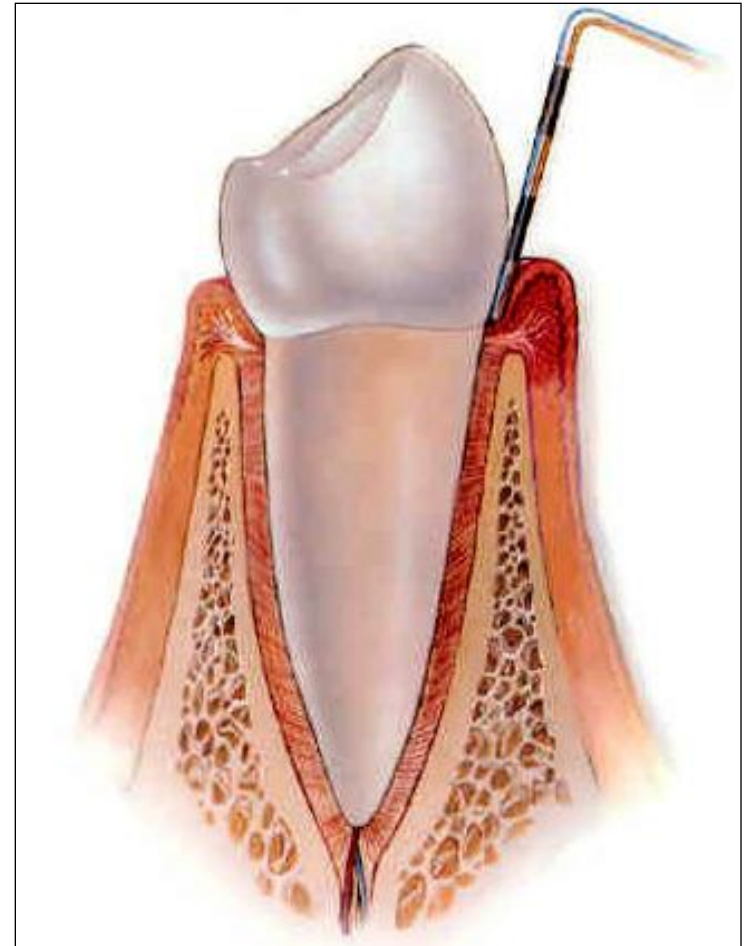
- on the root surfaces below the gingival margin
- can extend deep into periodontal pockets





1/ Gingivitis - symptoms

- gingival bleeding
- redness to livid colour
- swelling
- gingiva turgor loss
- tenderness or pain

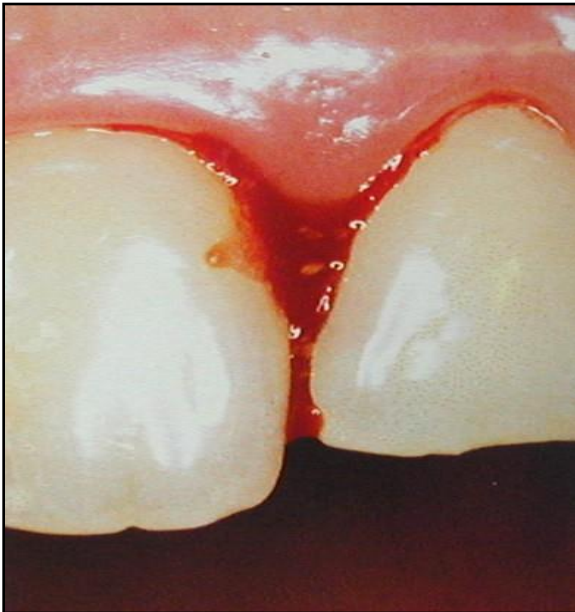




- 95 % of all gingivitis is plaque induced g.

- reversible

- alv. bone is not resorbed



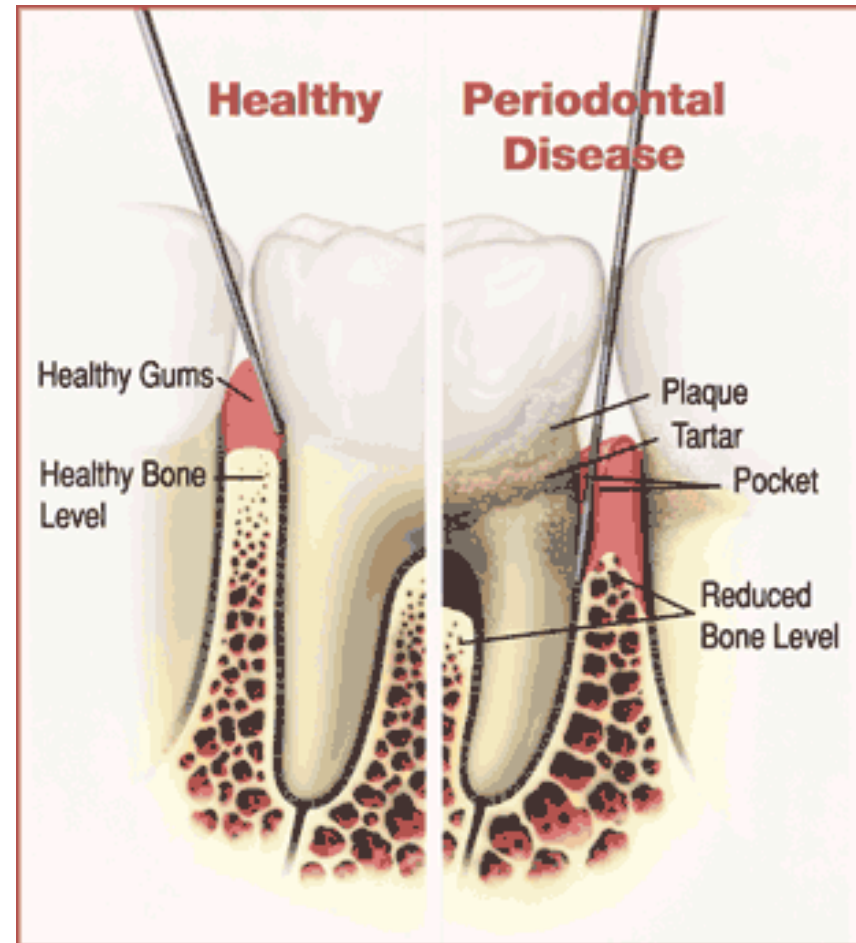


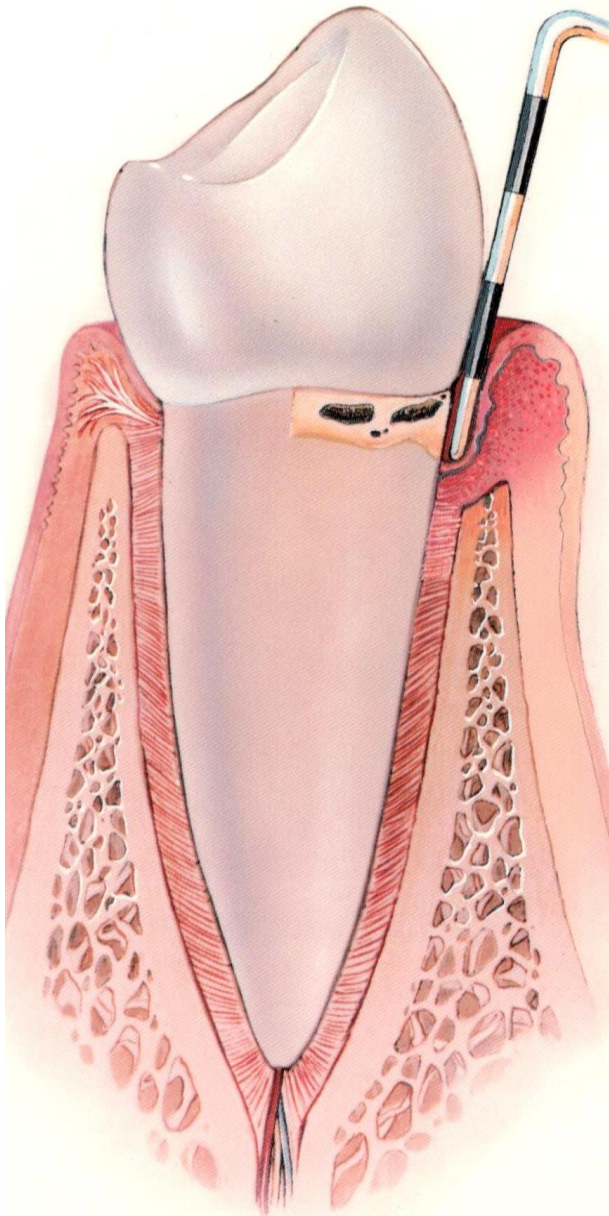
However, a large part of gingivitis is not recognized!!!



2/ Periodontitis

- inflammation of gingival tissue extends into the junctional epithelium
- attachment damage
- loss of alveolar bone
- periodontal pocket
- irreversible

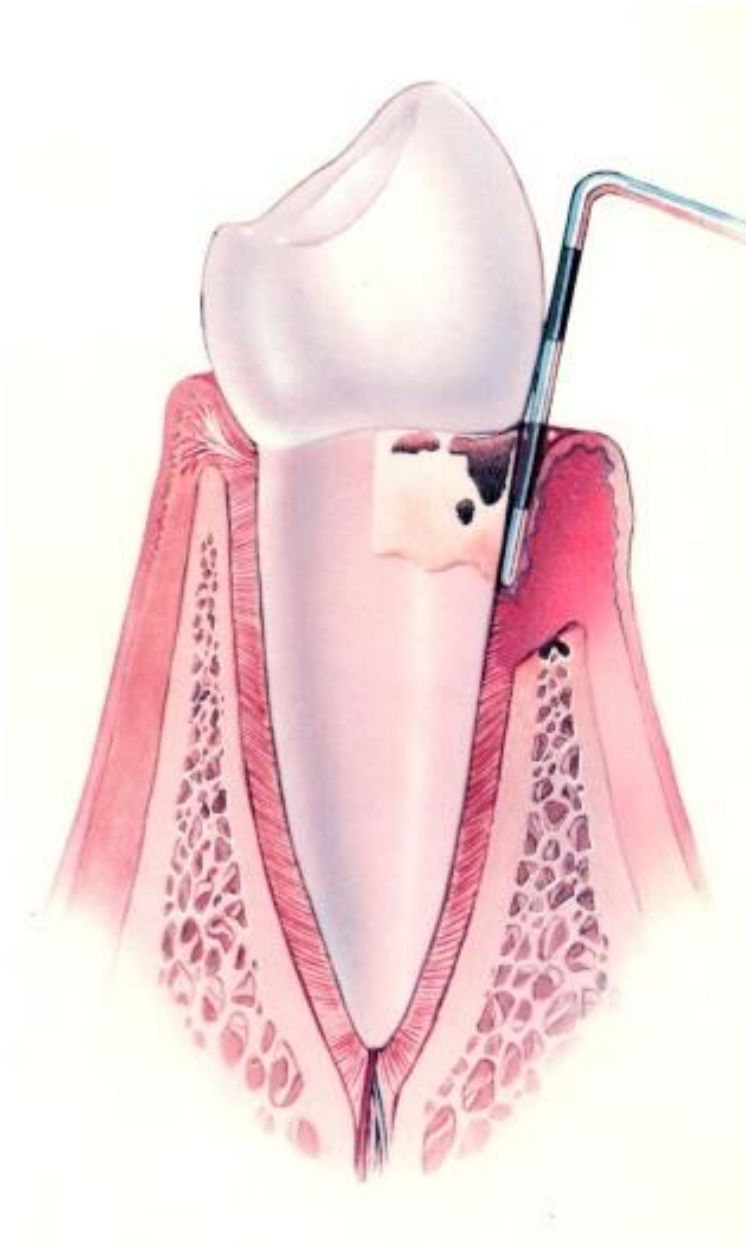


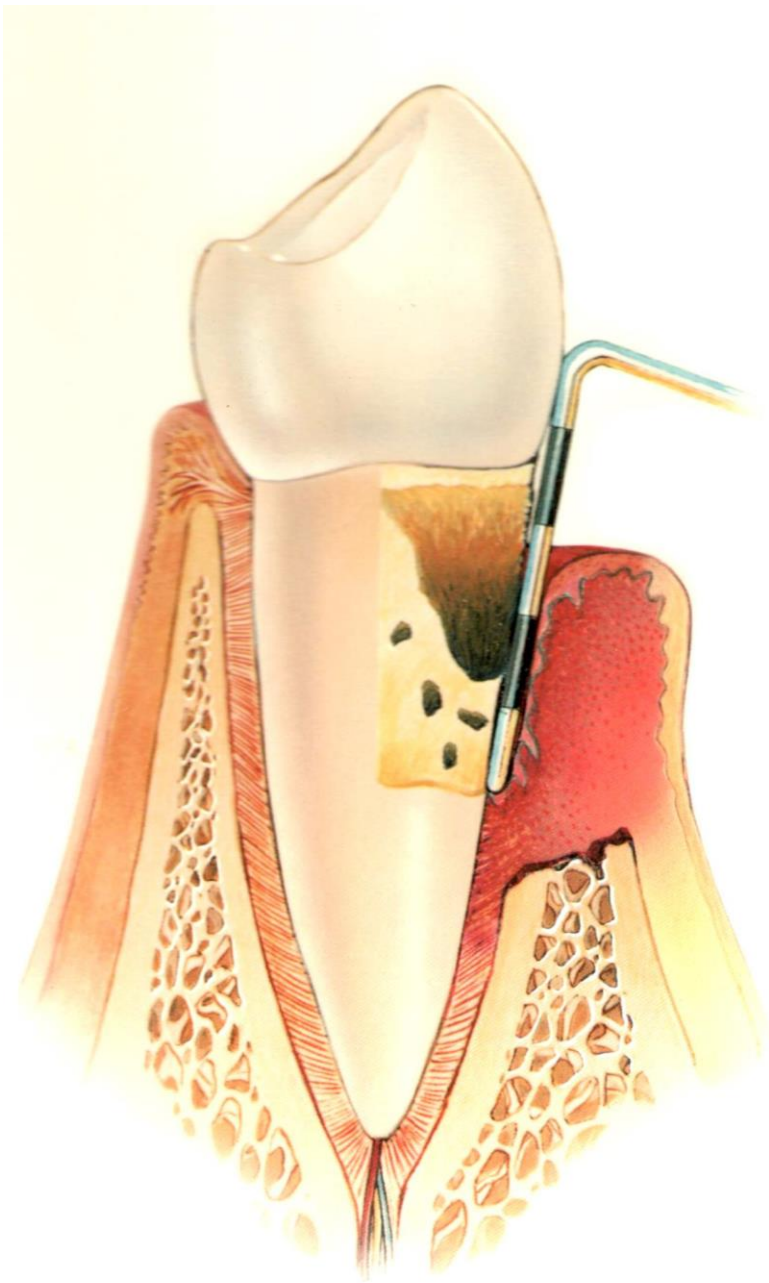


Incipient periodontitis

- Clinical symptoms are mild
 - bleeding from gingiva after irritating
 - oedema
 - redness
 - probing up to 6 mm
 - mild bone resorption

Intermediate periodontitis





Advanced periodontitis

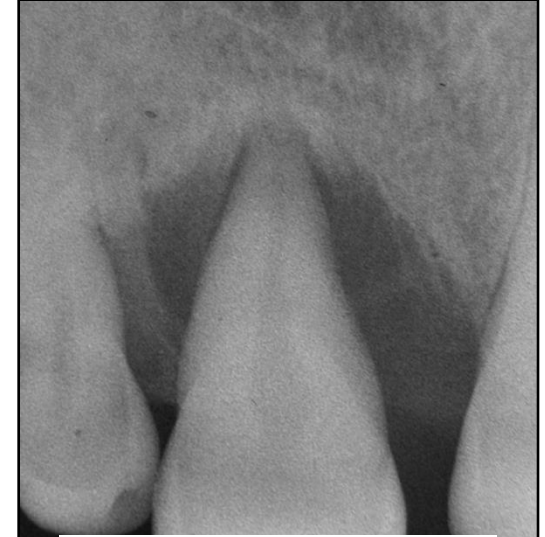
- deep periodontal pockets over 6 mm
- periodontal abscess
- mobility of teeth
- teeth tend to shift
- tooth loss
- advanced bone resorption
- bad breath



periodontal pocket with pus exsudation



periodontal pocket



bone resorption

Advanced periodontitis



periodontal abscess



teeth shifted

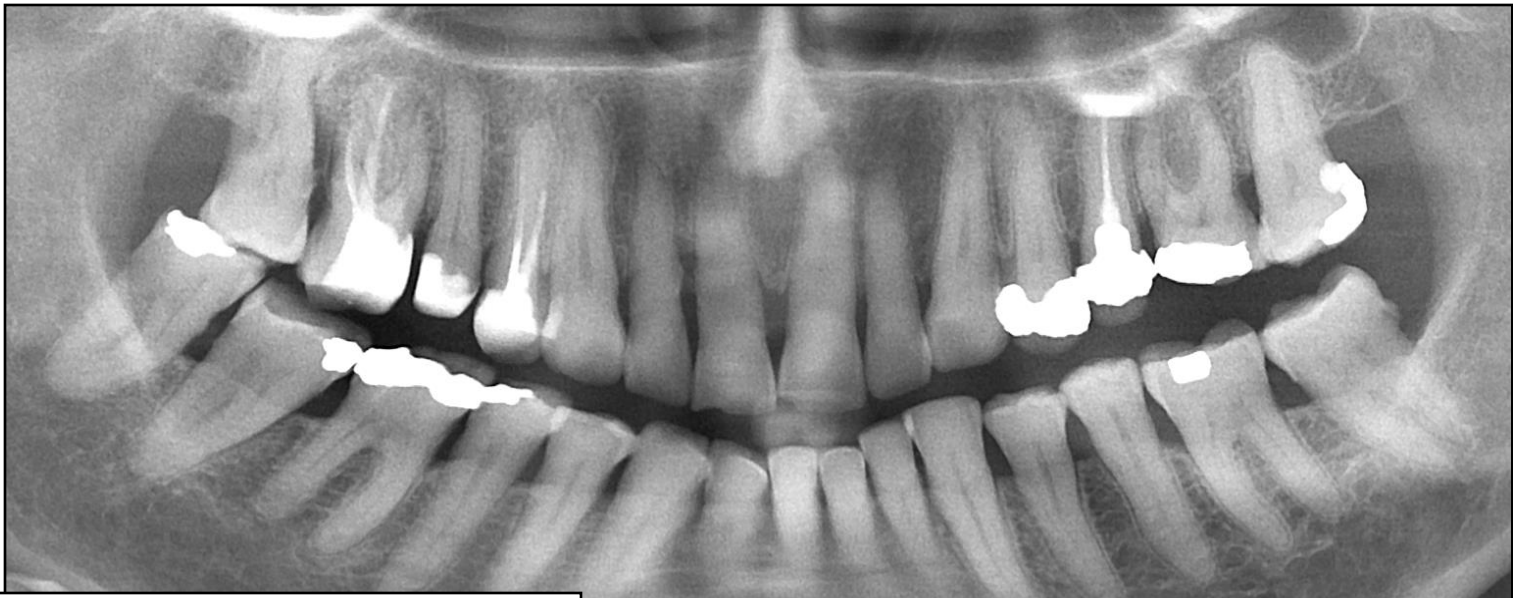




Man, 35 yrs old

Periodontitis
is with an
aggressive
course

Periodontitis
with a slow
chronic
course



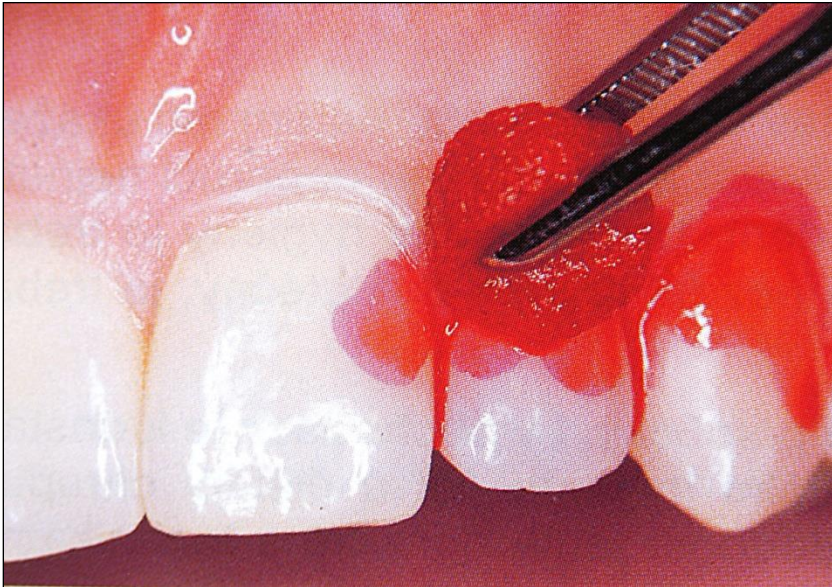
Woman, 72 years old

Examination of perio tissue

- Examination of oral hygiene (plaque, calculus), gingiva, measurement of periodontal pocket.....
- PBI
- API
- CPITN

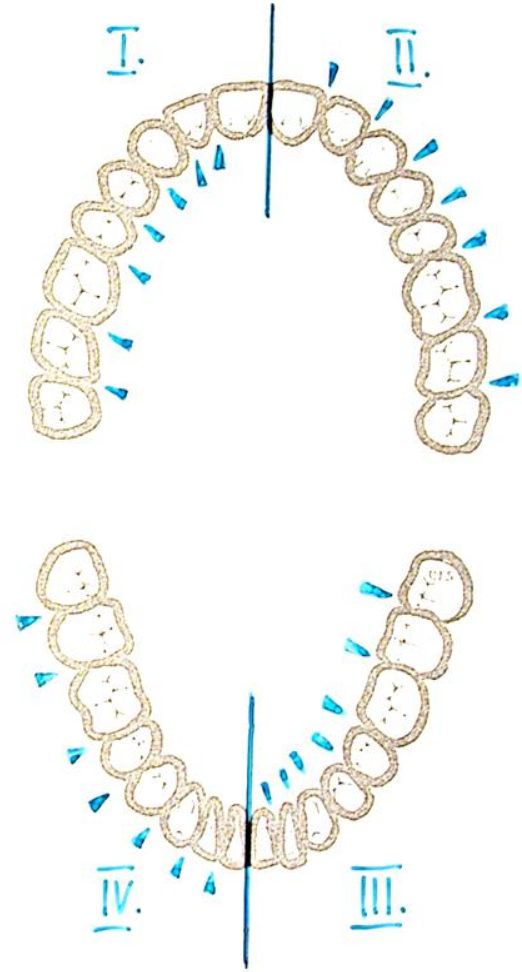
Aproximal Plaque Index API

- used with individual patients **after staining**
- records presence (+) or absence (-) of plaque in interdental spaces as a percentage



API

- 4 quadrants
- 7 interdental spaces in each quadrant
- 28 measurement sites in complete dentition
- I. and III. quadrant from oral aspect
- II. and IV. quadrant from facial aspect



Aproximal Plaque Index API

- number of locations **with plaque** / number of evaluated areas $\times 100$ (%)
- $28/28 \times 100 \cong 100\%$ Bad OH
- $0/28 \times 100 \cong 0\%$ Very good OH
- Good motivation ability

17	16	15	14	13	12	11	21	22	23	24	25	26	27
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+	+	+	+	-	-	-	-	-	-	+	+	+	+
+	+	+	+	-	-	-	-	-	-	+	+	+	+

47	46	45	44	43	42	41	31	32	33	34	35	36	37
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Index API

number of locations **with plaque** / number of
evaluated areas $\times 100$ (%)

$$\text{API} \cong 16 / 28 \times 100 \cong 56 \%$$

Interdental Hygiene Index HYG

- reverse
- number of locations **without plaque** / number of evaluated areas $\times 100$ (%)
- $28/28 \times 100 \cong 100\%$ Very good OH
- $0/28 \times 100 \cong 0\%$ Bad OH

17	16	15	14	13	12	11	21	22	23	24	25	26	27
----	----	----	----	----	----	----	----	----	----	----	----	----	----

-	-	-	-	+	+	+	+	+	+	-	-	-	-
-	-	-	-	+	+	+	+	+	+	-	-	-	-

47	46	45	44	43	42	41	31	32	33	34	35	36	37
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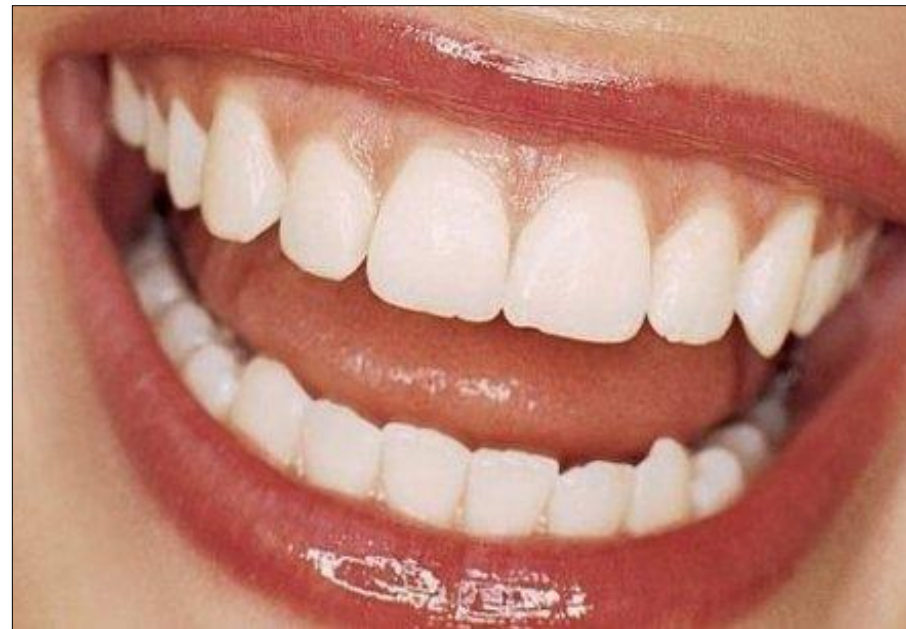
Index HYG

number of locations **without plaque** / number
of evaluated areas $\times 100$ (%)

$$\text{API} \cong 12 / 28 \times 100 \cong 44 \%$$



Education
Motivation
Instruction



Education - Motivation Instruction

- explanation of microbial etiology
- explanation of the symptoms



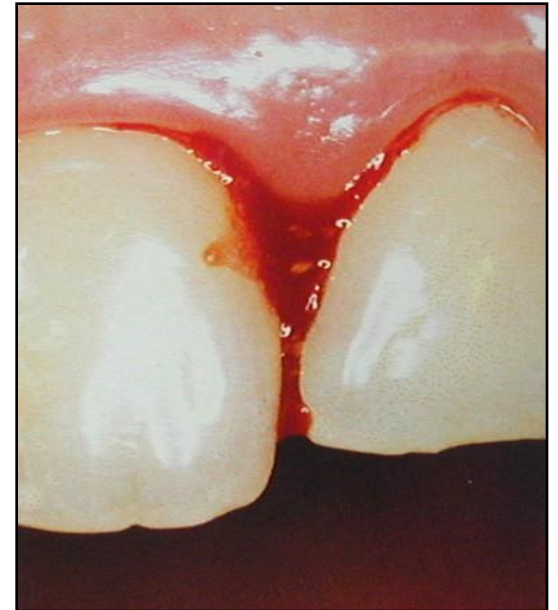
Education - Motivation - Instruction

- demonstration of bleeding gingiva (PBI)
- demonstration of plaque (API)



Motivation

- bleeding
- plaque



Special tablets or rinses can colour plaque



Oral hygiene products

- Toothbrush
- Single toothbrush
- Dental floss
- Interdental cleaners
- Toothpaste (fluorid, antimicrobial agents, anticalculus agents)
- Oral irrigators
- Mouth rinses



Recommendation ADA

- brush your teeth **twice a day** with **fluorid** toothpaste
- **clean between teeth** daily with floss or an interdental cleaner
- **replace your toothbrush** when bristles are frayed
- brush the outer, inner, chewing and interdental surfaces

Professional hygienic care

- History - Examination - Diagnosis
- Education - Motivation
- Oral hygiene instruction and monitoring
- Elimination of plaque retentive areas
- Plaque and calculus removing
- Control

Toothbrush

- Short head
- Medium or soft, multitufted, straight bristles

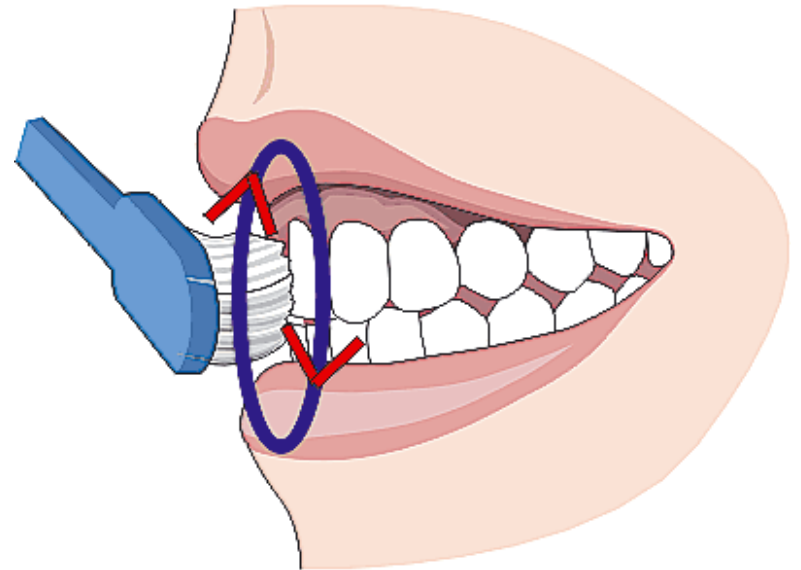




Tooth brushing techniques

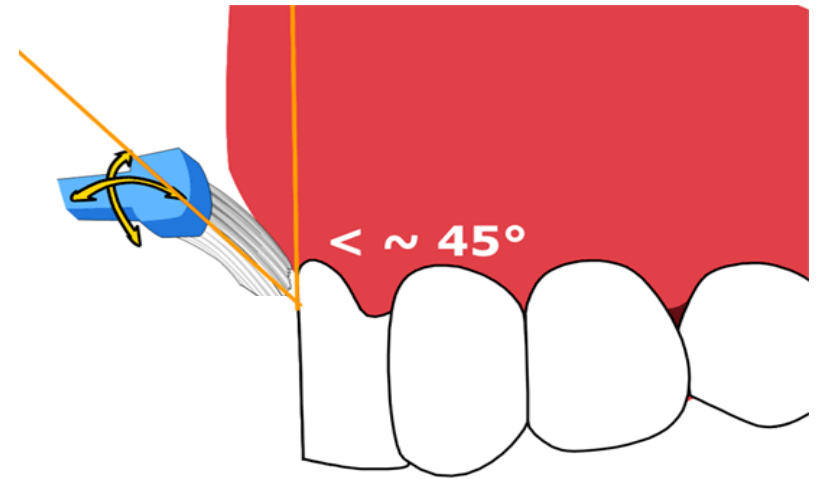
We clean only the occlusal surfaces horizontally

- Fones method
- Charters method
- Stillmann method
- Bass method



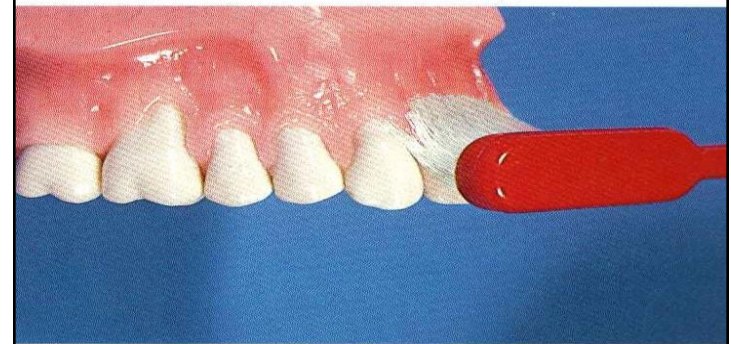
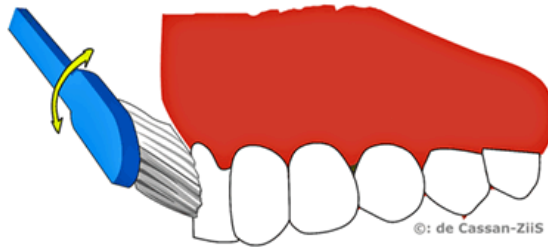
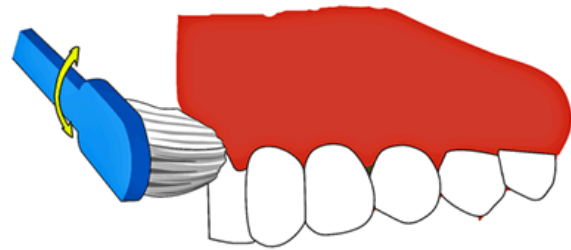
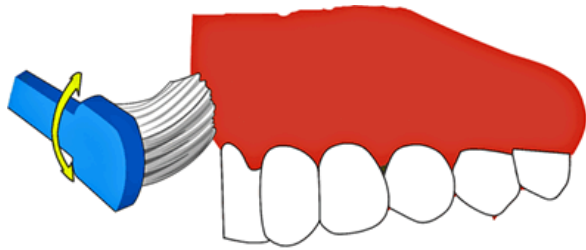
Tooth brushing techniques

- Charters method
- Modified Charters
- bristles are perpendicular to the tooth + vibration



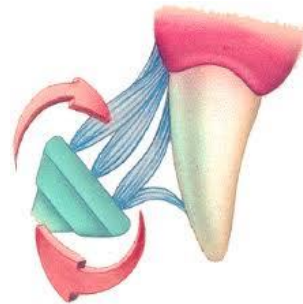
Tooth brushing techniques

- Stilmann method



Tooth brushing techniques

- Bass method
intrasulkular



Electric Toothbrushes

- Rotary oscillating brushes
- Sonic brushes
 - are not necessary
 - selection always individual
 - professional training is recommended (in case of inappropriate use, insufficient cleaning is likely, or the risk of gingival recessions - gingival biotype!)





Consequences of improper toothbrushing

- Horizontal toothbrushing
 - Hard bristles
 - Toothbrushing too frequently
- abrasion of the tooth structure
 - gingival recession (root exposure, hypersensitivity)



Single toothbrush

Suitable for cleaning hard-to-reach places:

- oral areas
- irregularly erupted teeth
- crowded teeth
- third molars
- fixed ortho appliances
- fixed prosthetic restorations,
- implants ...



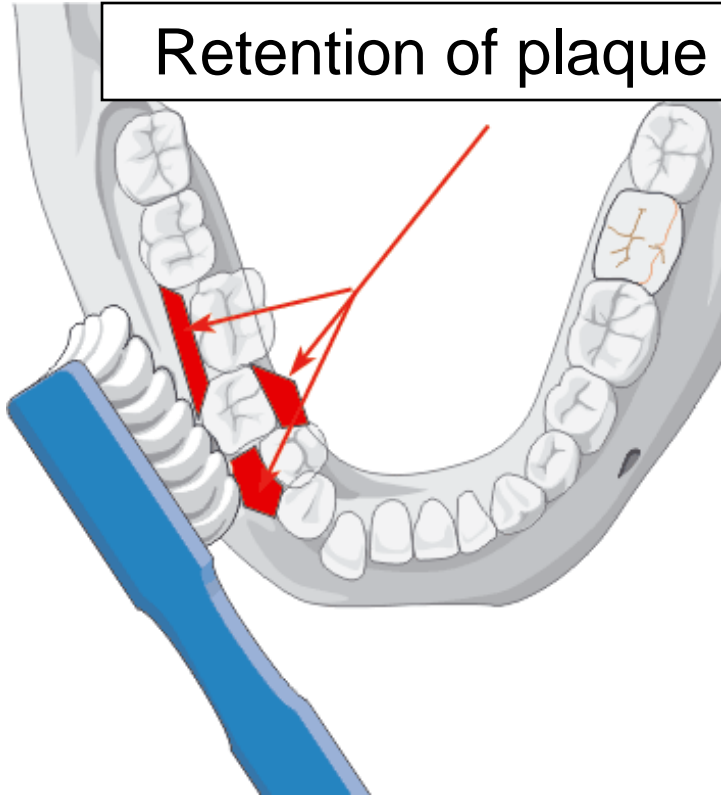
„ siwak“

Single toothbrush

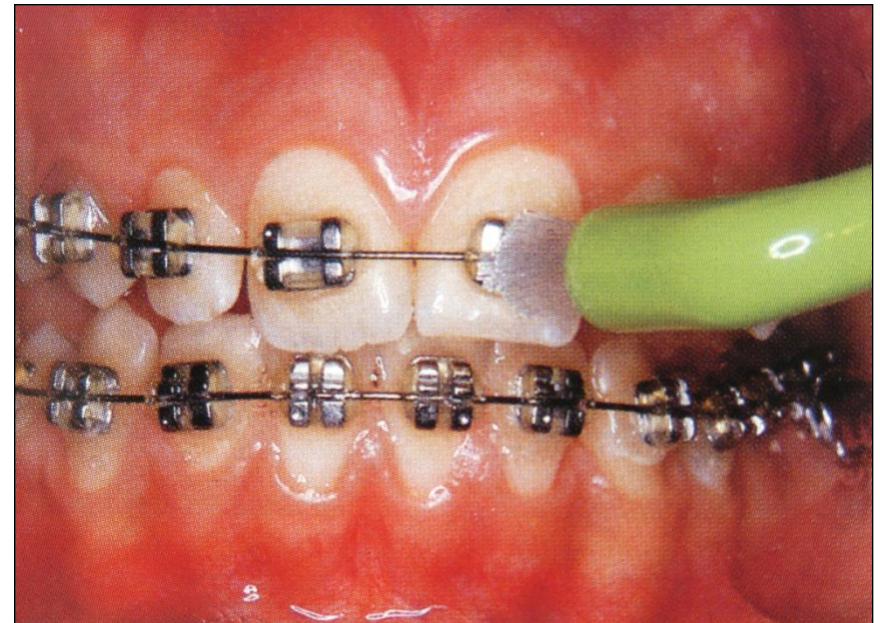


„ siwak“

Retention of plaque



- Crowded teeth
- Orthodontic appliances (braces)
- Implants

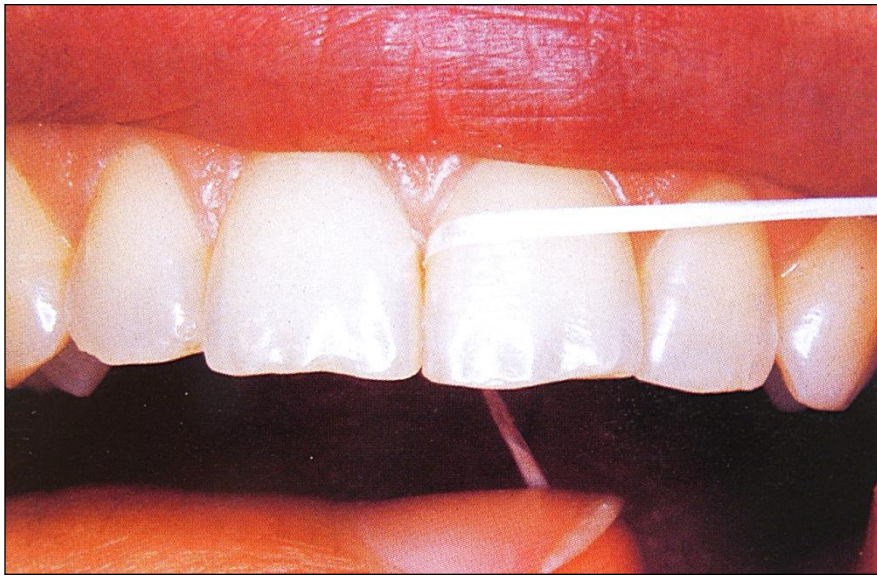


Interdental hygiene

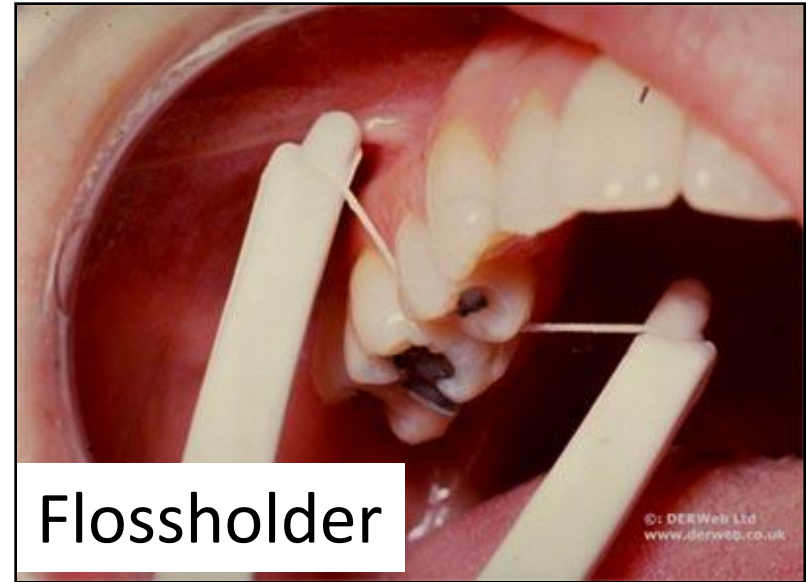
(dental floss, interdental cleaners)



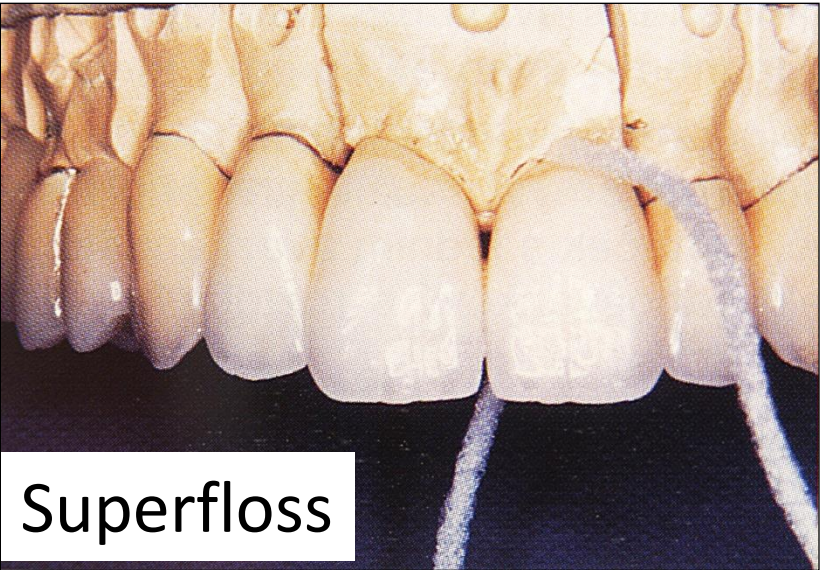
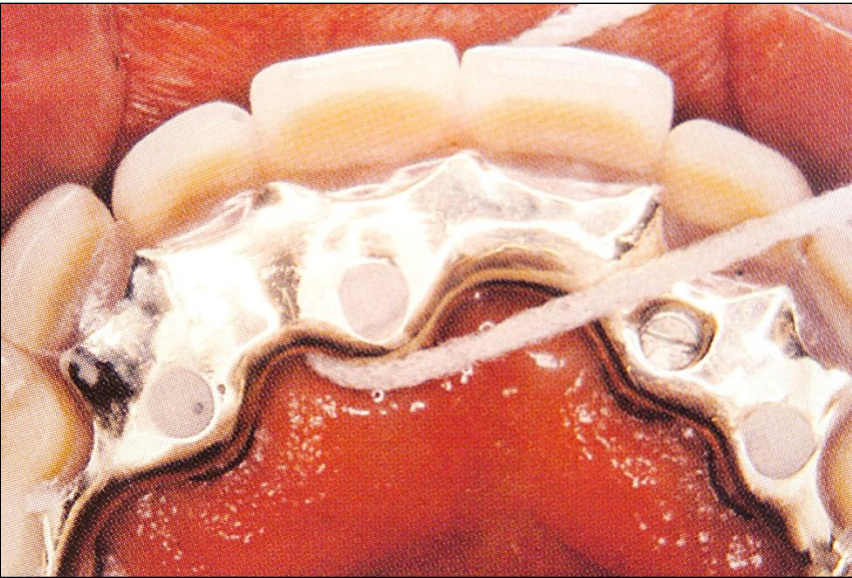
Hidden caries, gingivitis - periodontitis



Floss - waxed, unwaxed



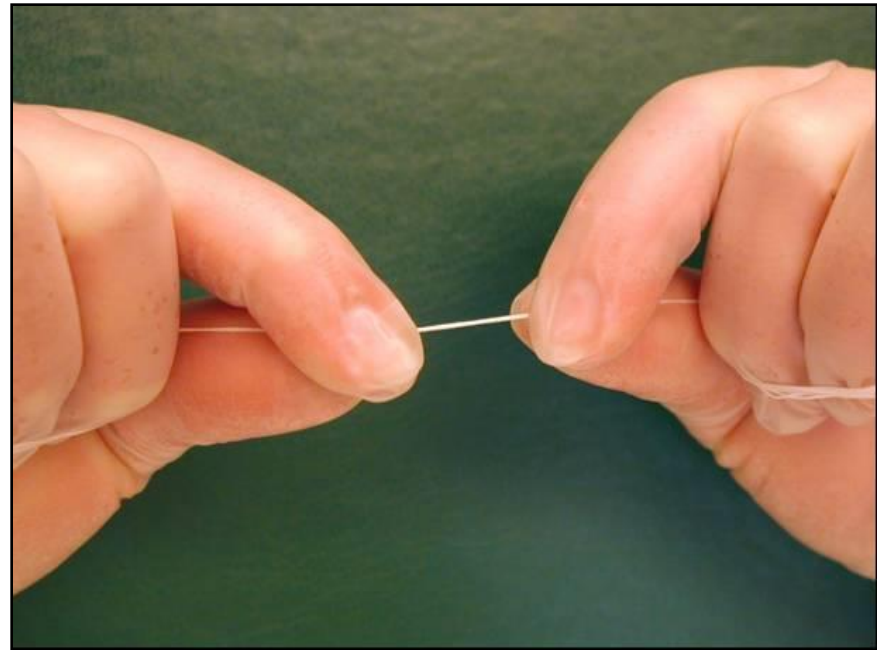
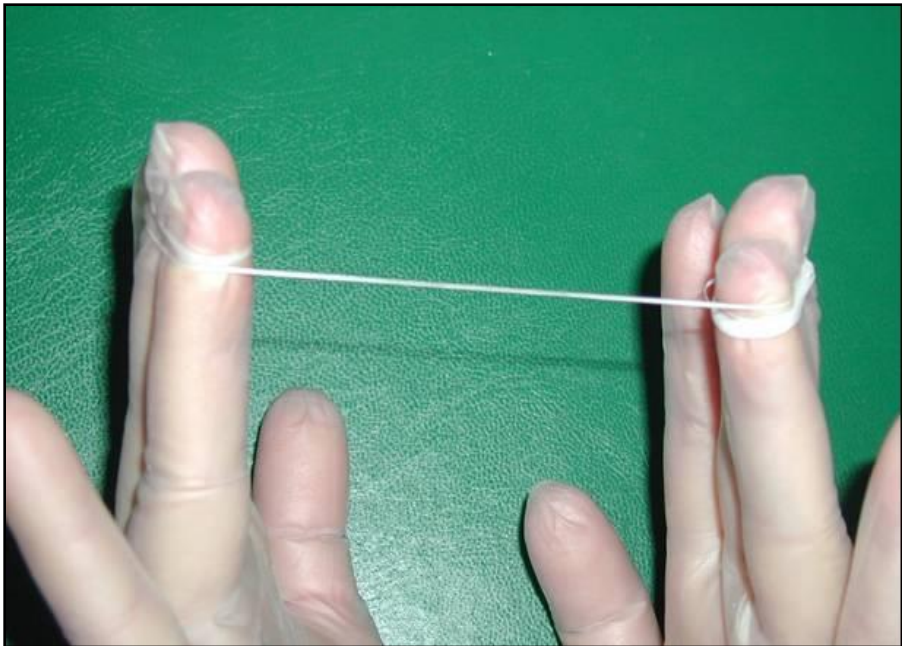
Flossholder



Superfloss

Flossing

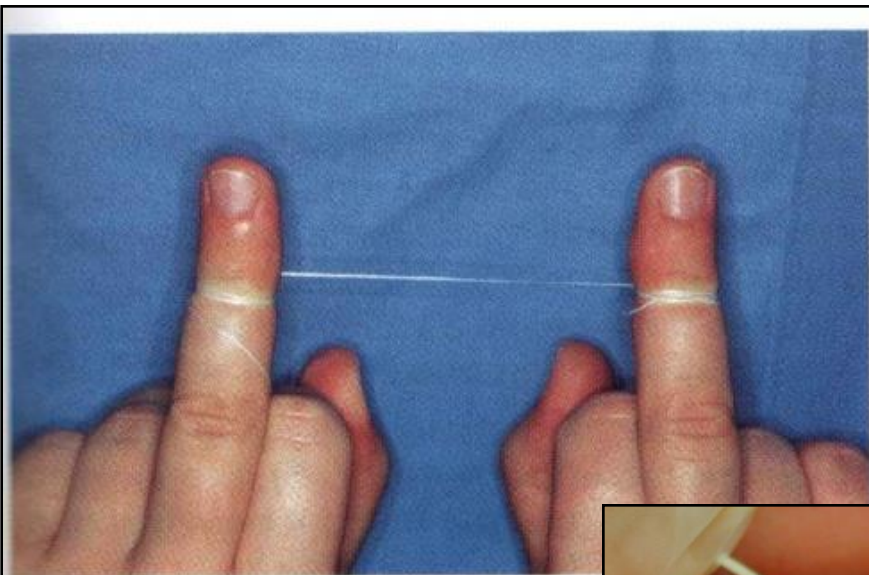
- break off about 15 - 20 cm
- roll floss around middle fingers
- hold the floss between thumbs and index finger
- guide floss between your teeth



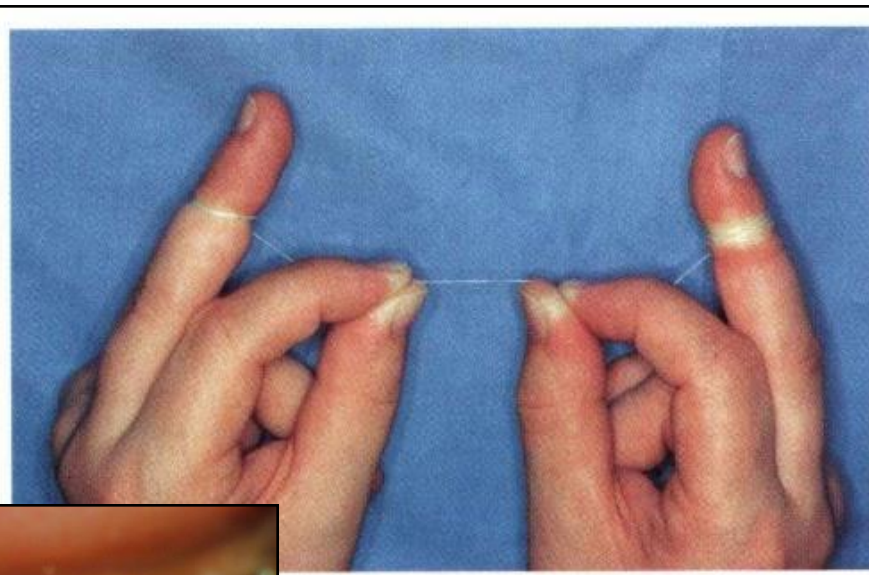
Flossing

- curve it into a C shape against one tooth
- slide it into the space between the gum and the tooth
- move the floss up and down
- do not forget back side of last tooth





Obr. 9a „Upevnění“ dentální nitě namotání obou rukou.



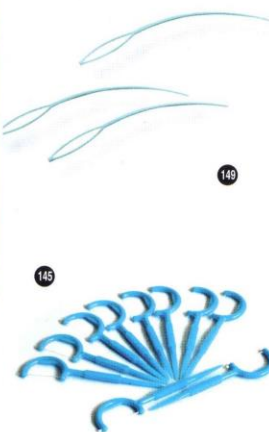
nitě se uchopí palci a ukazováký obou rukou.



Obr. 11a a b Rozsah pohybu dentální nitě ve vertikálním směru.



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145



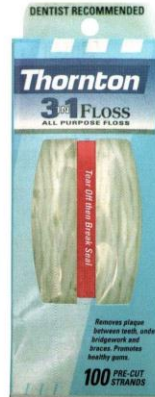
DENTIST RECOMMENDED

143



DENTIST RECOMMENDED

140



DENTIST RECOMMENDED

141



147

148



147



154



150



151



153

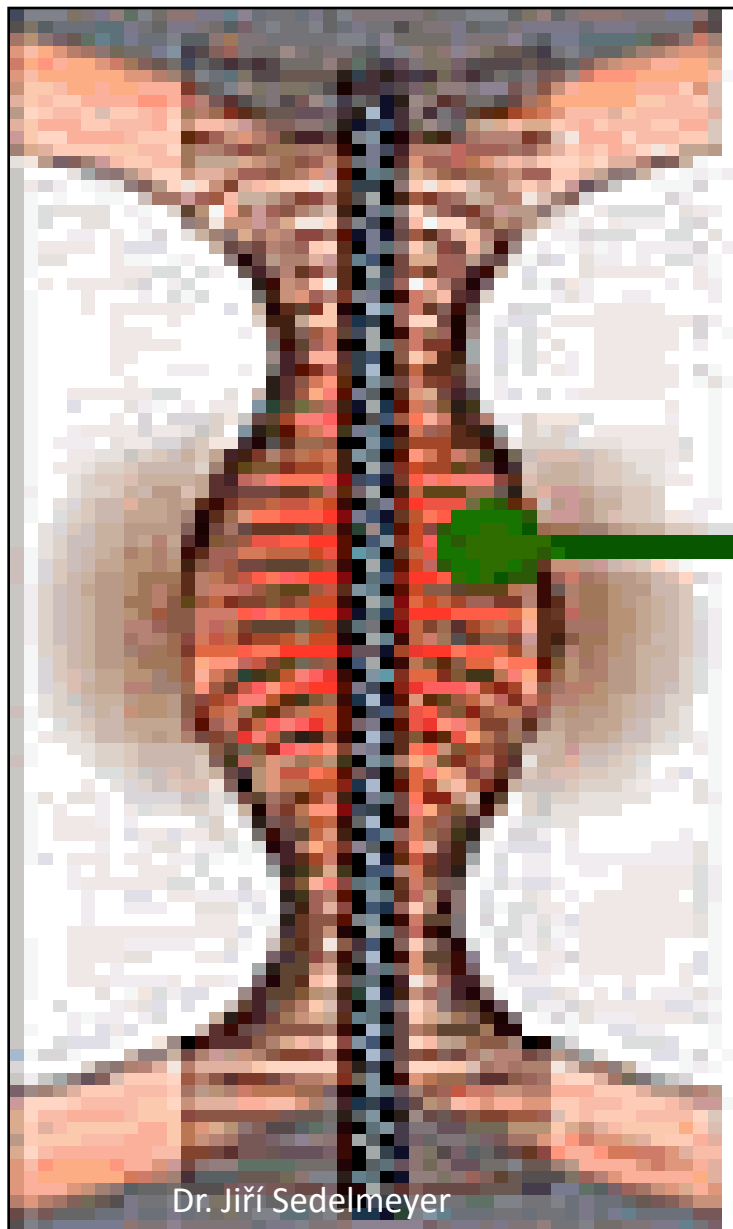


144

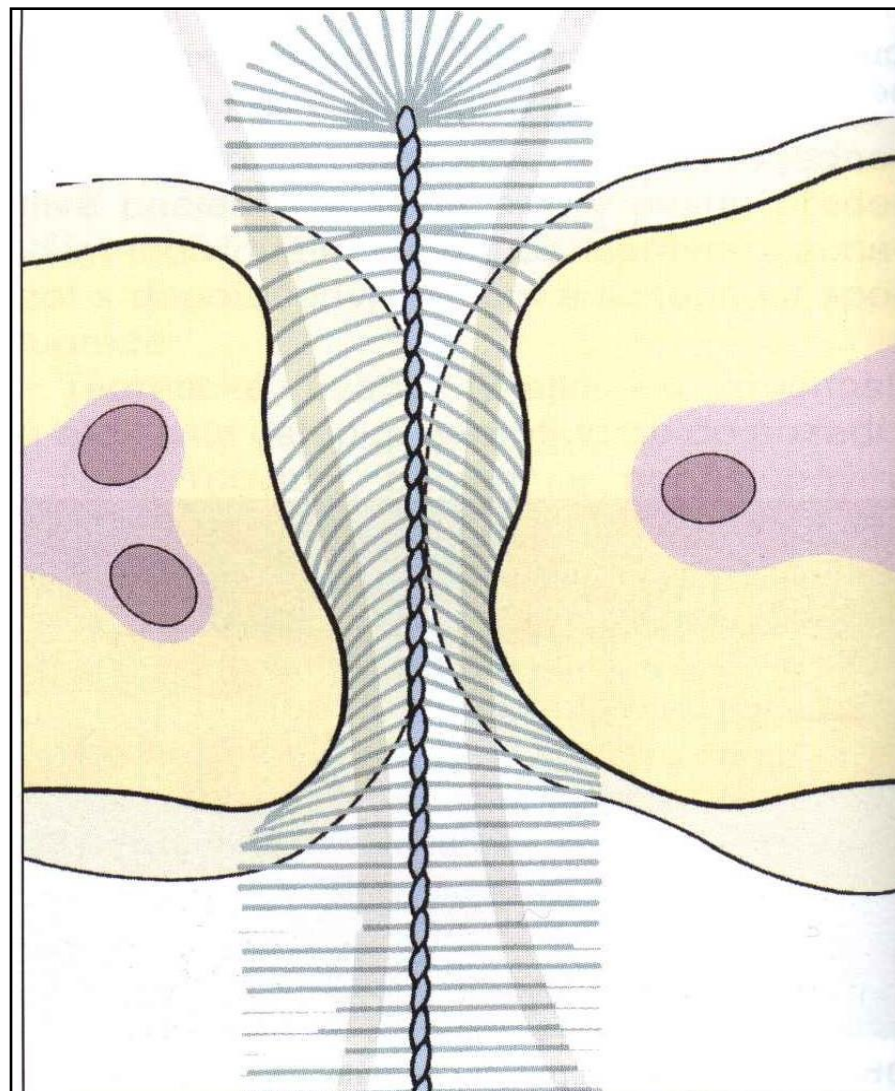


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Interdental cleaners

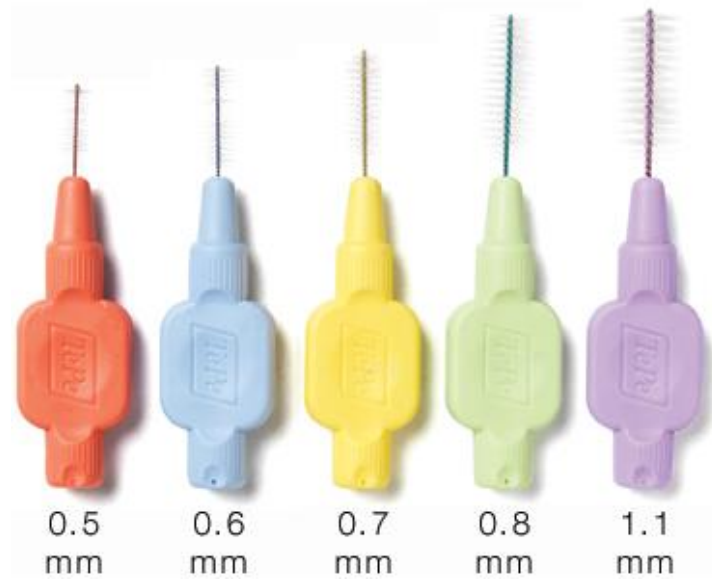
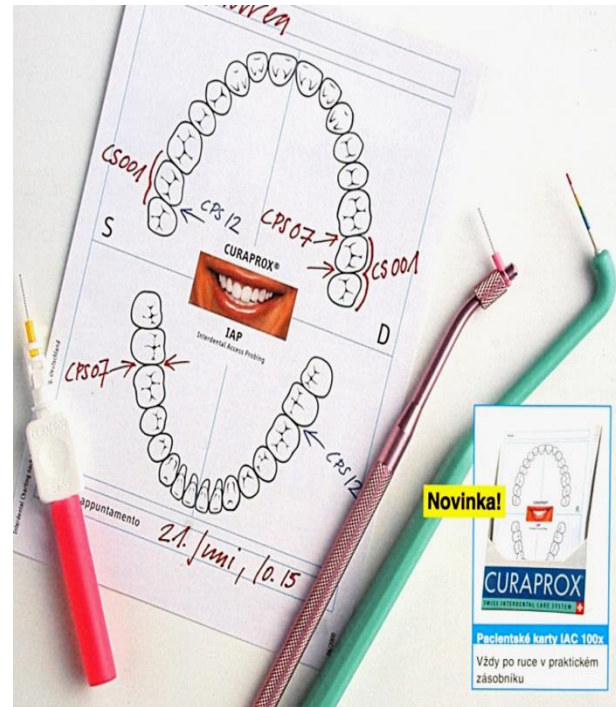


Dr. Jiří Sedlmeyer



	TePe® Original	TePe® Extra soft	TePe® Angle	GUM® Trav-Ler	GUM® SoftPicks	GUM® Bi-Direction	TANDEX® Flexi	DOFT Interdental Brush	CURAPROX CPS-prime	CURAPROX CPS-regular	Oral-B® Interdental
RÜCHODNIK											
ISO	● ↓	● ↓	● ↓	●★ ↓ ↓	● ↓	● ↓	● ↓				● ↓
ISO 0	137610 0,4 mm		154610 0,4 mm	G1312			TA 819070 0,35 mm TA 819071 0,4 mm	IB04 0,4 mm	CPS 06		
ISO 1	137620 0,45 mm	122625 0,45 mm	154620 0,45 mm	G1314	G632M10 G632M80	G2114 0,43 mm	TA819072 0,45 mm		CPS 07		
ISO 2	137630 0,5 mm	122635 0,5 mm	154630 0,5 mm	G1412	G634MA40	G2314 0,43 mm	TA819073 0,5 mm	IB05 0,5 mm	CPS 08 CPS 09	CPS 10	
ISO 3	137640 0,6 mm	122645 0,6 mm	154640 0,6 mm	G1414 ▲ G1512		G2614 0,53 mm ▲	TA819074 0,6 mm	IB06 0,6 mm	CPS 011	CPS 11	OB2209130
ISO 4	117650 0,7 mm	122655 0,7 mm	154650 0,7 mm	G1514 ▲ G1612	G636M10		TA819075 0,7 mm	IB07 0,7 mm		CPS 12	
ISO 5	117660 0,8 mm	122665 0,8 mm	154660 0,8 mm	G1614 ▲			TA819076 0,8 mm ▲	IB08 0,8 mm		CPS 14 ▲ CPS 14Z	OB2209125 ▲
ISO 6	114670 1,1 mm	122675 1,1 mm		G1618			TA819077 1,0 mm ▲	IB09 0,9 mm			
ISO6							TA819078 1,2 mm			CPS 15	
ISO7	114680 1,3 mm									CPS 18	
ISO7	114690 1,5 mm										

- ▲ kónický tvar kartáčku
- ▼ trojúhelníkový průřez mezizubního kartáčku
- plastem izolovaný drátek
- ★ vlákna impregnovaná chlórhexidímem 0,3%



CPS řady «perio»

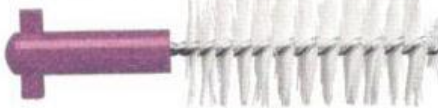
CPS 405

1,3 mm* / 5,0 mm**



CPS 406

1,7 mm* / 6,5 mm**



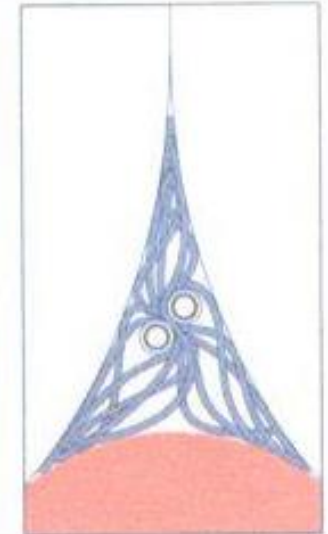
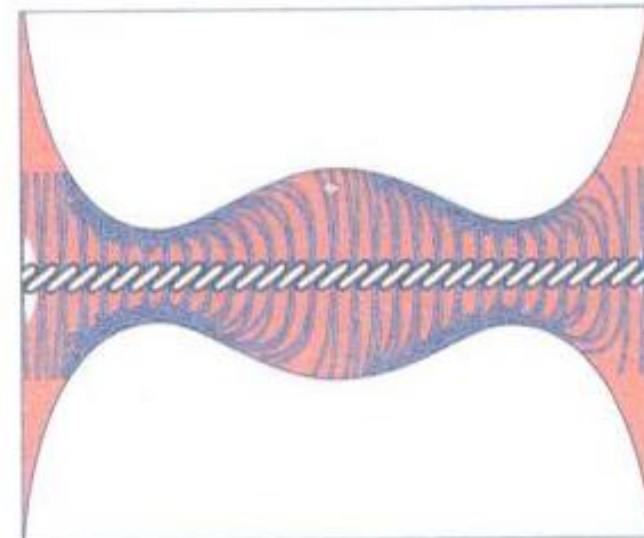
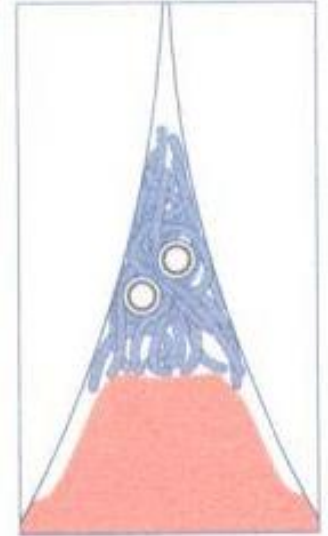
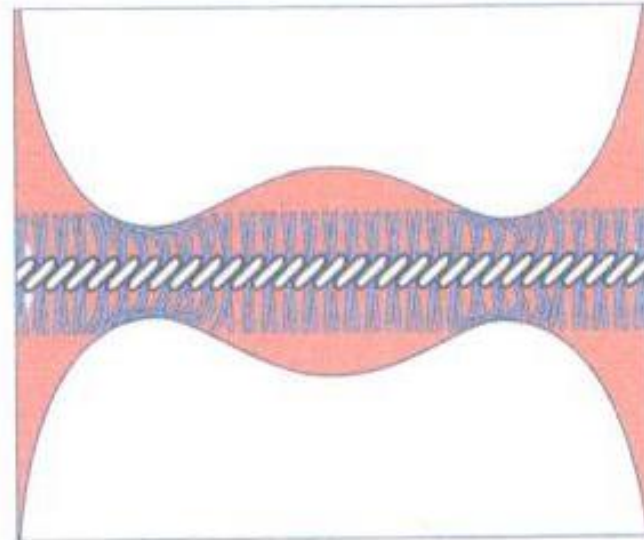
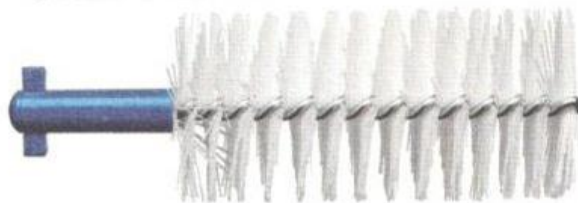
CPS 408

2,2 mm* / 8,0 mm**

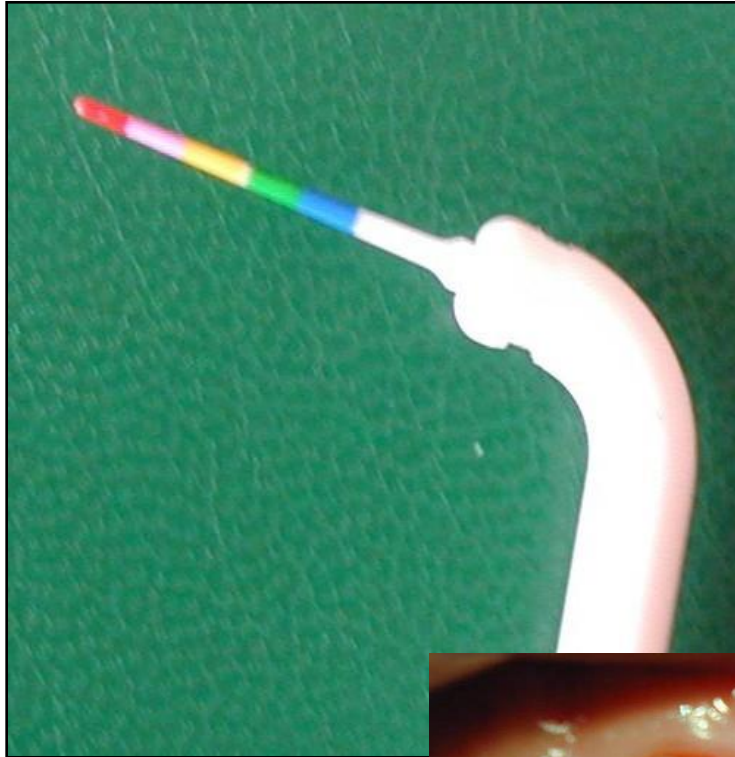


CPS 410

2,5 mm* / 10,0 mm**



Interdental cleaners



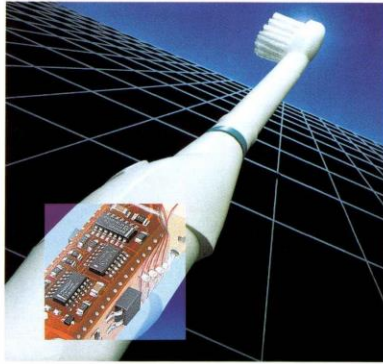
IAP probe

In patients with periodontitis, the **furcation area** can also be cleaned with interdental toothbrushes

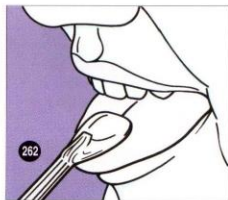
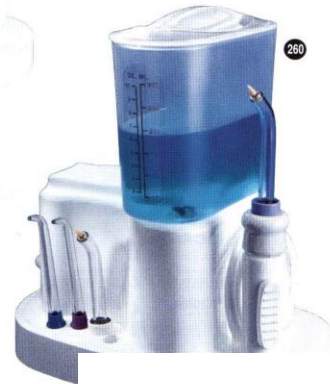
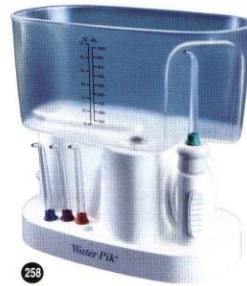
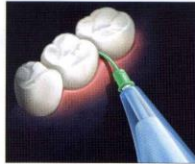




You forgot
about
interdental
spaces !!!



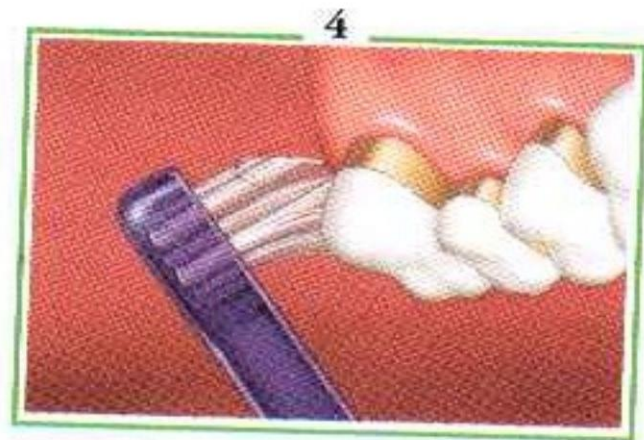
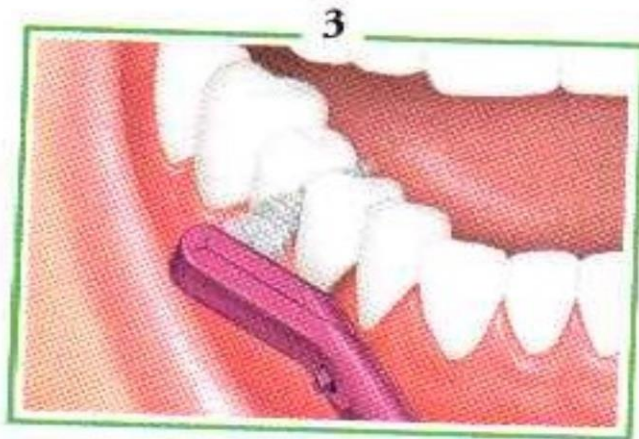
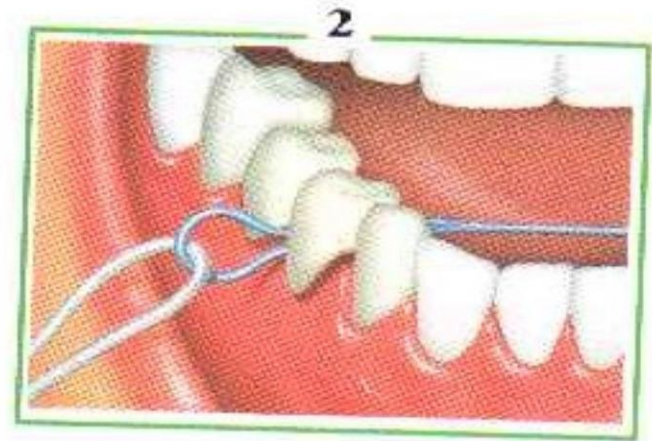
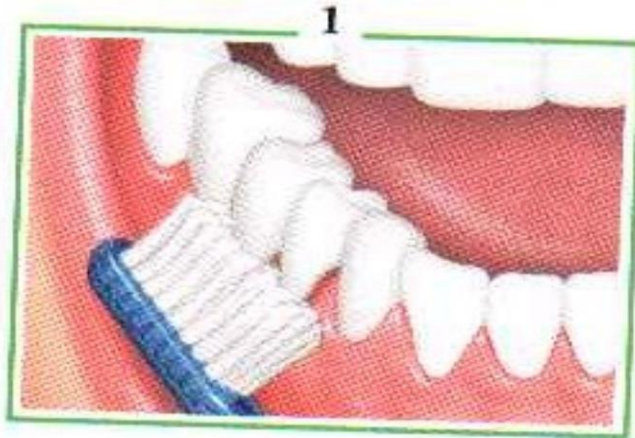
Water Pik



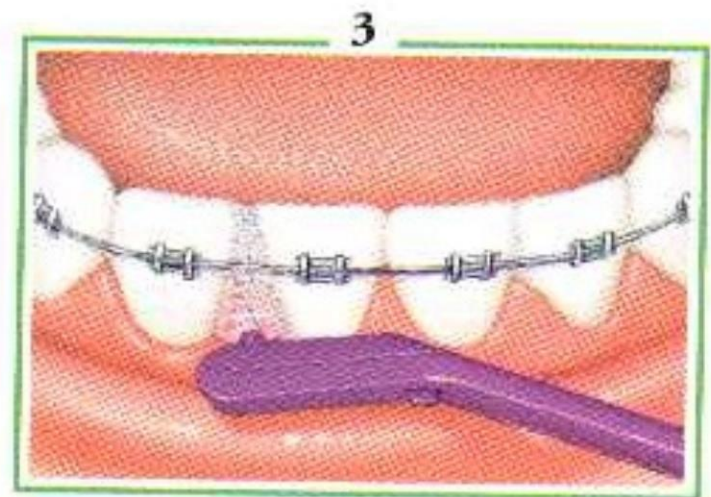
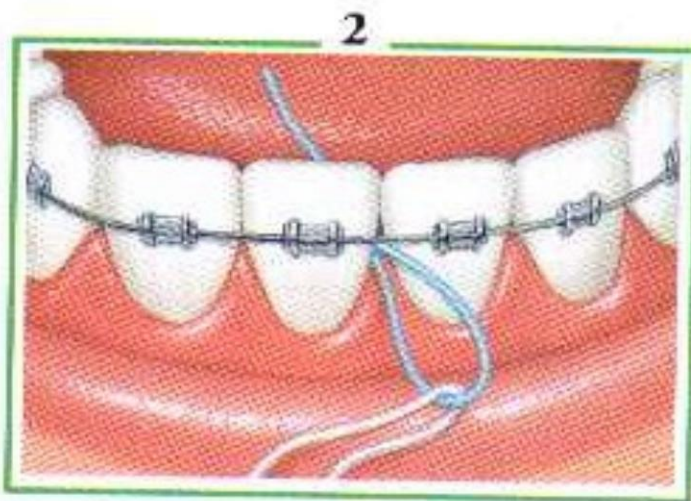
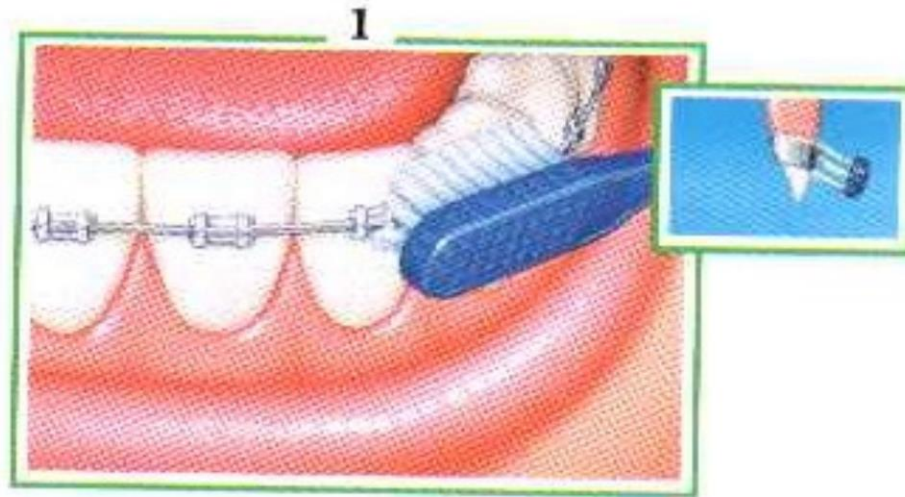
Irrigators

water sprays don't
remove plaque !!!

How to clean bridges

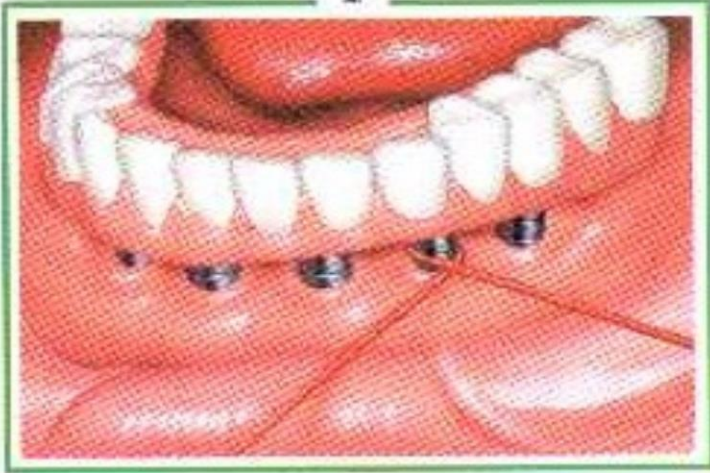


How to clean orthodontic appliances

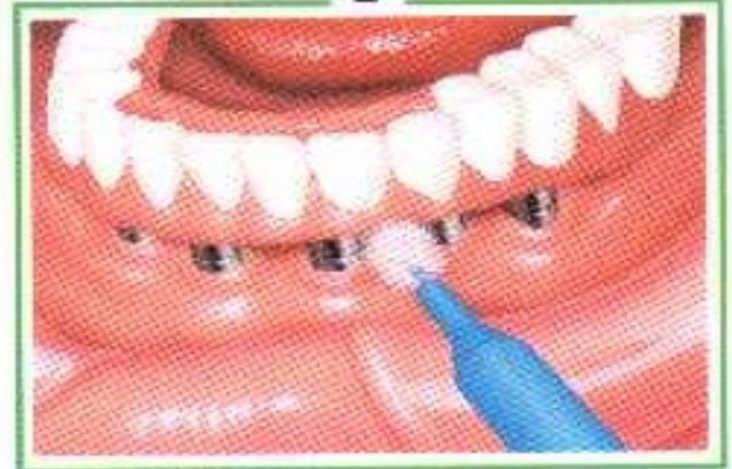


How to clean implants

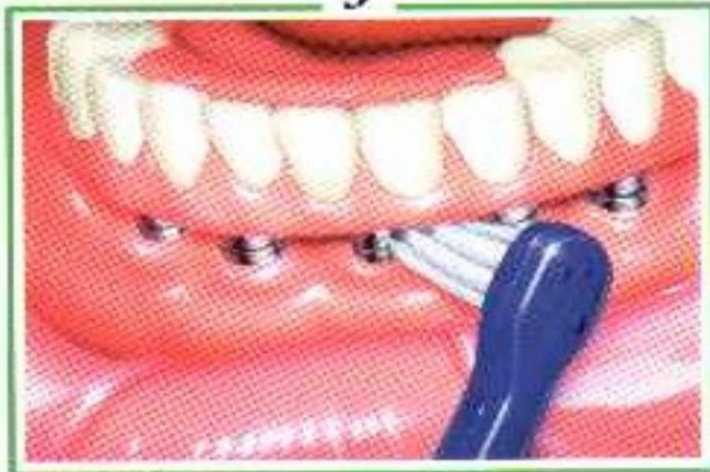
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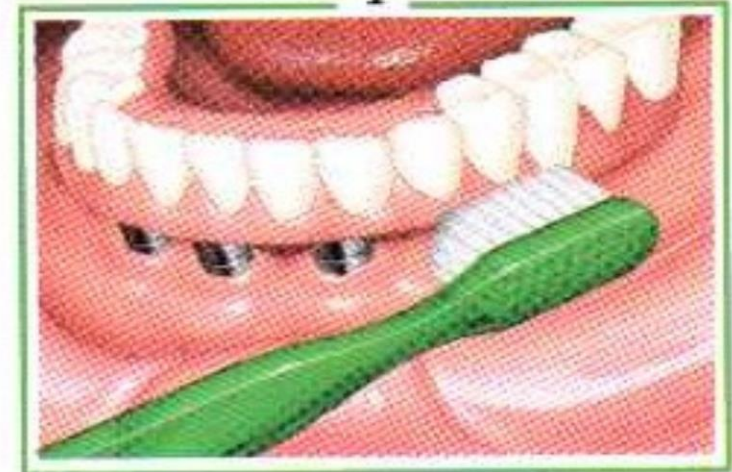
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3



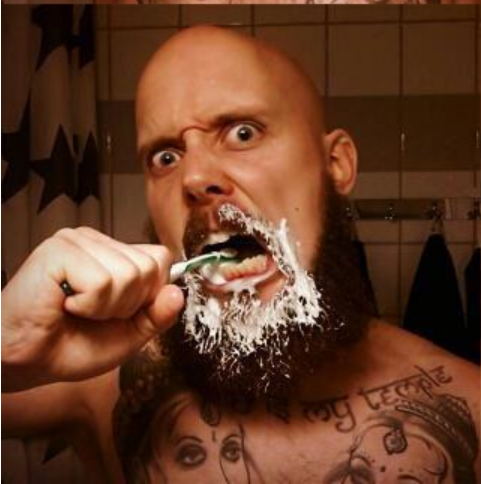
4



Toothpastes

- Abrasives (RDA)
- Detergents, surfactants, dyes
- Taste correction

- **Fluorides** (NaF, Aminofluoride, SnF, sodium monofluorophosphate)
- **Antimicrobial components** (triclosan, CPC, CHX)
- **Calculus inhibitors** (ZnCl)
- Adstringent factors
- Desensitizers
- Bleaching agents



Mouthwash

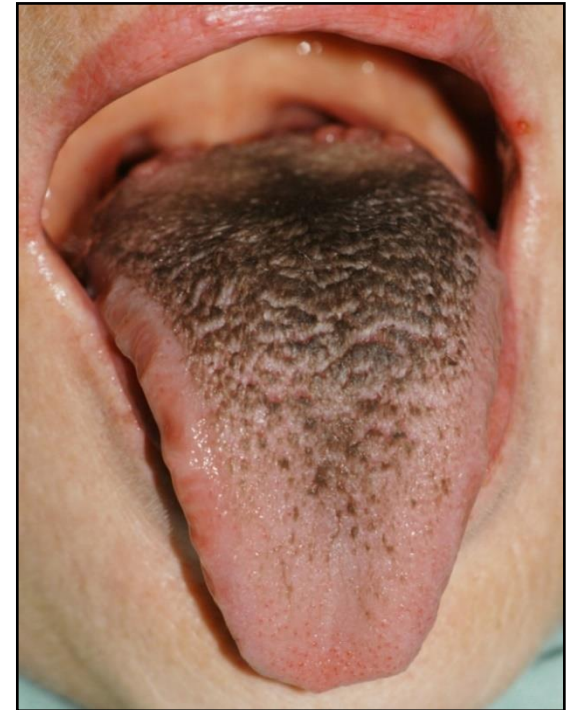
??????

- Antiseptic/antiinflammatory
- chlorhexidine
- Against tooth decay
- with fluorine content
- Desensitization



CHX - antibacterial, antiviral, antifungal effect

- 0,2% max 2 weeks
- 0,12% 0,1% 0,06%
- Unpleasant side effects
 - staining of teeth and tongue
 - taste disturbances
 - mucosal desquamation
- Adjunct during initial therapy
- Desinfection of oral cavity before dental treatment
- In handicapped patients
- Periodontal surgery



Conclusion

Clean tooth can not be ill

