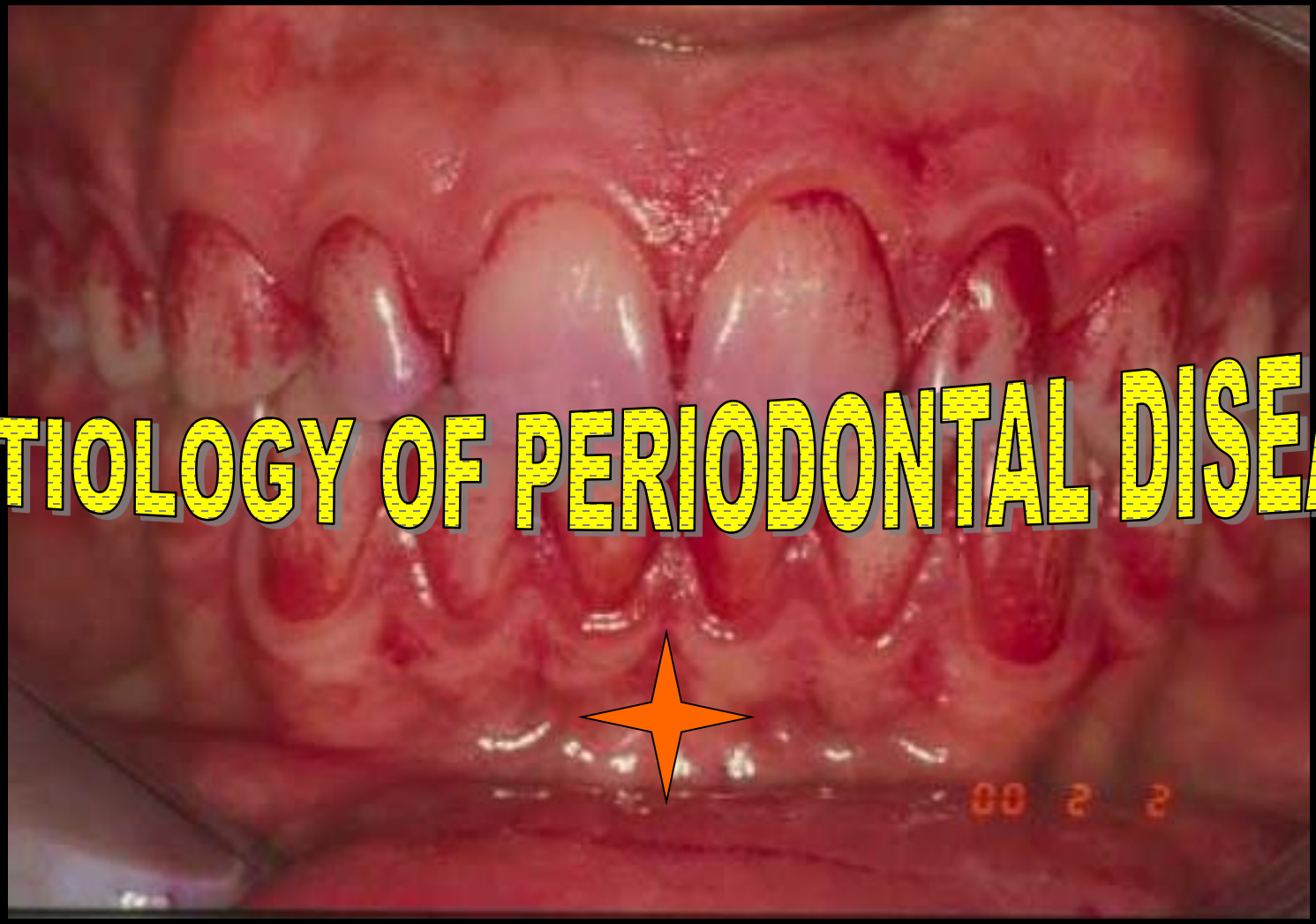
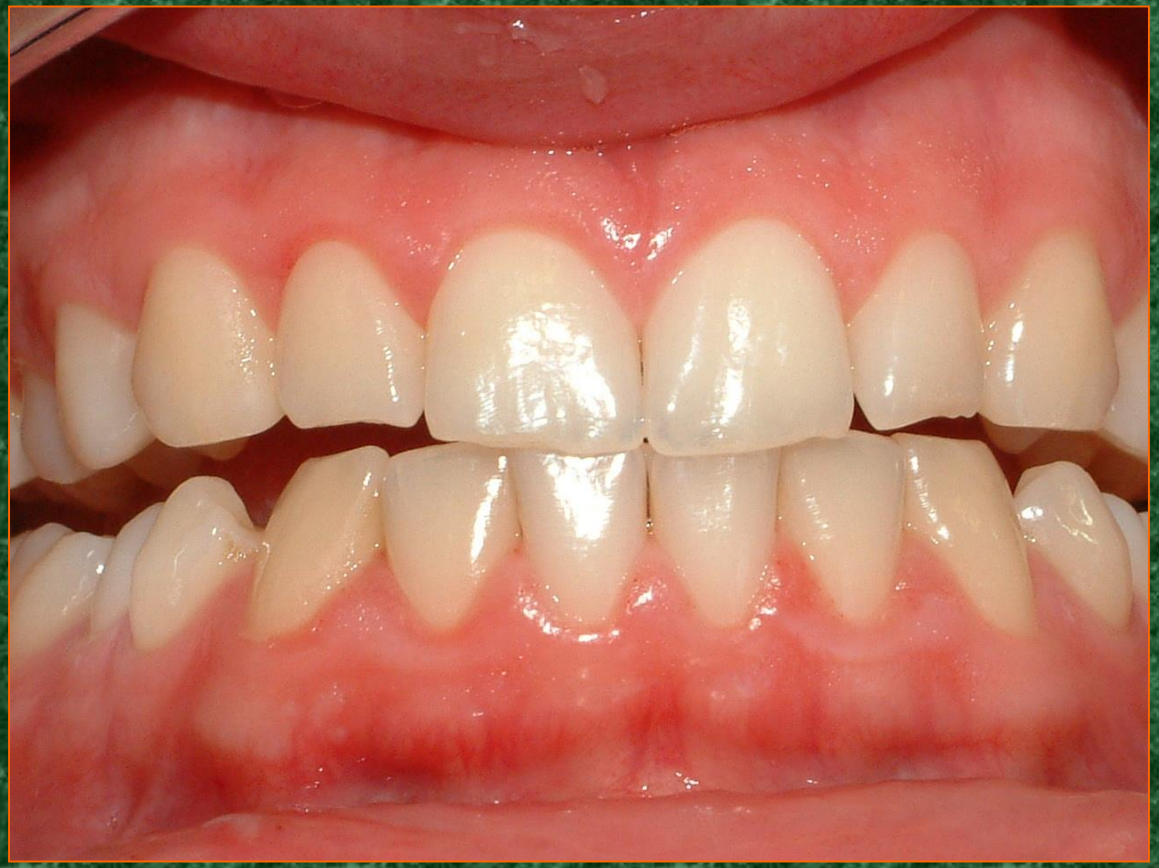
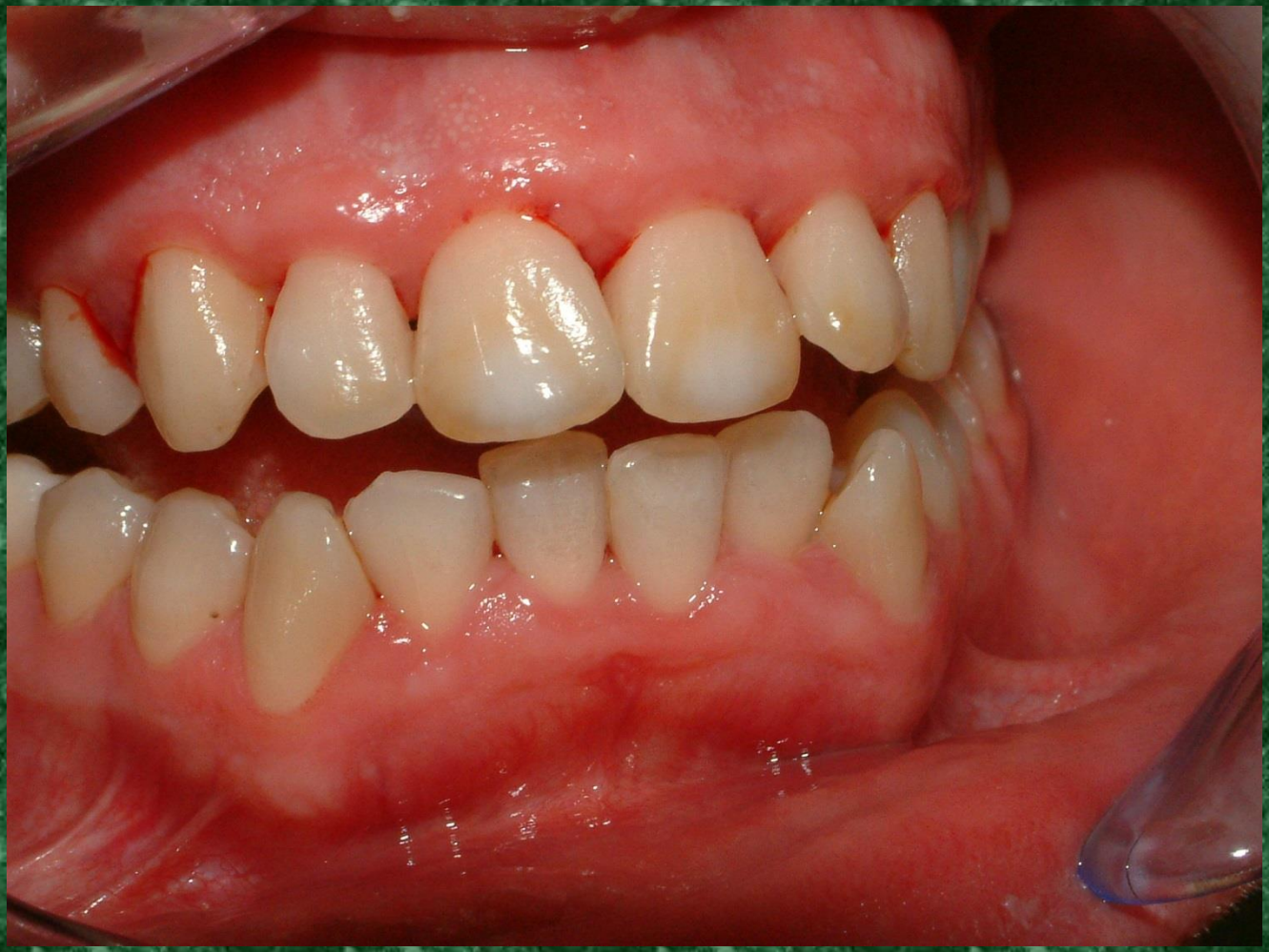
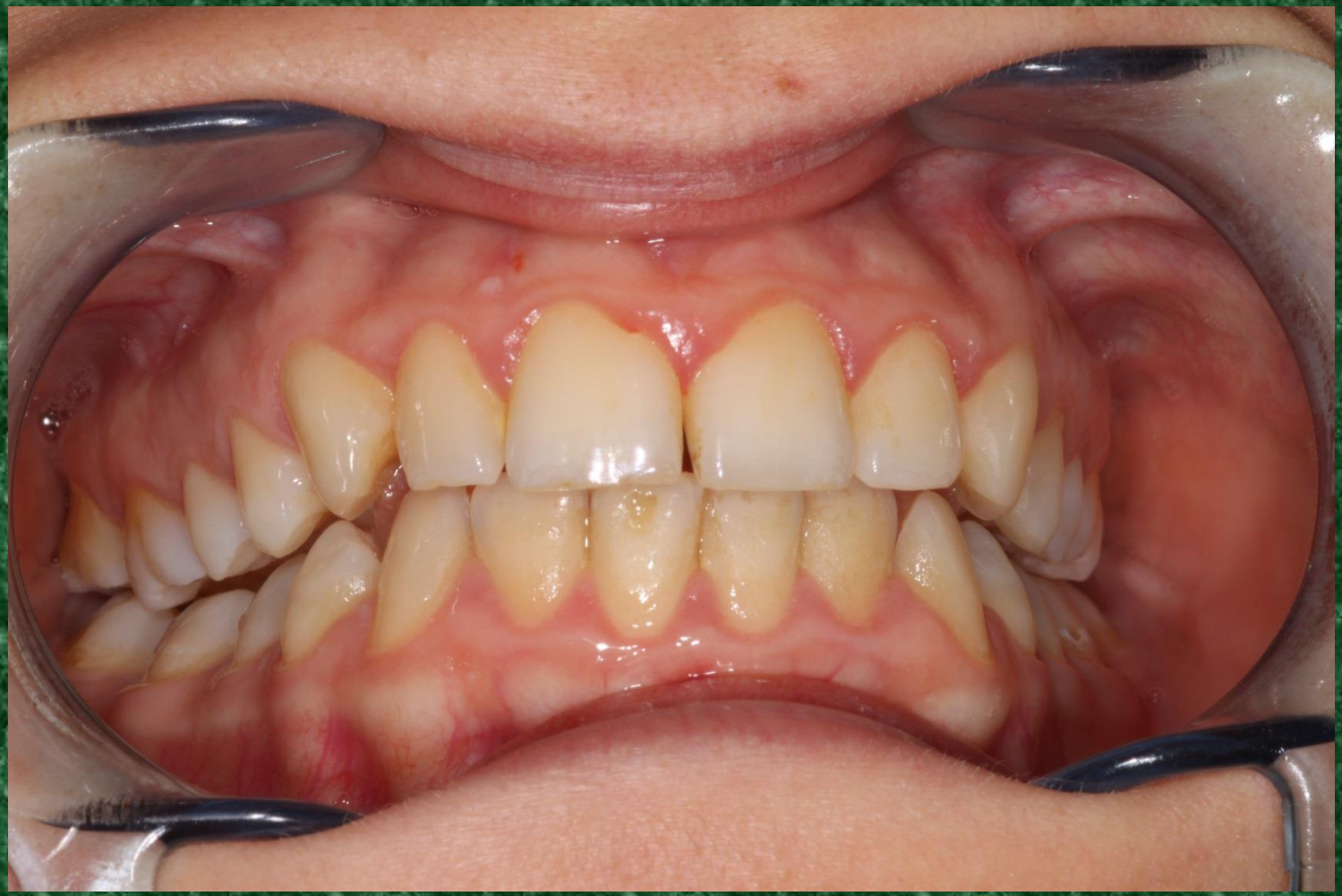
DENTAL PLAQUE - THE MAJOR ETIOLOGIC FACTOR OF ALL KIND OF PERIODONTAL DISEASES



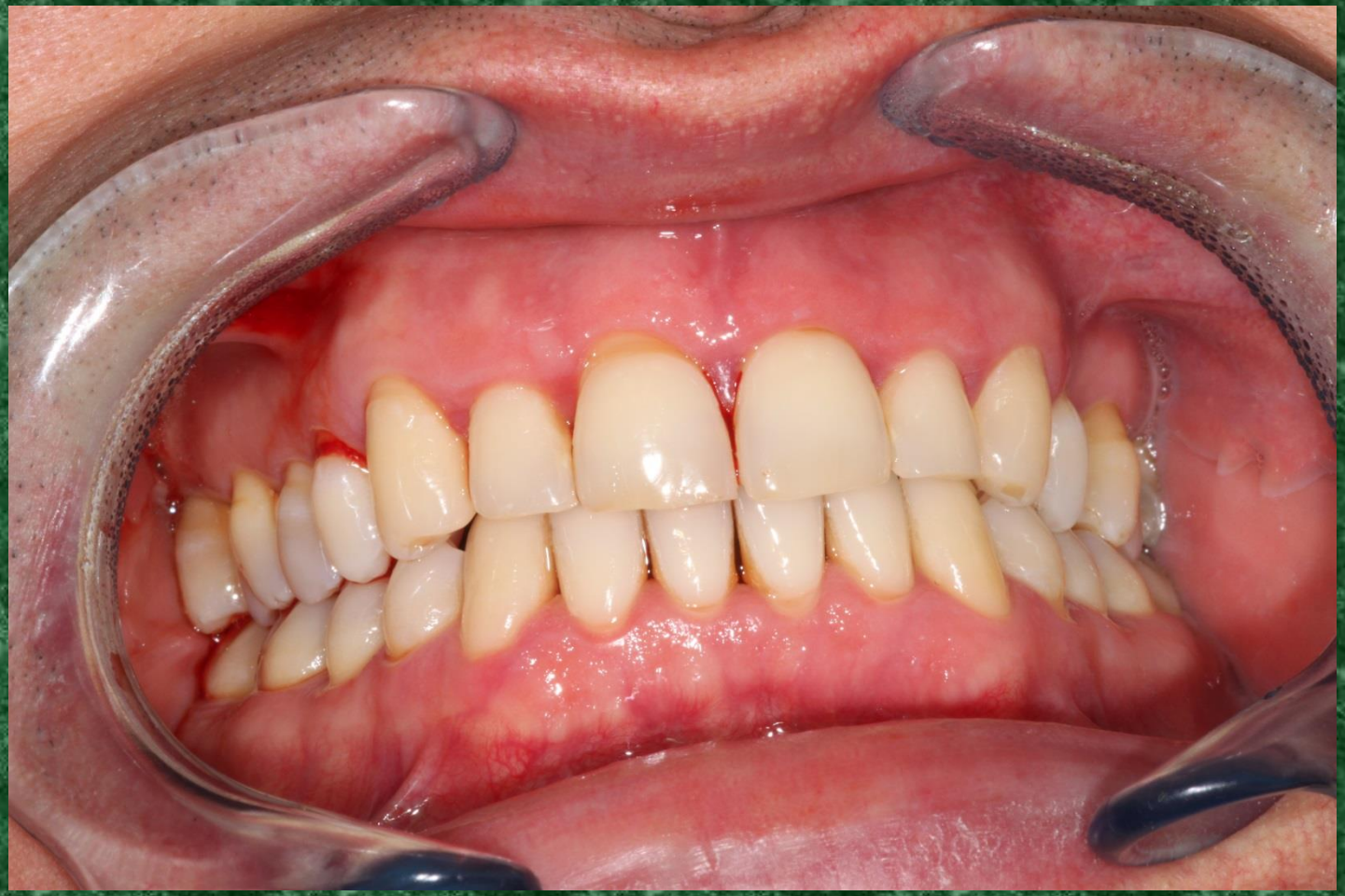




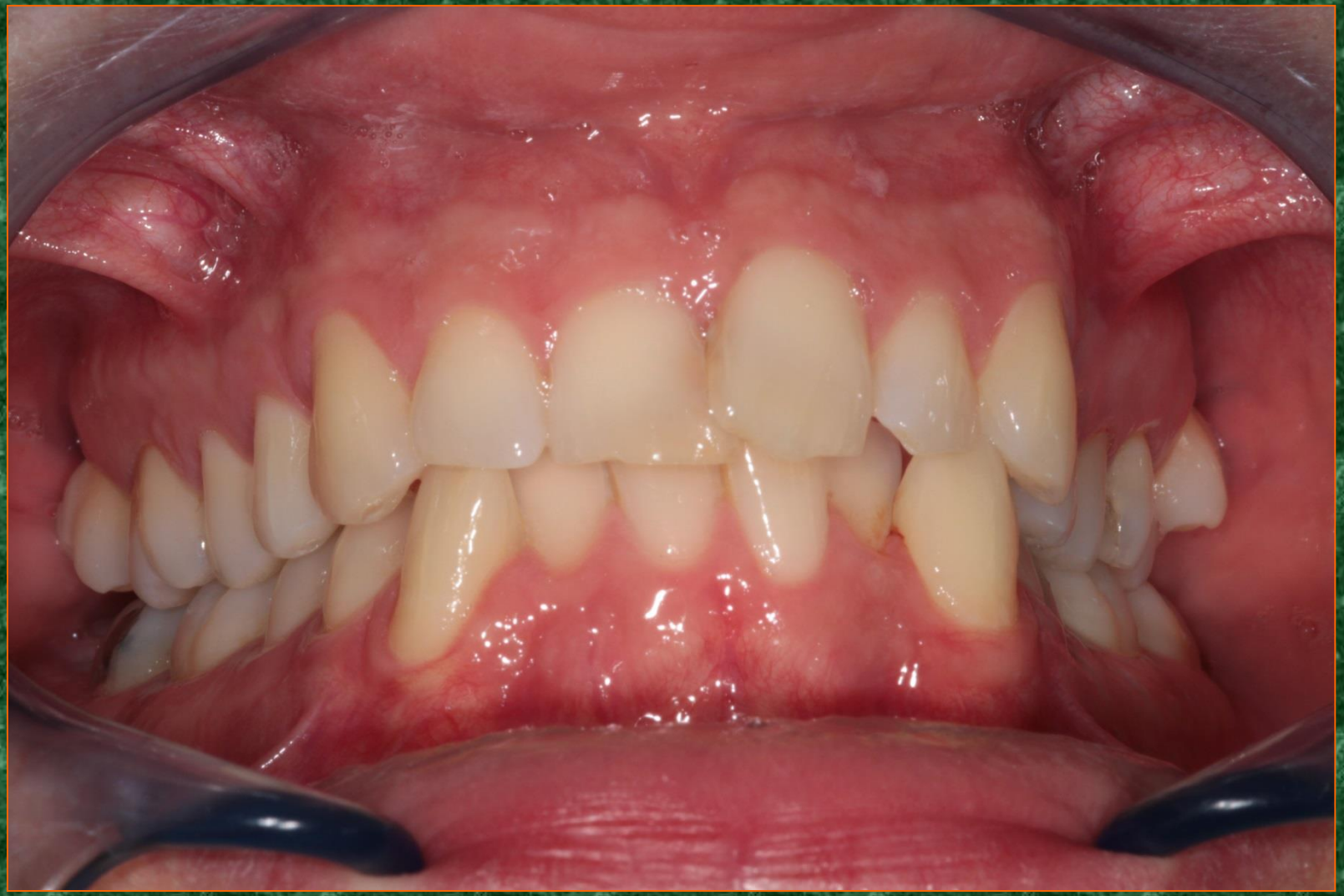
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???



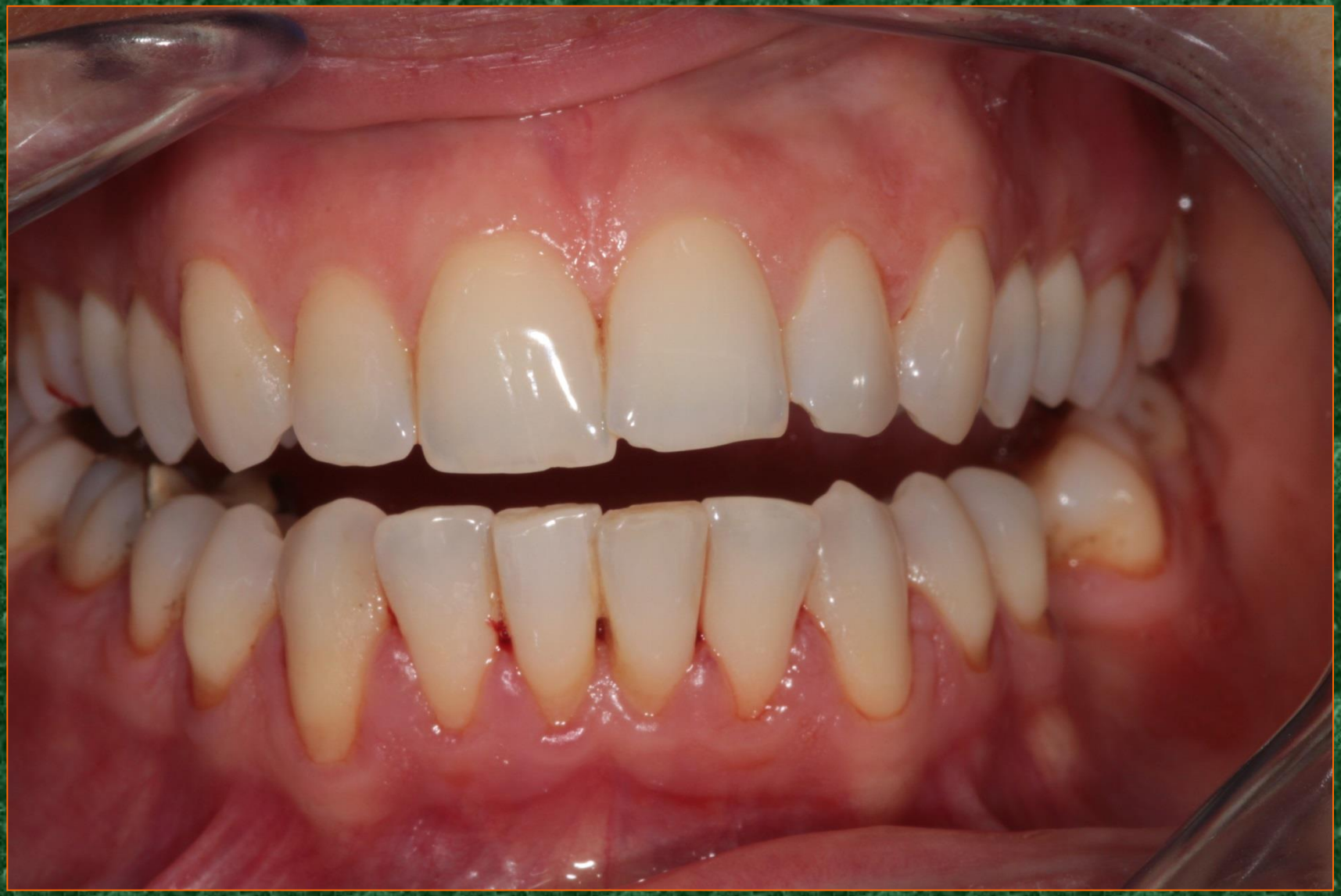
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???



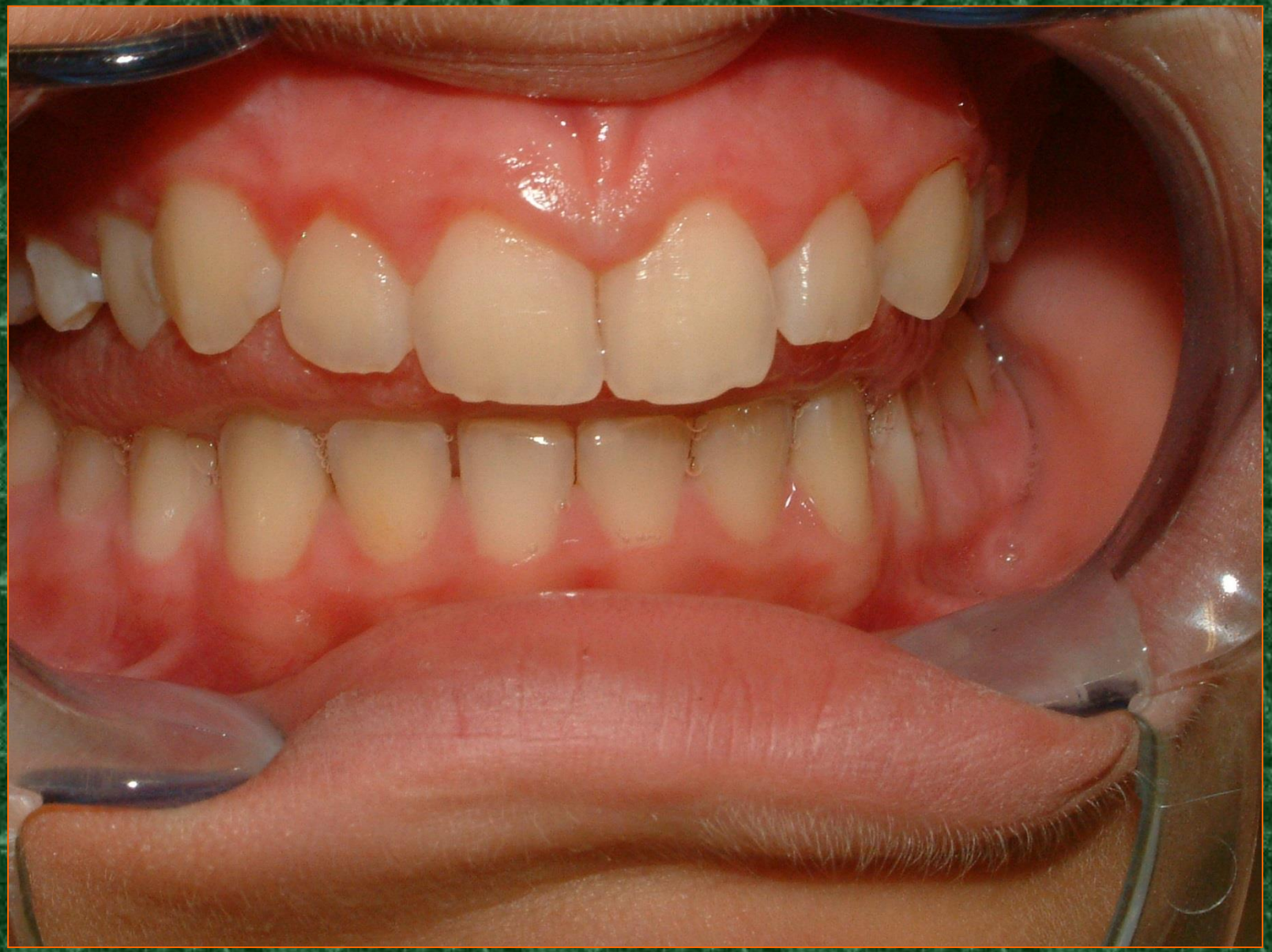
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???



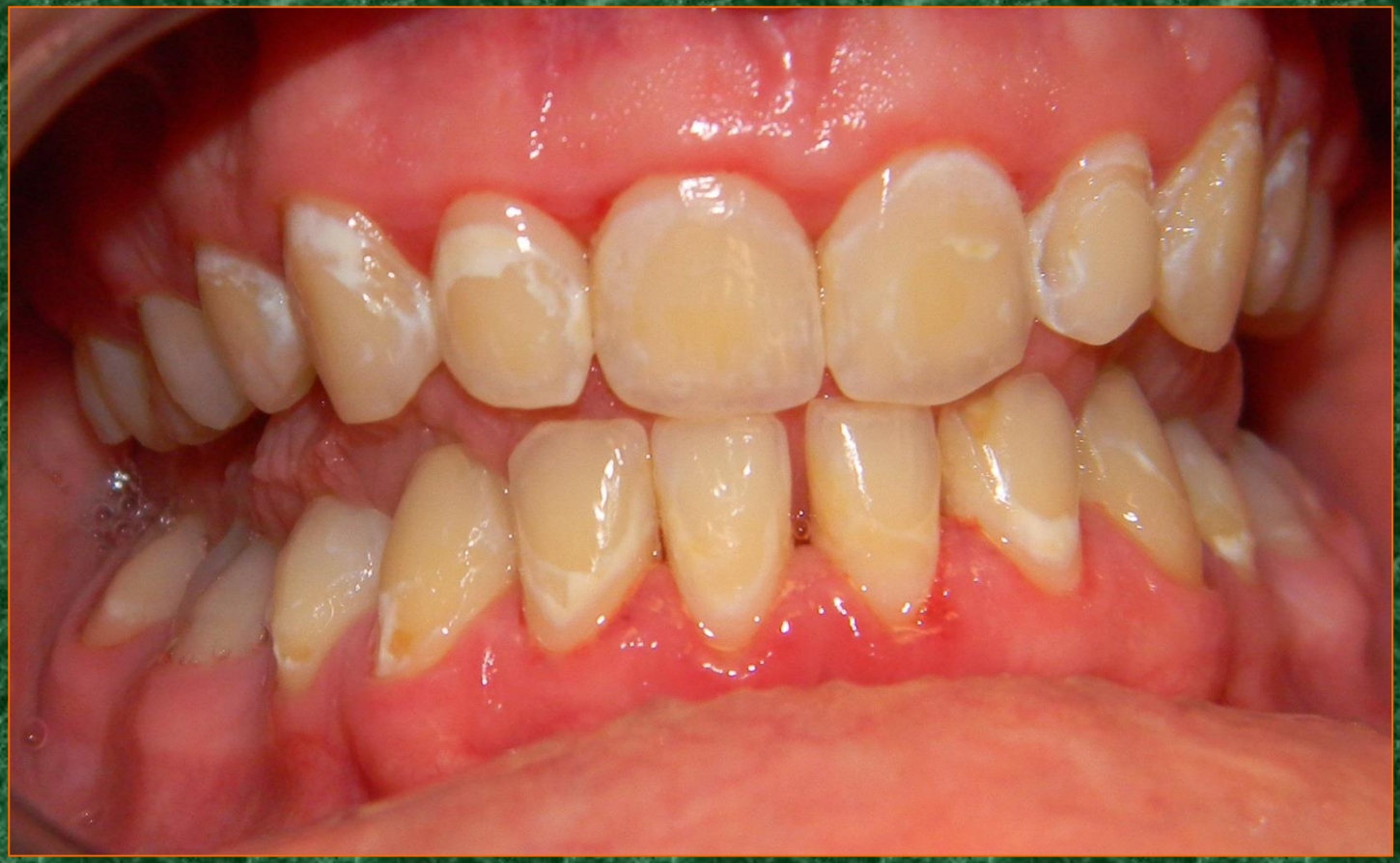
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???



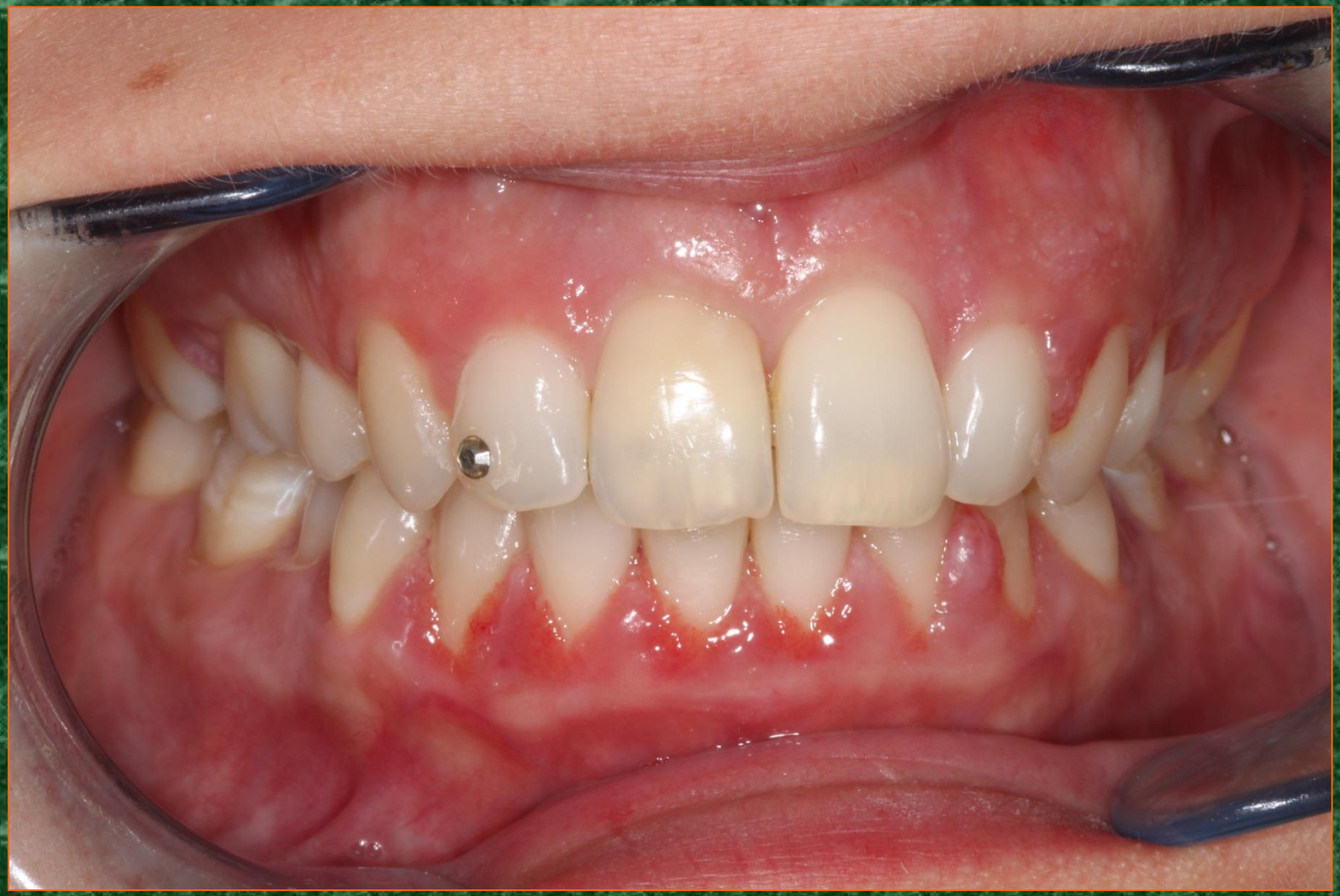
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???



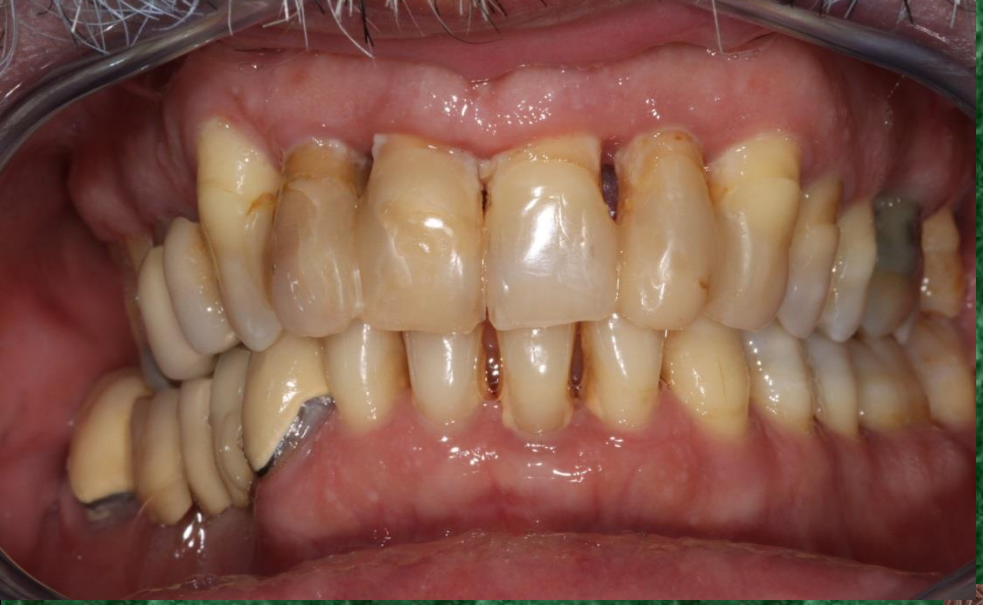
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???

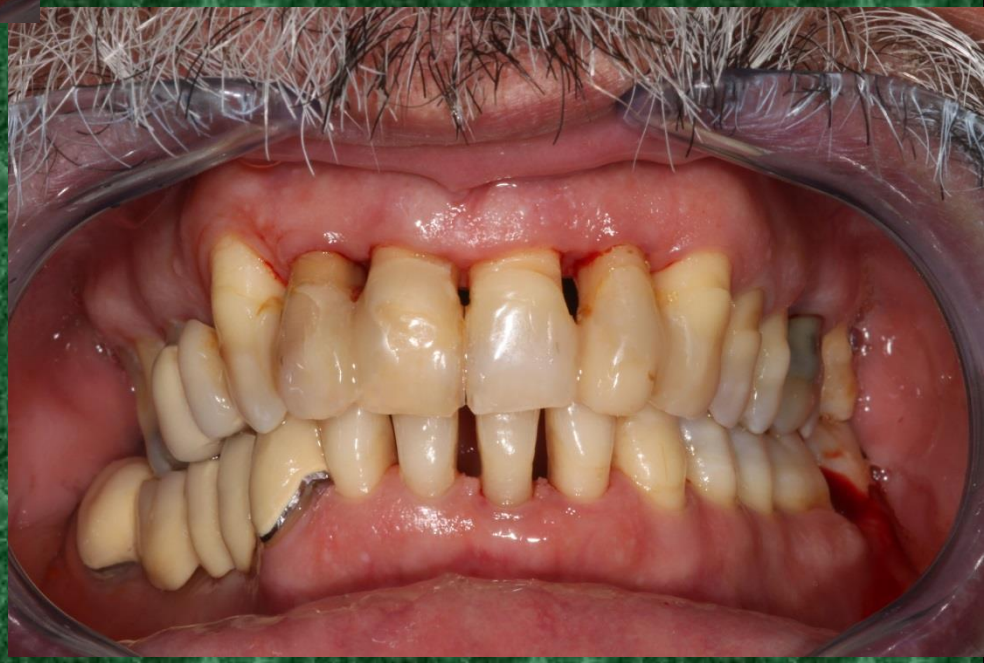


WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???

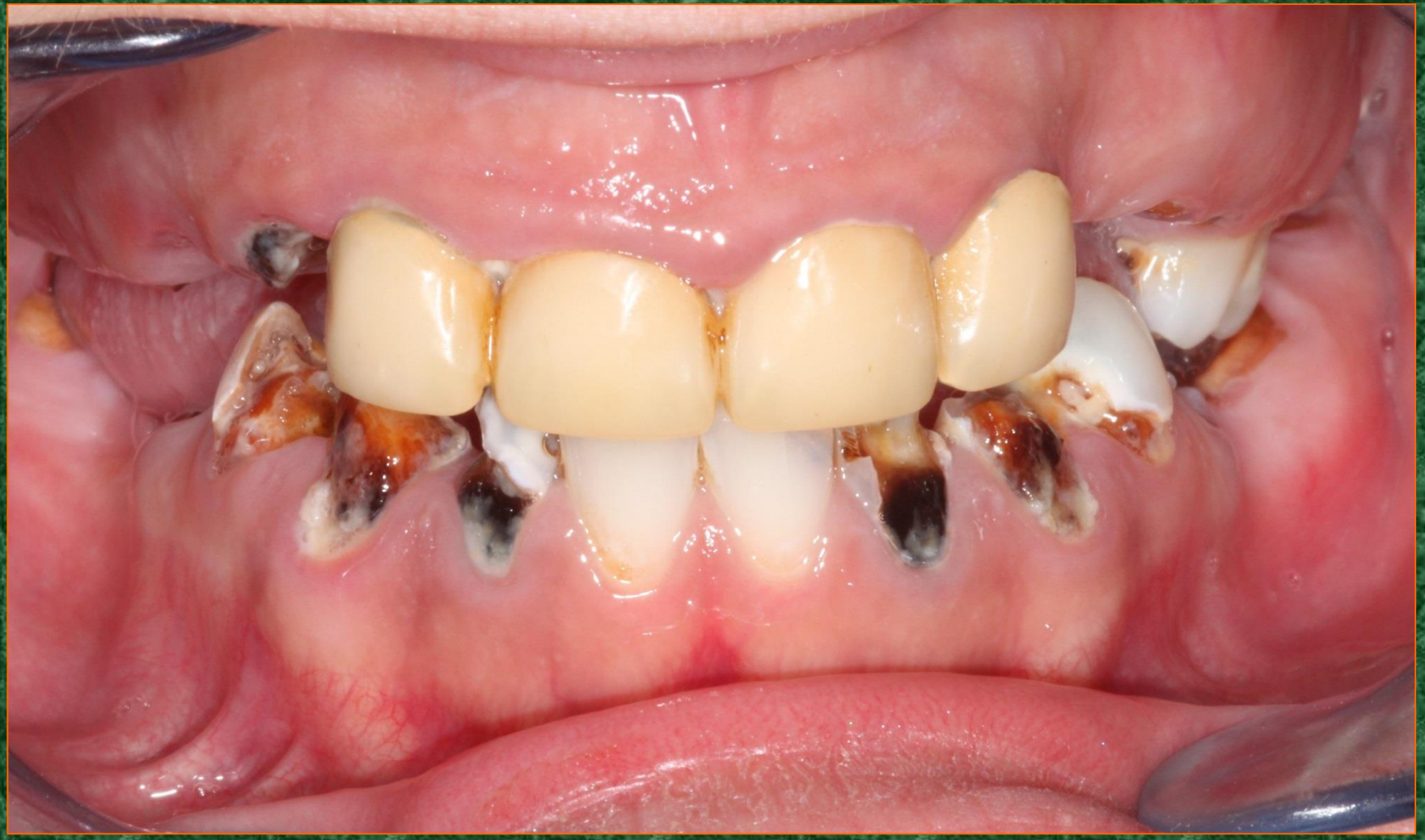


WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???

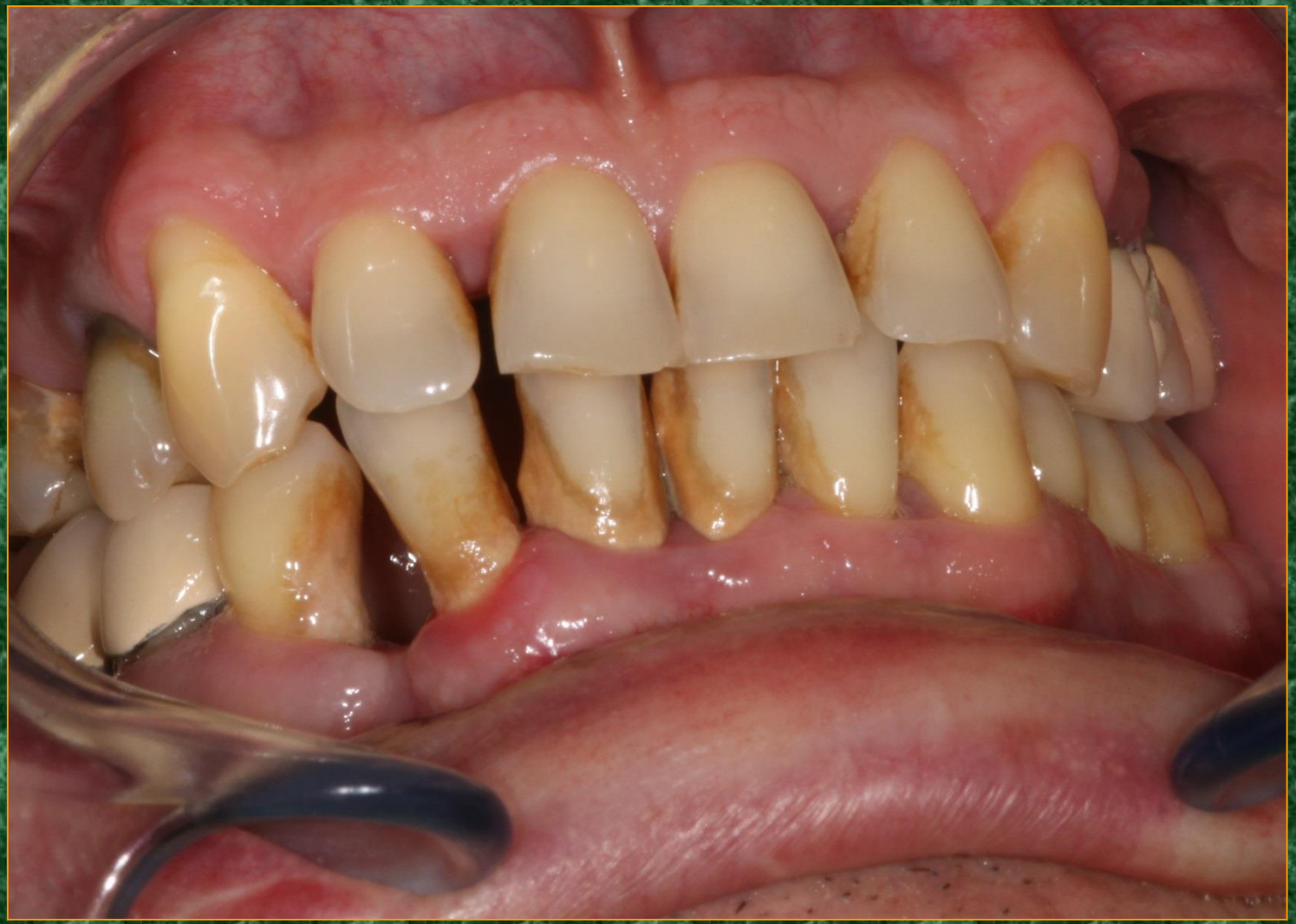




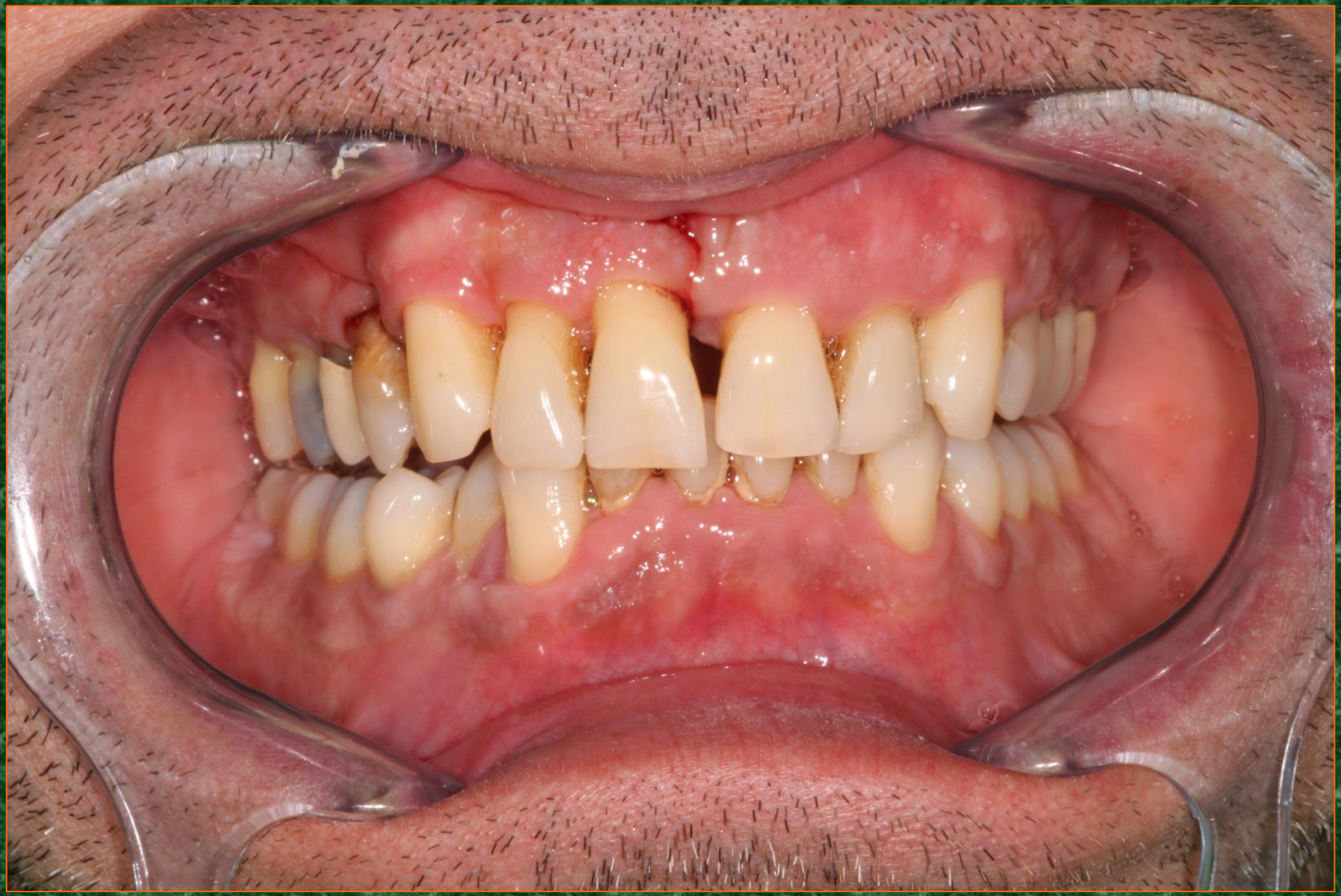
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???



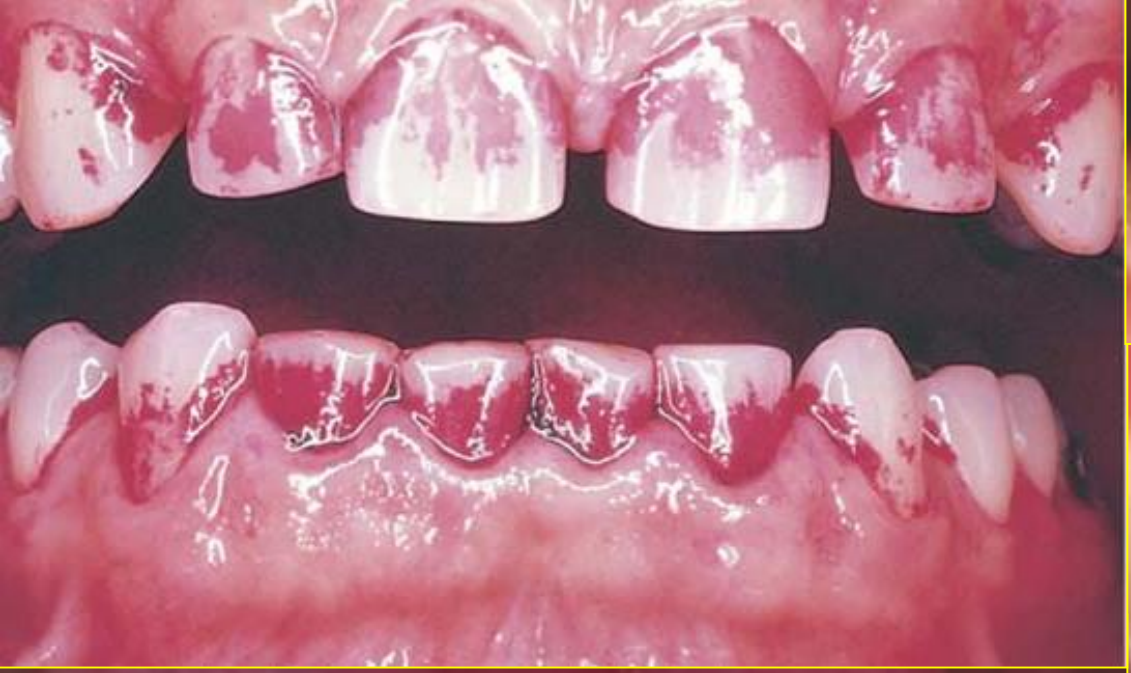
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???

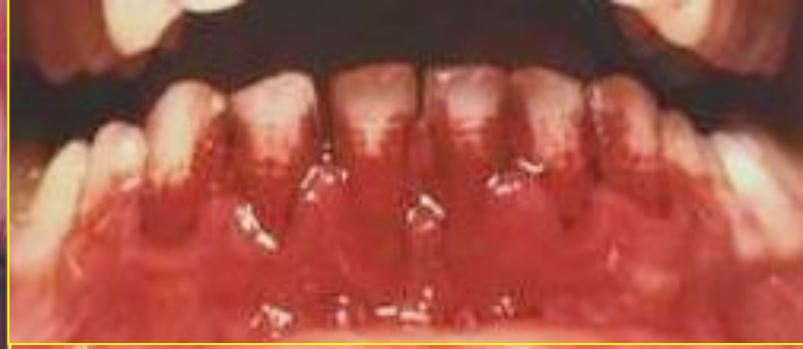


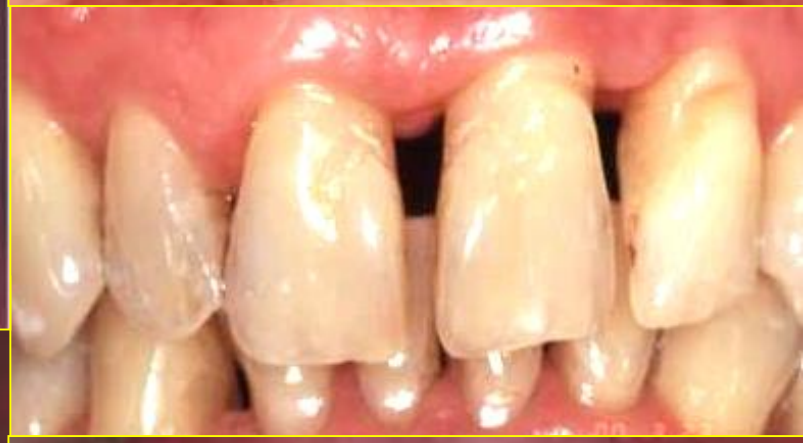
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???

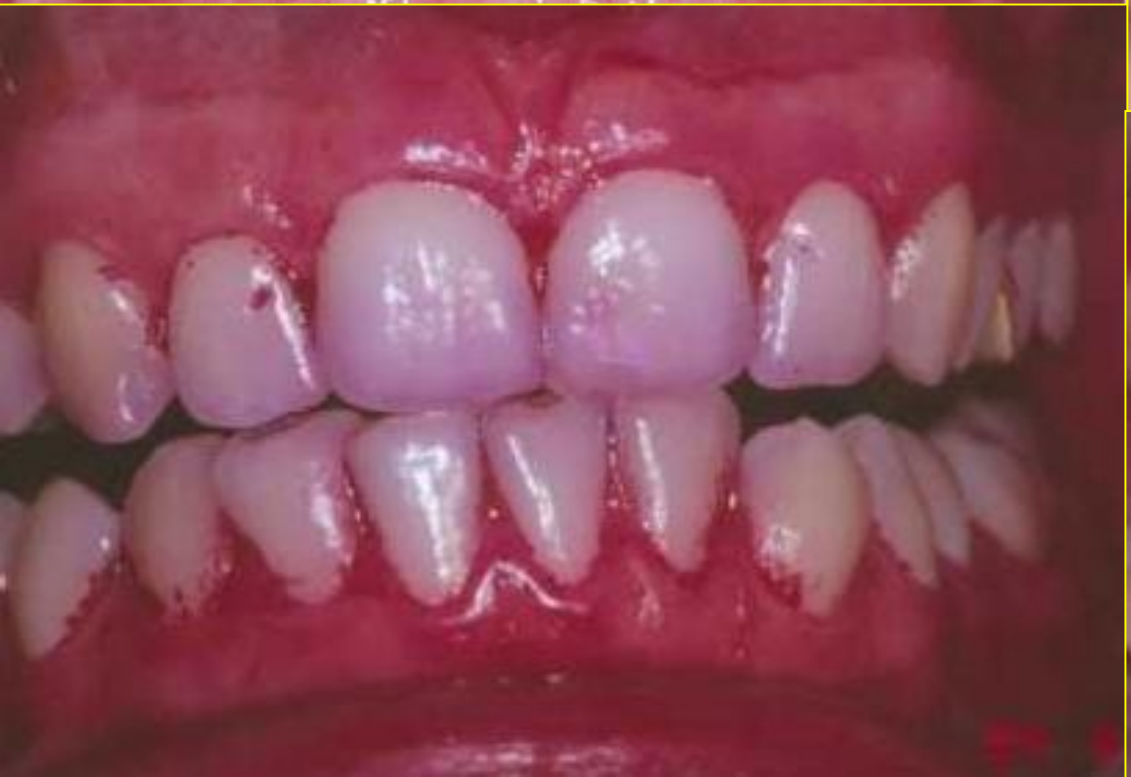


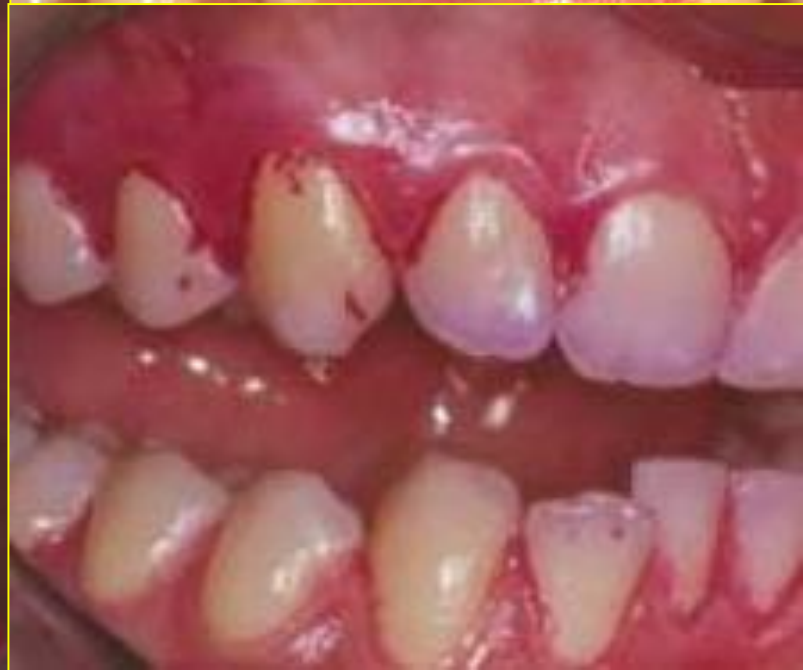
WHY DEVELOPS GINGIVITIS OR PERIODONTITIS???











PLAQUE FORMATION

Gingivitis/periodontitis are hardly exogenous infections

The normal indigenous bacterial flora is the source of the "endogenous " infection.

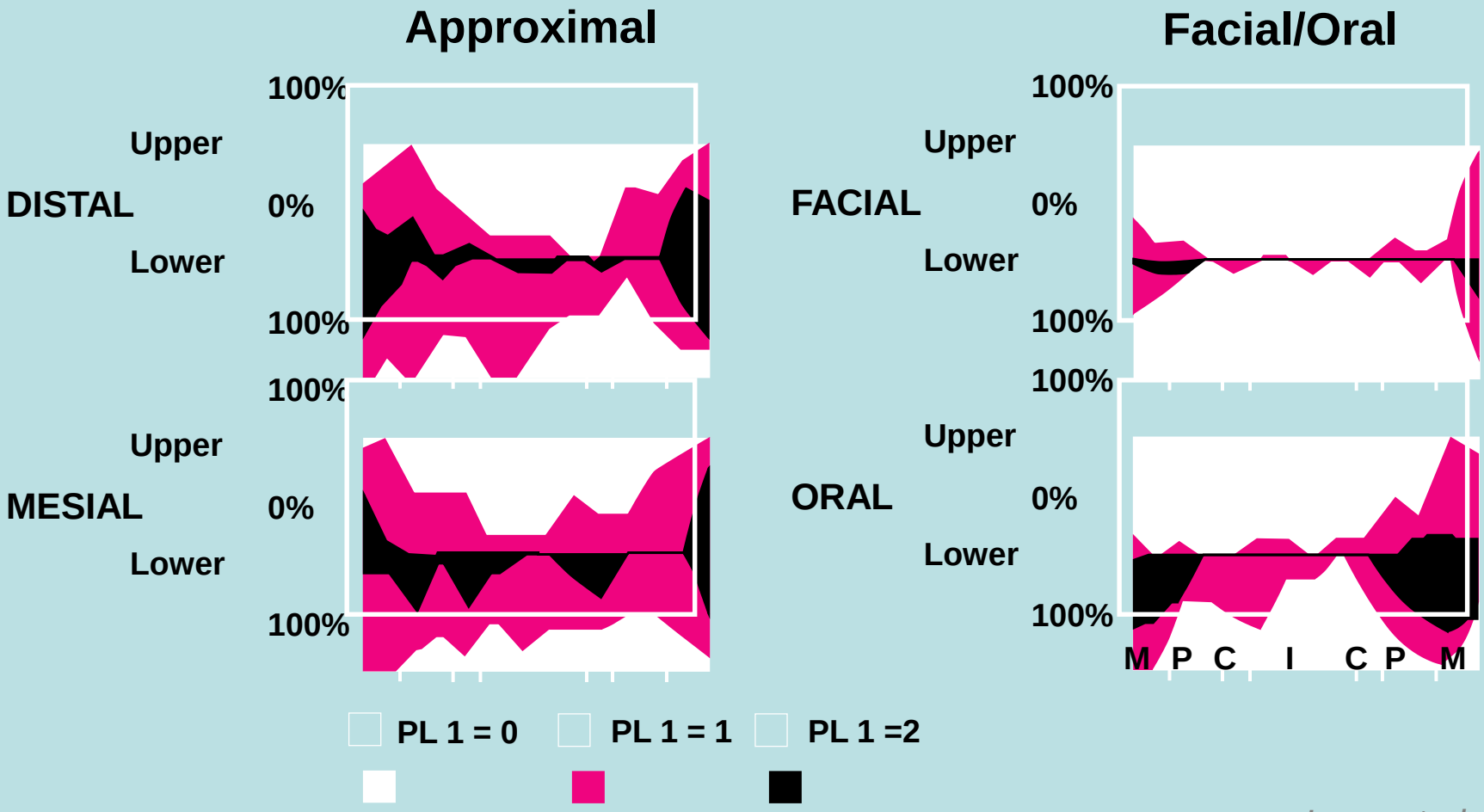
It is a true opportunistic infection

PLAQUE FORMATION

Dental plaque accumulation starts supragingivally but later the bacteria spread into the gingival sulcus and into the pathologically deepened sulcus - ie. periodontal pocket.

The composition and morphology of the subgingival plaque are totally different from the supragingival one.

Plaque distribution after 12 hours of no oral hygiene



Lang et al. 1973

THE MECHANISM OF PLAQUE ACCUMULATION

Initially bacteria binds to pellicle by physico-chemical forces (ionic bonds, Van der Waals force). Later bacteria bind to pellicle by protein-protein and protein - carbohydrate interactions.

Several virulence factors can enhance their adhesion. The natural bacterial glycoprotein coat (glycocalix), contains a great amount of polysaccharides that many times organized in surface fibrils.

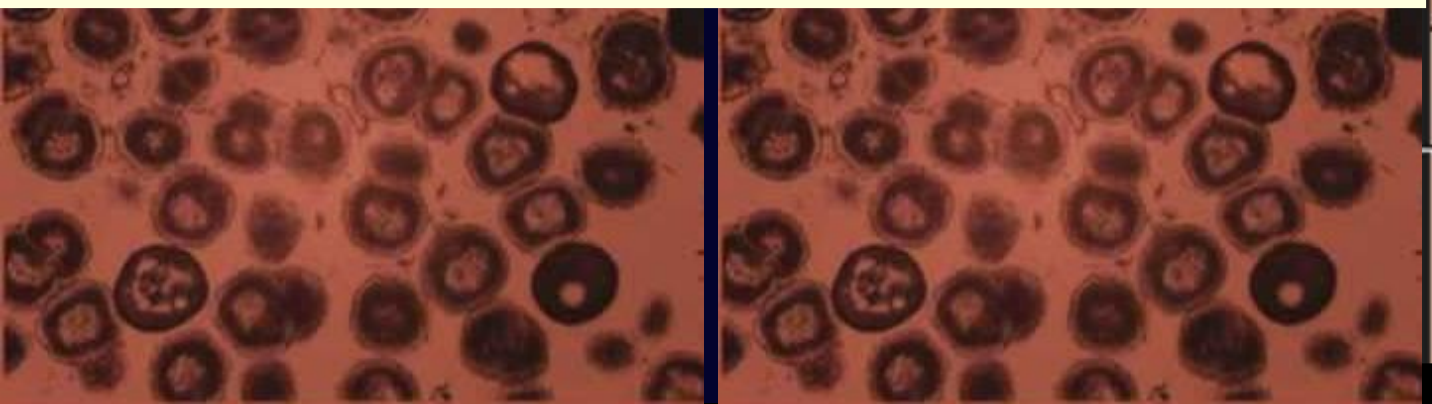
Certain bacteria can synthesize extracellular polysaccharides by glycosyl transferase enzyme.

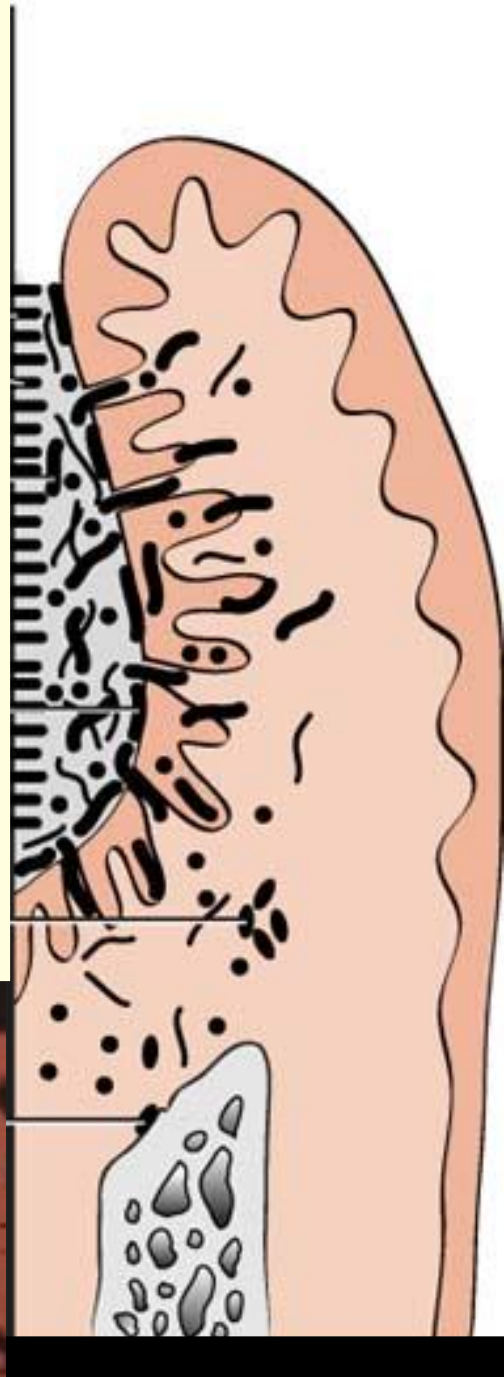
De Jong HP, DeBoer P, Busscher HJ et al.: Surface free energy changes of human enamel during pellicle formation: an in vivo study *Caries Res* 18: 408-415. 1984.

THE MECHANISM OF PLAQUE ACCUMULATION

The non-soluble extracellular polysaccharides form the interbacterial matrix of the dental plaque while the soluble part serves as energy reservoir.

The attached bacterial mass grows very rapidly partly by cell division partly bacterial coagreagation





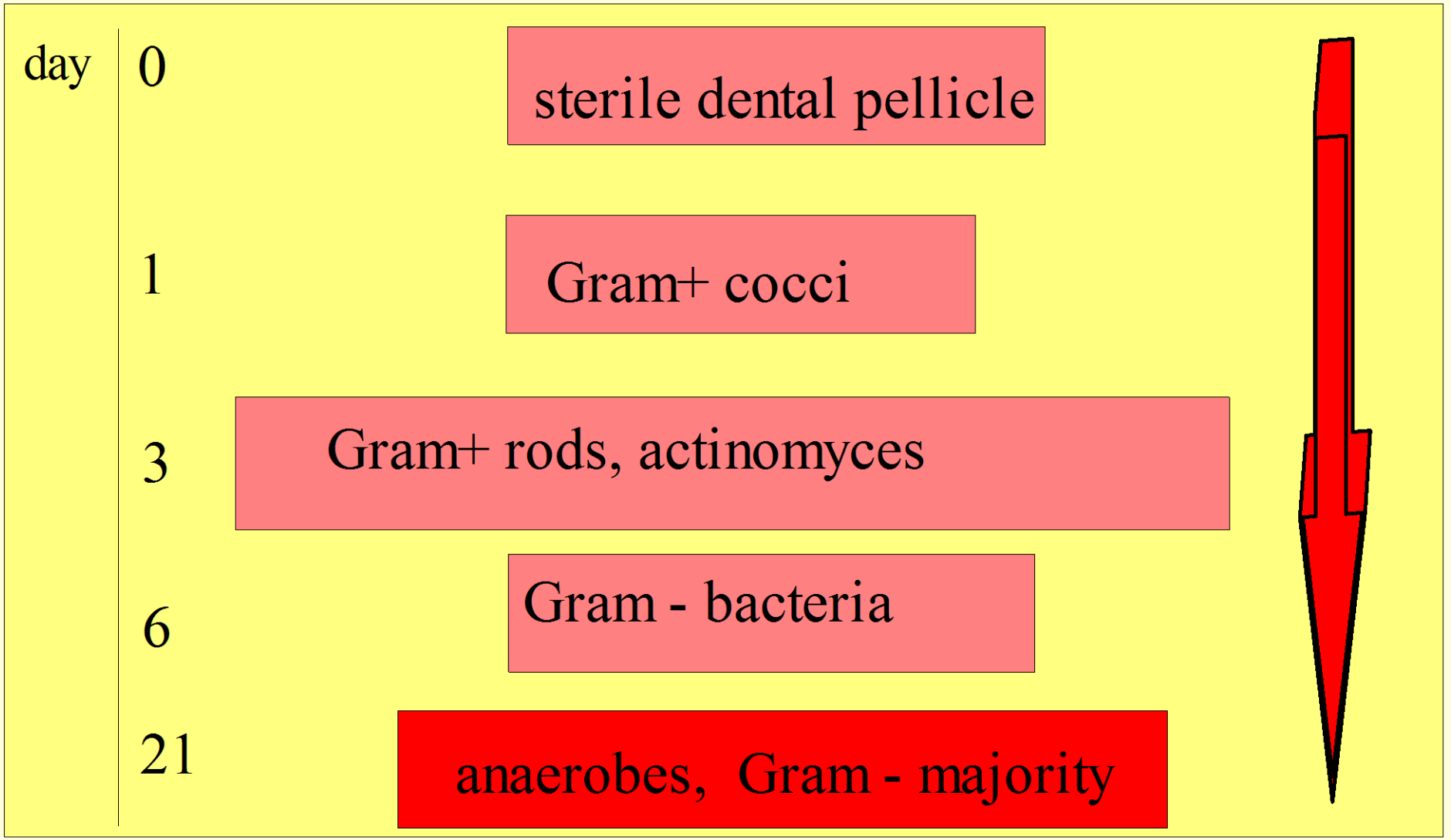
THE MECHANISM OF PLAQUE ACCUMULATION

In the depth - anaerobes
on the surface - aerobe or facultative anaerobes

In the depth bacteria cannot utilize nutrients originating from the saliva they use the sulcular fluid and blood as energy source.

In the depth of the sulcus no saccharolytic bacteria occur.

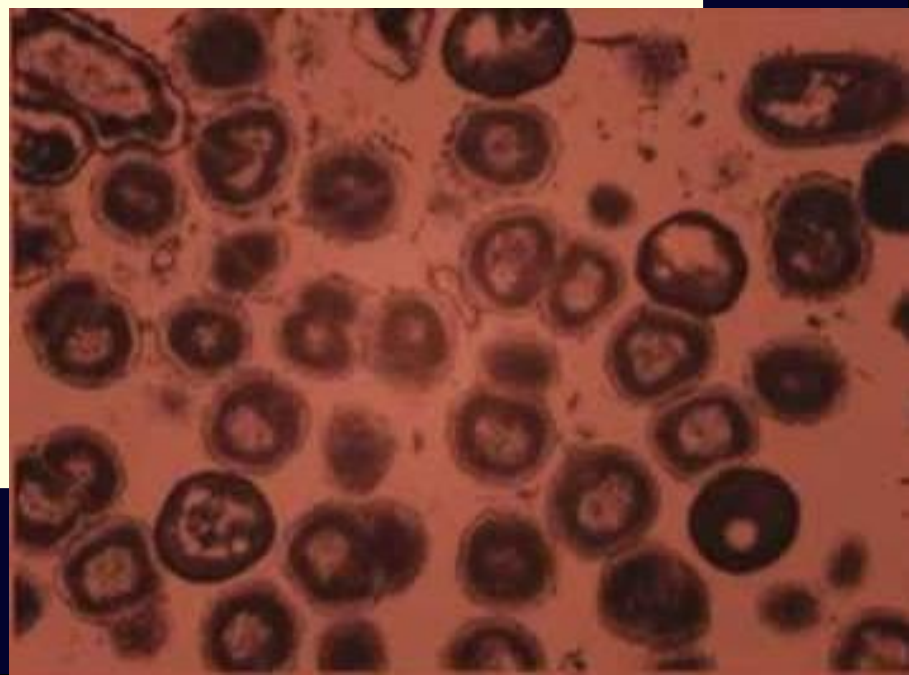
THE MECHANISM OF PLAQUE ACCUMULATION



Dental plaque as a biofilm

The nutrients diffuse through the soluble interbacterial matrix into the depth of the biofilm.

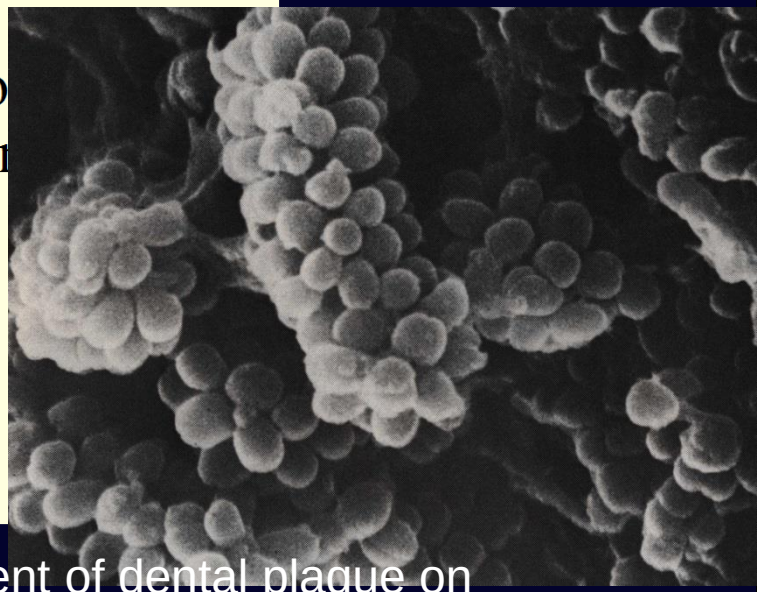
In the biofilm a well defined oxygen and nutrient gradient develops from the surface downwards into the depth.



Supragingival plaque

When Van Lavenhook in the 17th century fabricated his first microscope and discovered light microscopy he first investigated and described dental plaque.

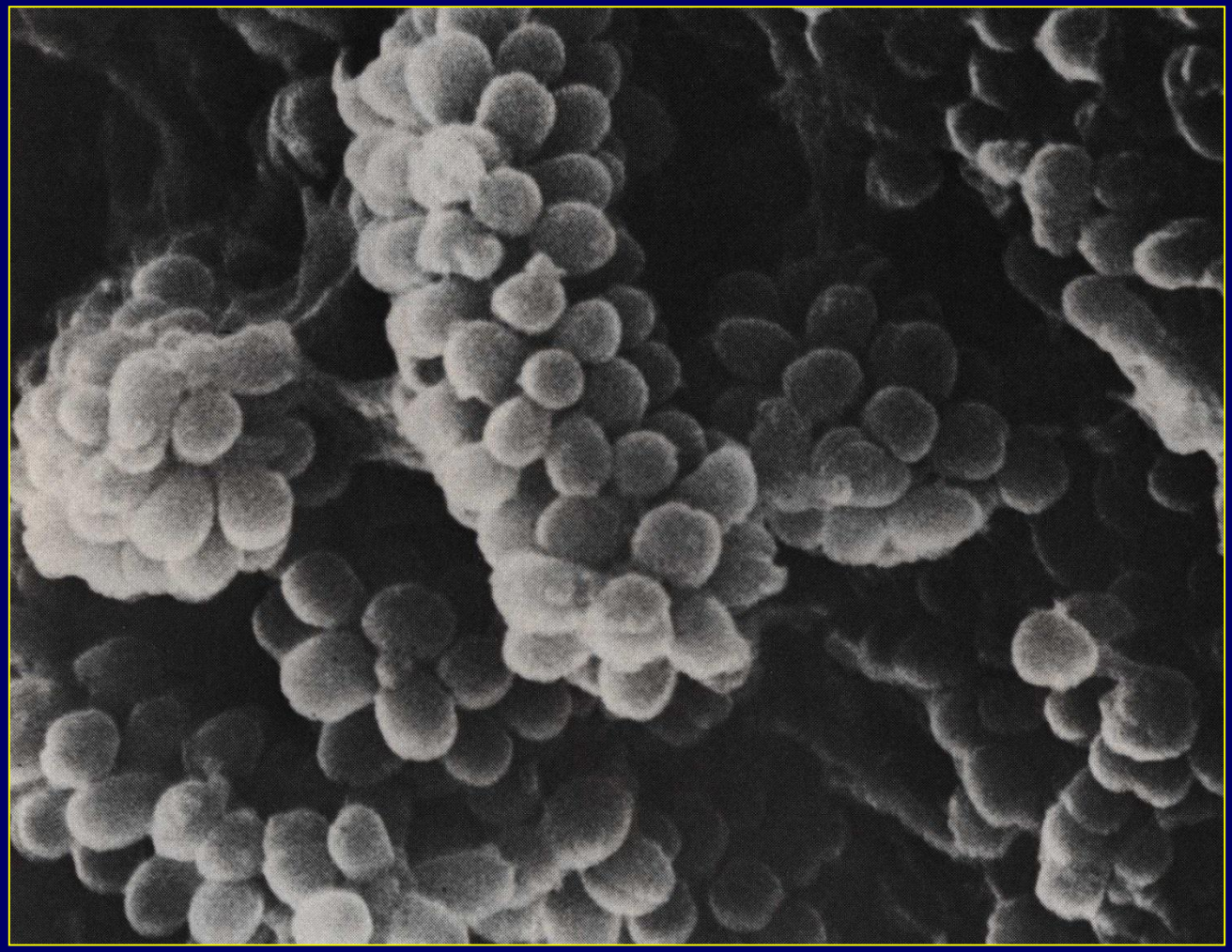
The ultrastructure the light and EM microscopy o
plaque is well defined and varies in different cli
stages and maturation stages.



Corn-cob formation

Listgarten MA, Mayo HE, Tremblay R.: Development of dental plaque on epoxy resin crowns in man. A light and electron microscopic study *J Periodontol* 46: 10-26. *1975,*

Listgarten MA: Structure of the microbial flora associated with periodontal health and disease in man. A light and electron microscopic study *J Periodontol* 47: 1 -18. *1976,*

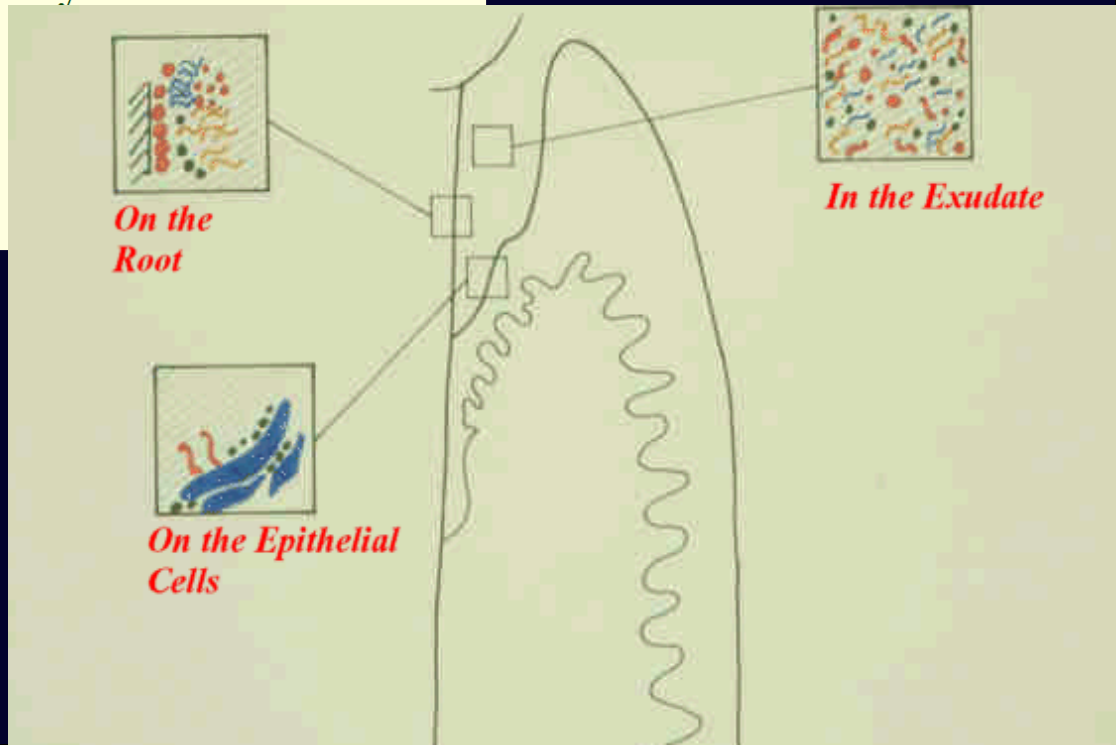


Corn-cob formation

Subgingival plaque

Subgingivally can be distinguished :
hard tissue associated plaque
dispersed bacteria in the sulcular fluid
epithelia associated plaque

The composition of subgingival dental plaque in superficial and deep pockets are totally different.



Subgingival plaque

In gingivitis the subgingival plaque is the simple continuation of the supragingival plaque

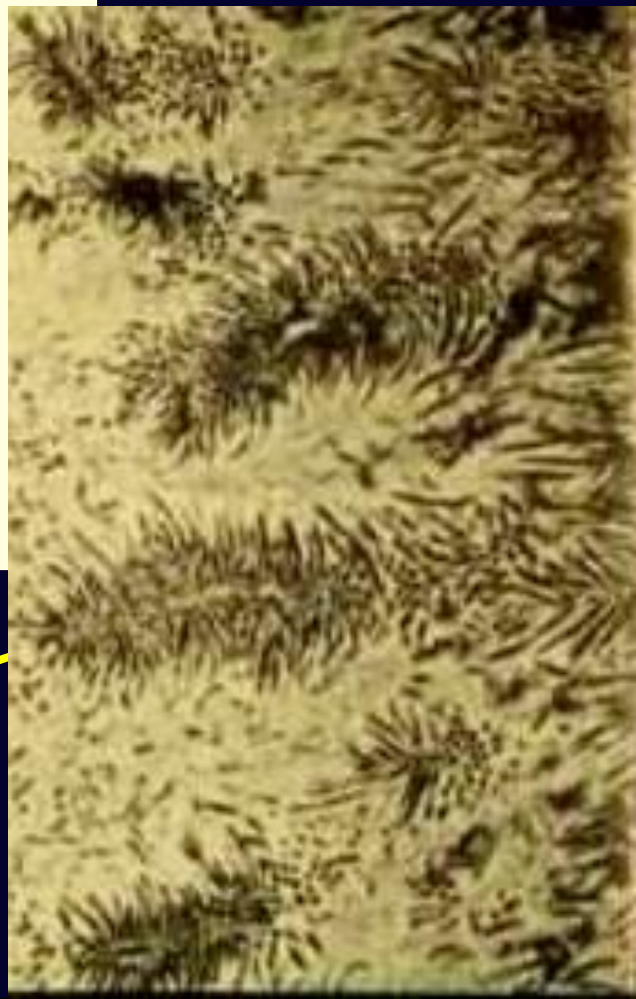
Its structure is similar to the supragingival plaque but its bacterial composition is substantially different.

Subgingival plaque

Deep periodontal pockets:

Anaerobe filaments, few cocci and rods numerous spirochaetes The subgingival plaque is predominantly motile.

Well organized bacterial colonies and bacterial configurations
Characteristic subgingival plaque formations - " test tube brush formation" , in which a central filament is coated by a mass of anaerobe rods.



Testube brush formation

Subgingival plaque

In the bottom of the pocket the plaque organization is not so complex. The filamants are missing, the majority of plaque is built up by small densely packed anaerobic bacteria without any characteristic organization.

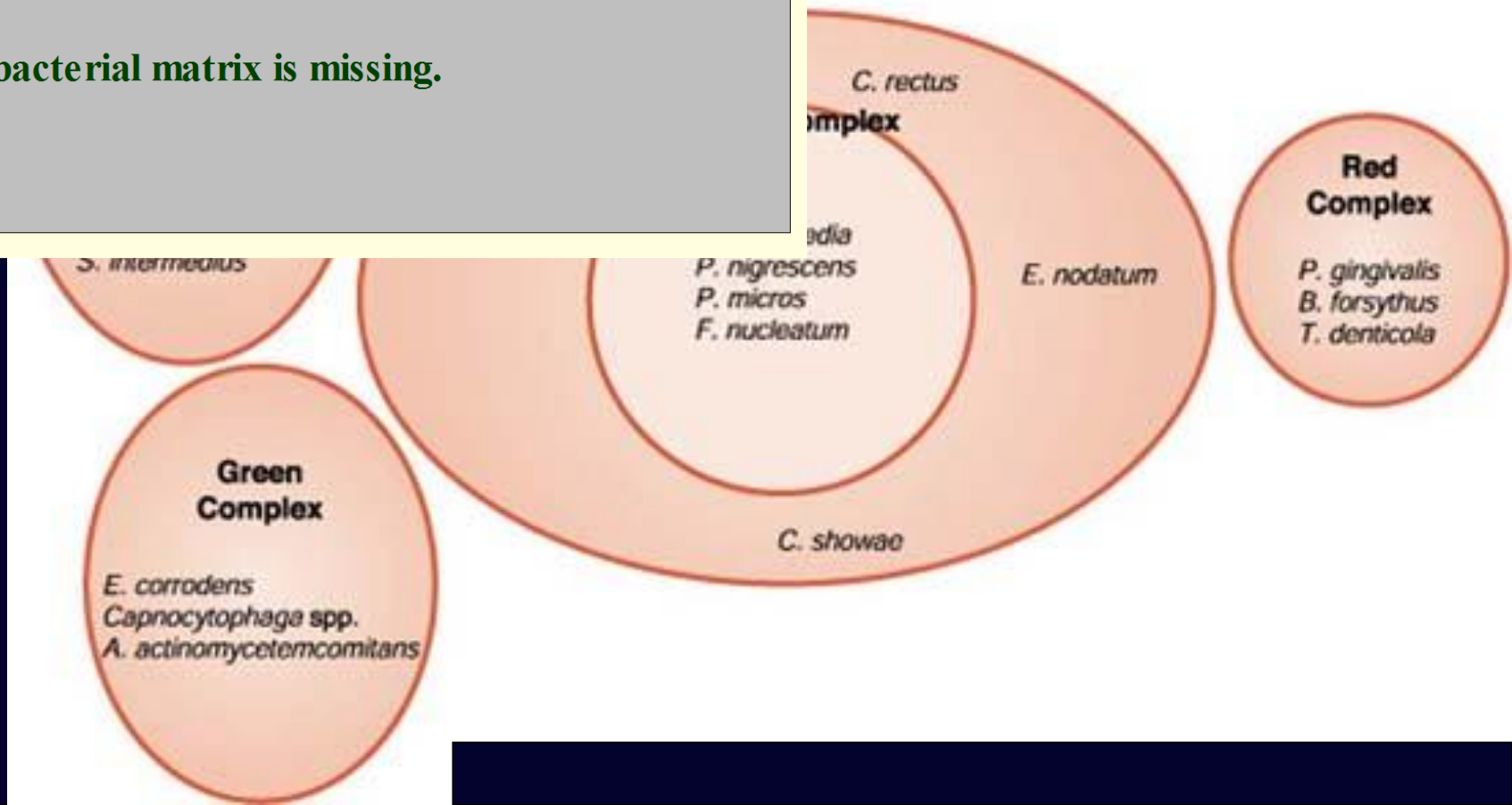
1. *Listgarten MA:* Structure of the microbial flora associated with periodontal health and disease in man. A light and electron microscopic study *J Periodontol* 47: 1 -18. *1976,*

Subgingival plaque

The structure of the soft tissue associated plaque is totally different from the hard tissue associated one. The main component are spirochaetes and , other motile flagellated bacteria.

There are numerous cocco-bacilli and short rods.

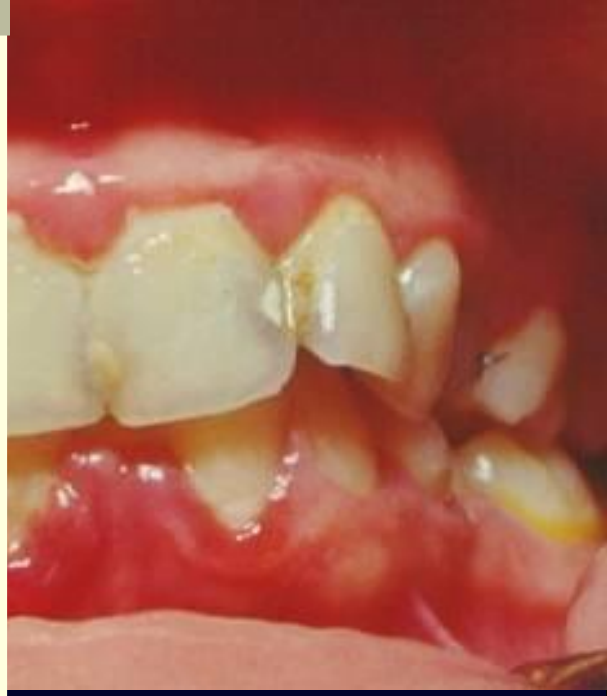
The interbacterial matrix is missing.

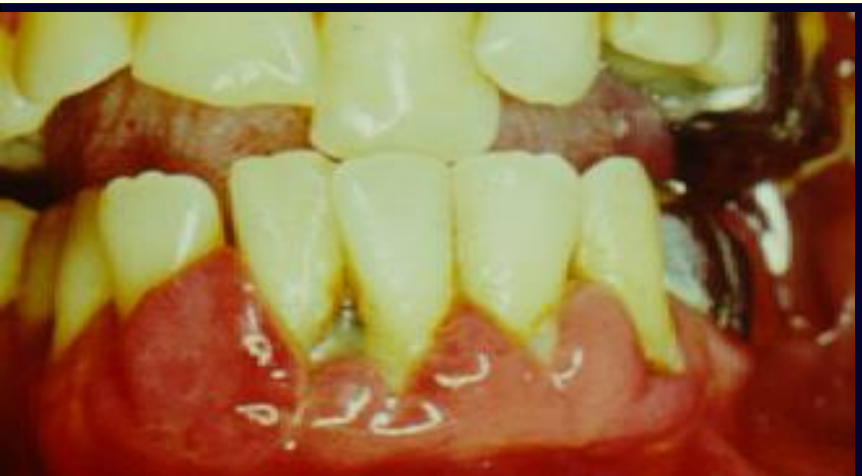


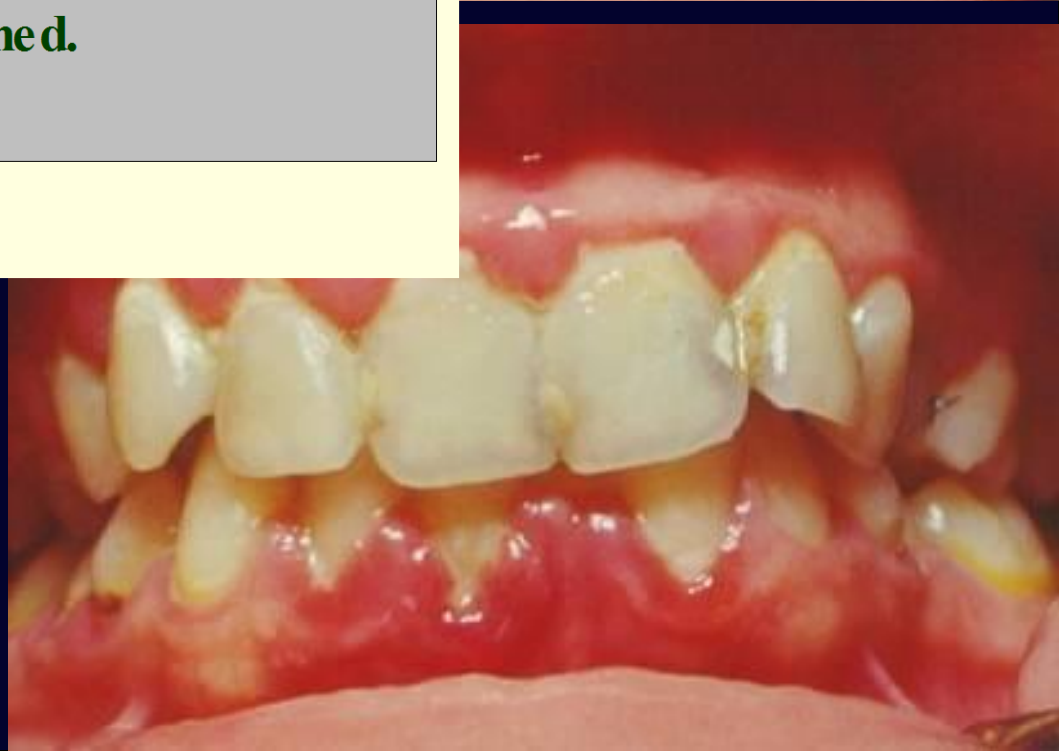
Dental calculus

Normally develops from the adherent old dental plaque after its mineralization. Its formation is totally dependent on the individual oral hygiene.
Nevertheless some calculus formation was detected in gnatobiotic animals under sterile conditions.

Similarly to dental plaque, also supragingival and subgingival calculus can be distinguished.



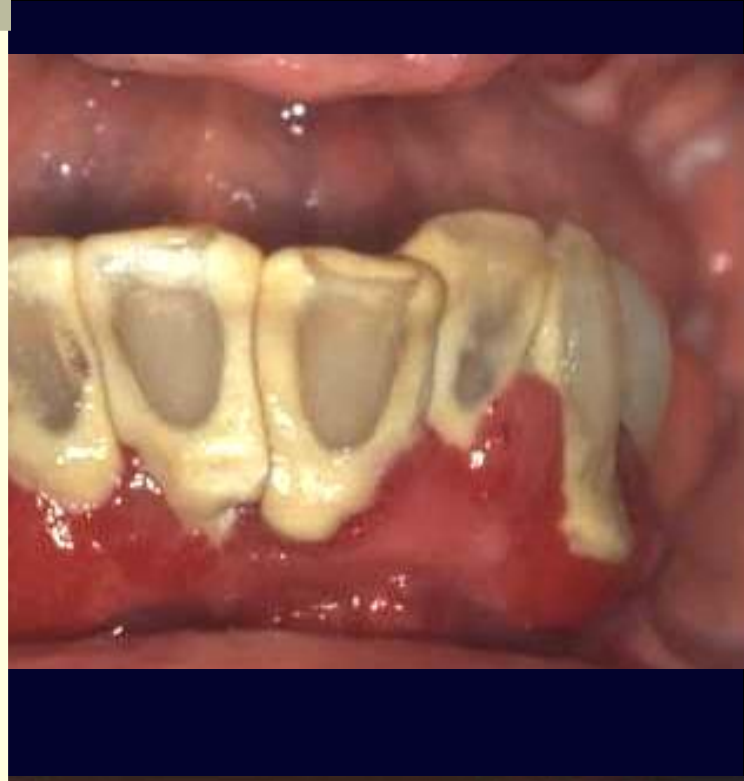


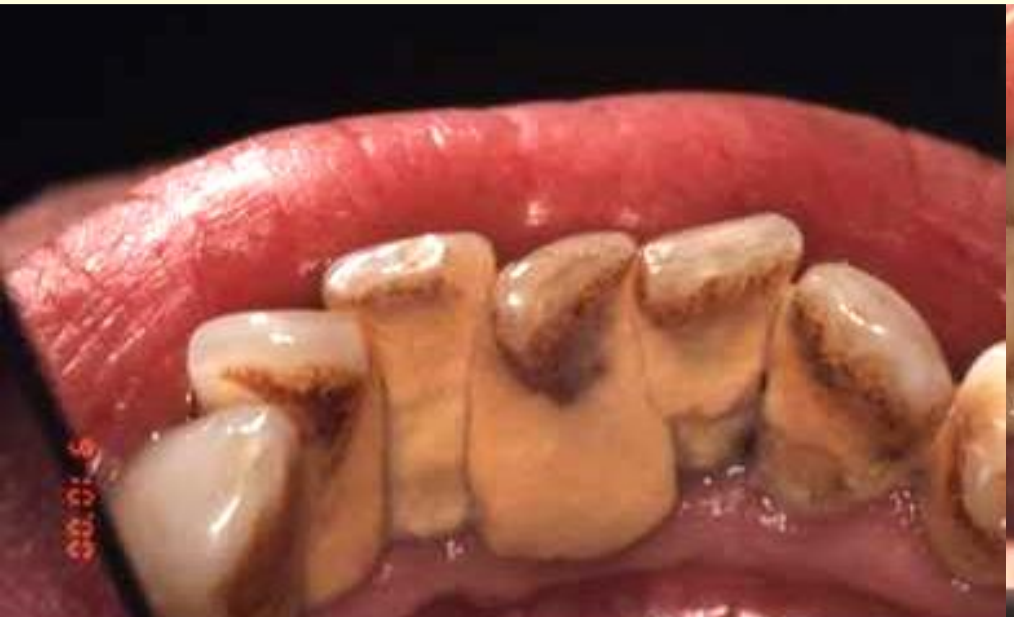


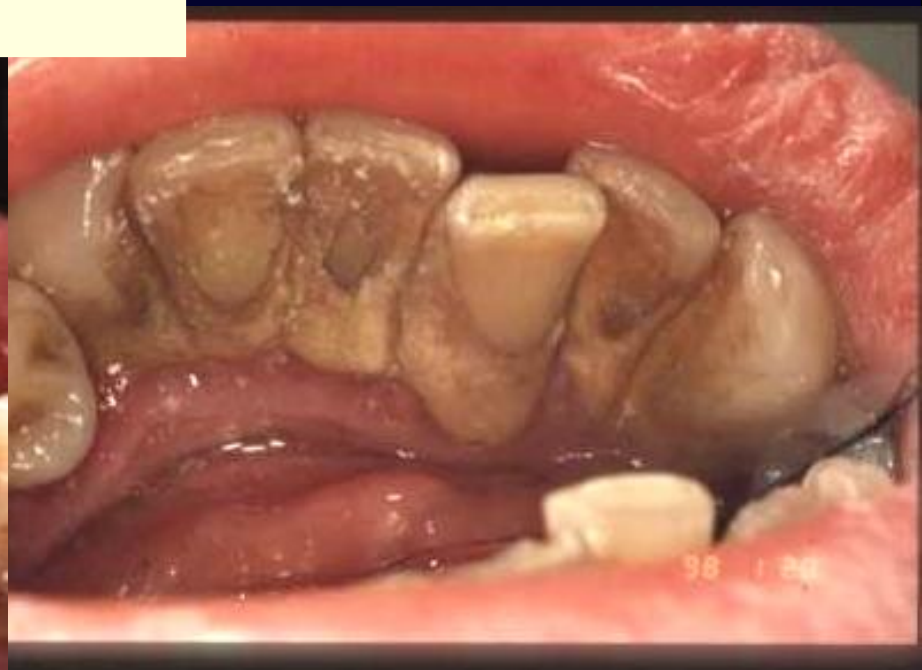
Dental calculus

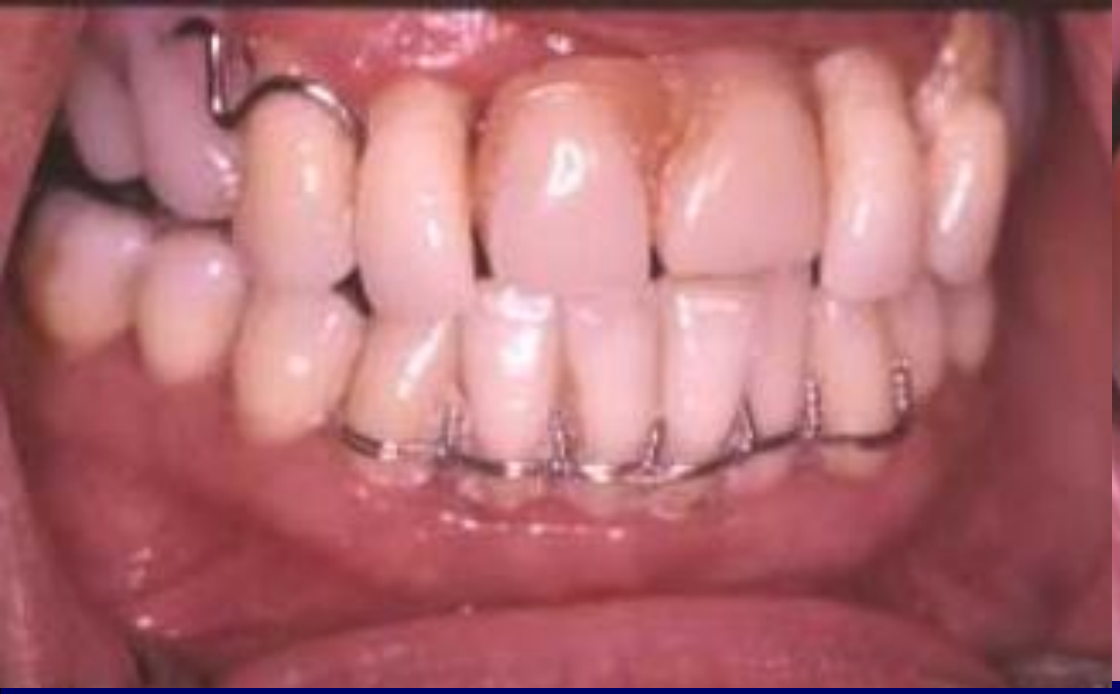
Supragingival calculus

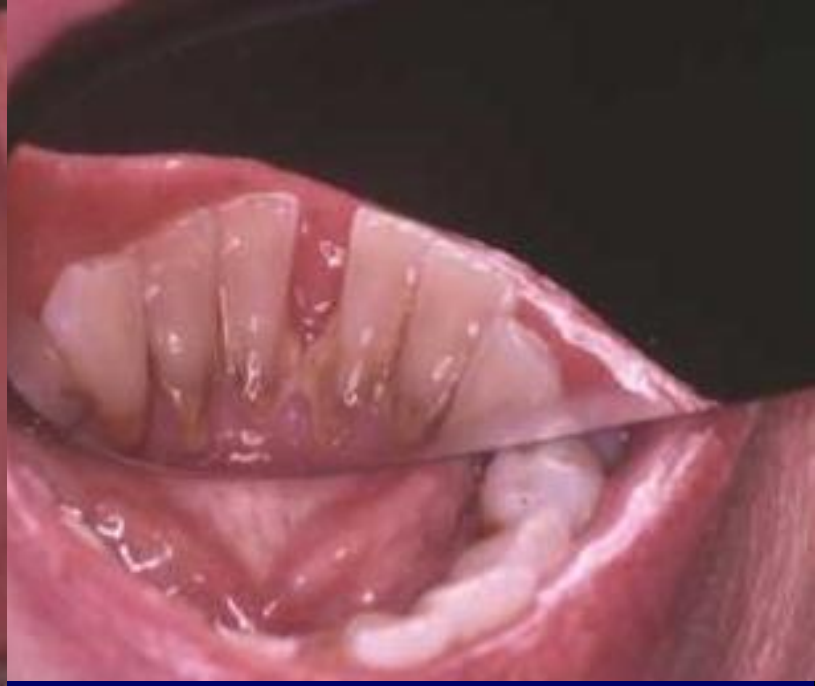
Develops coronally from the gingival margin. Its color is white or yellow. But tobacco smoking or other dietary pigments can create brownish shade.

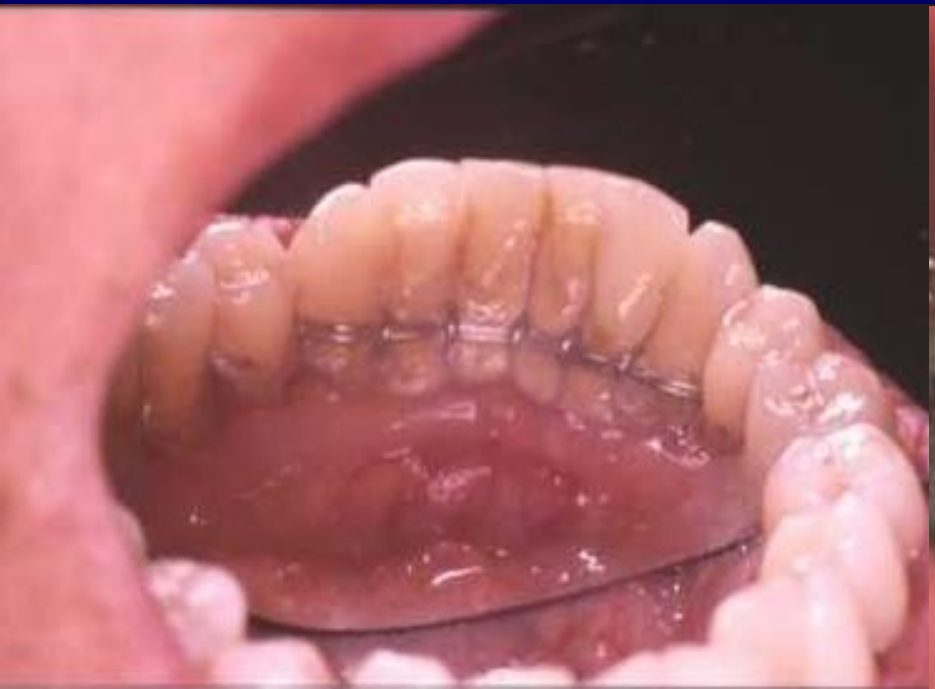


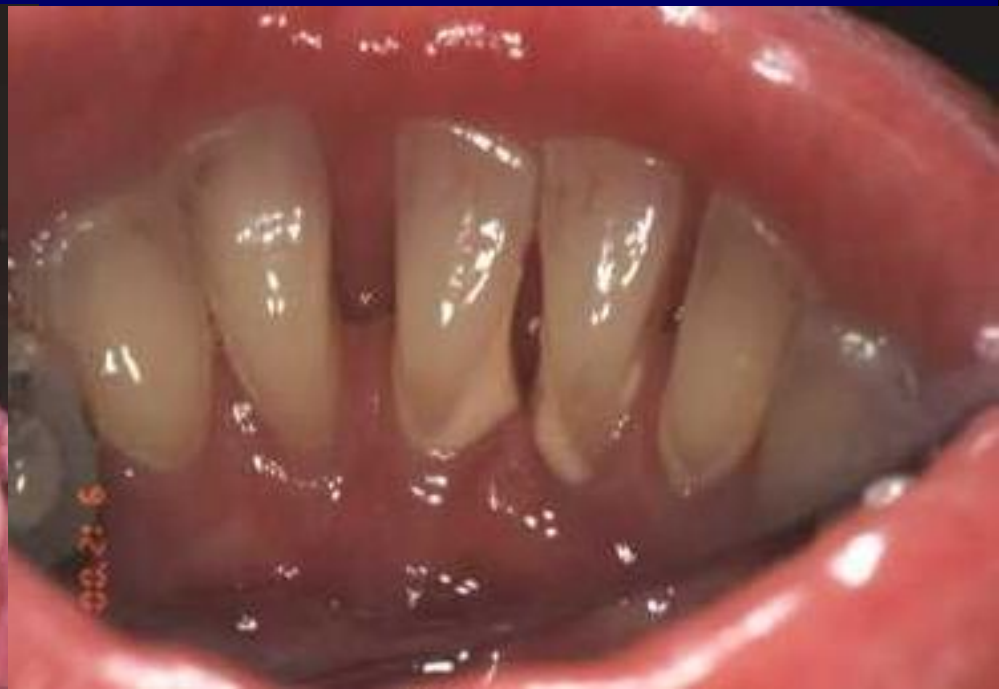


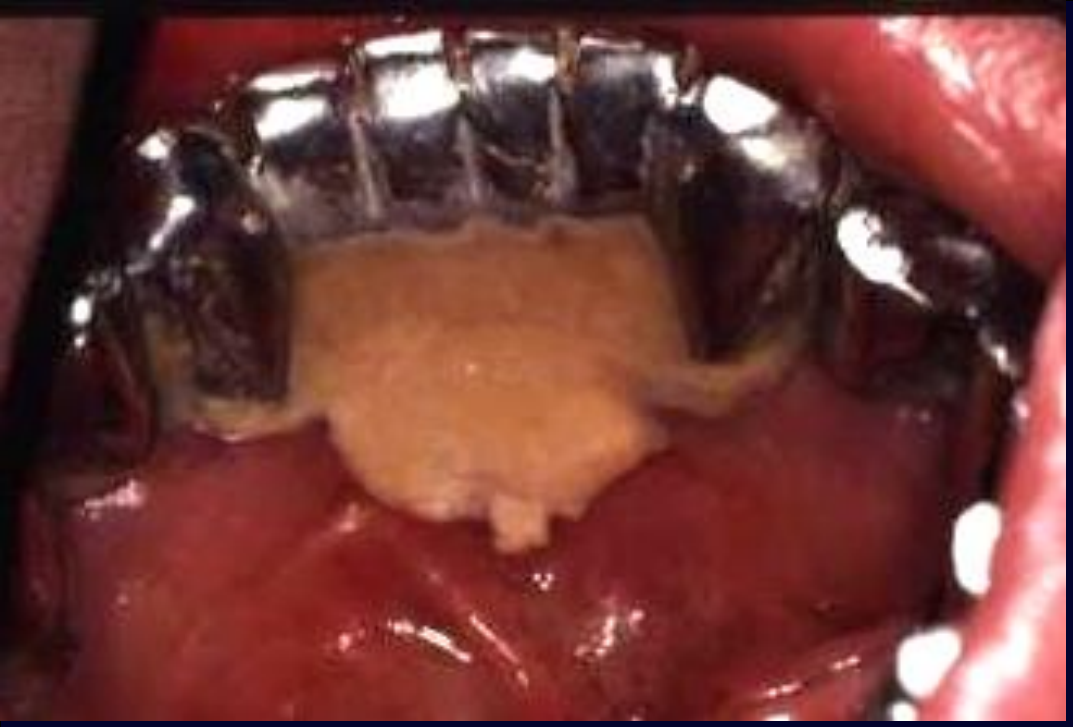


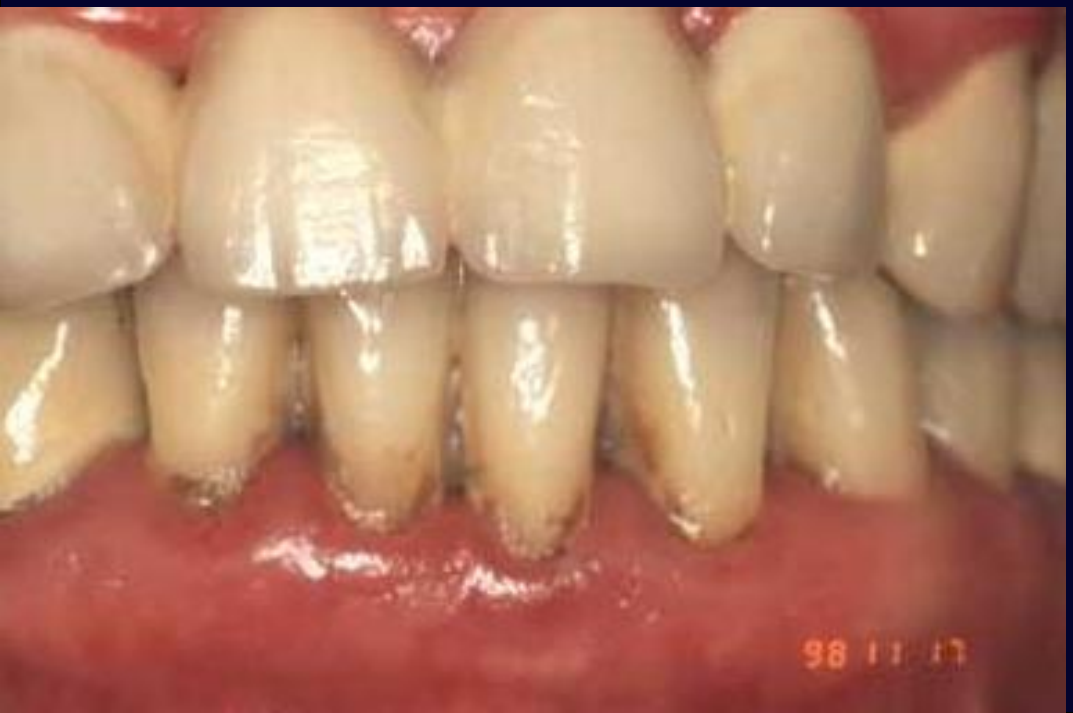


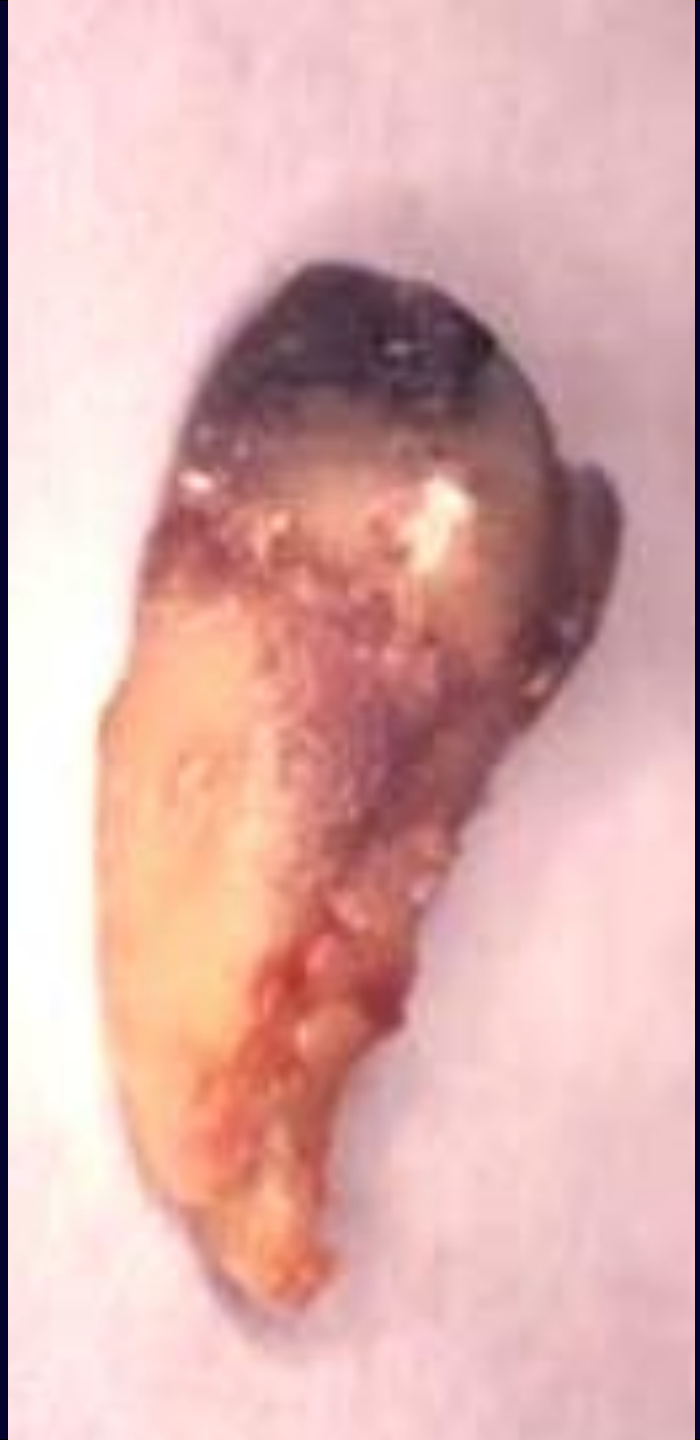









98 11 17

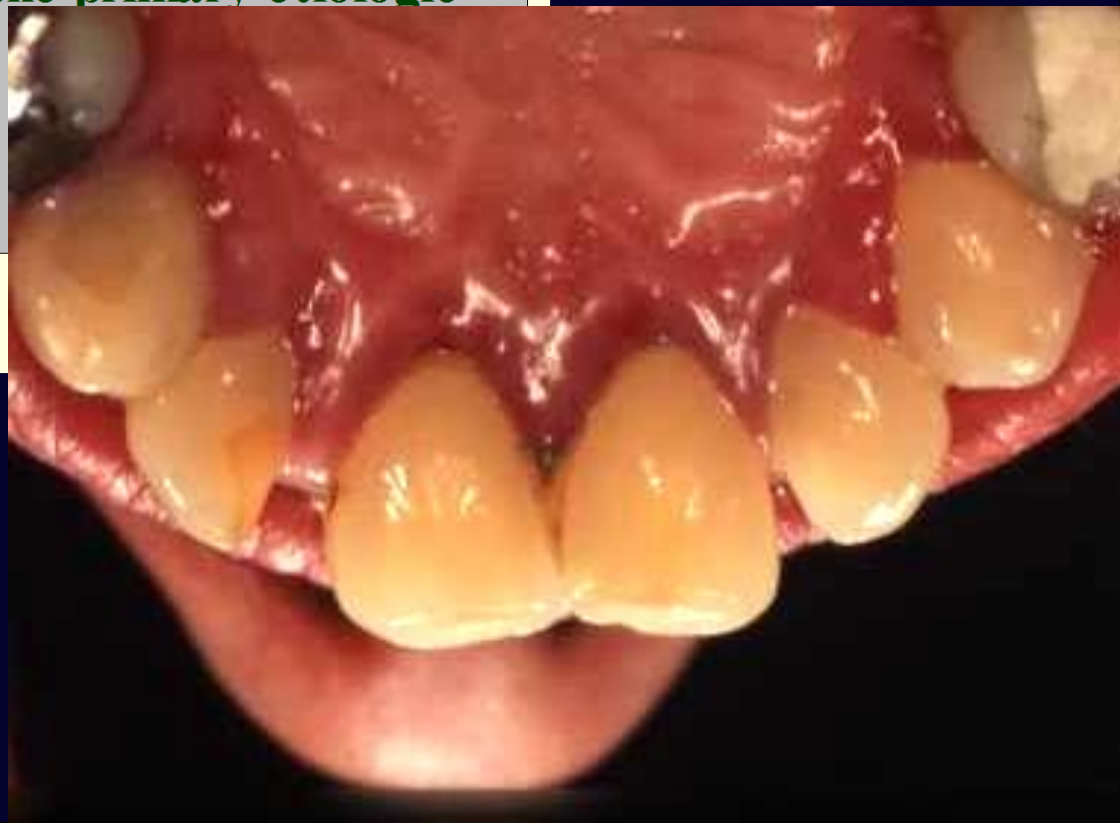


Dental calculus

Subgingival calculus

Subgingival calculus never develops in healthy, non inflamed sulcus.

Though it plays an important role in the development and sustain of inflammation, it is rather considered as a symptom of inflammation than the primary etiologic factor.

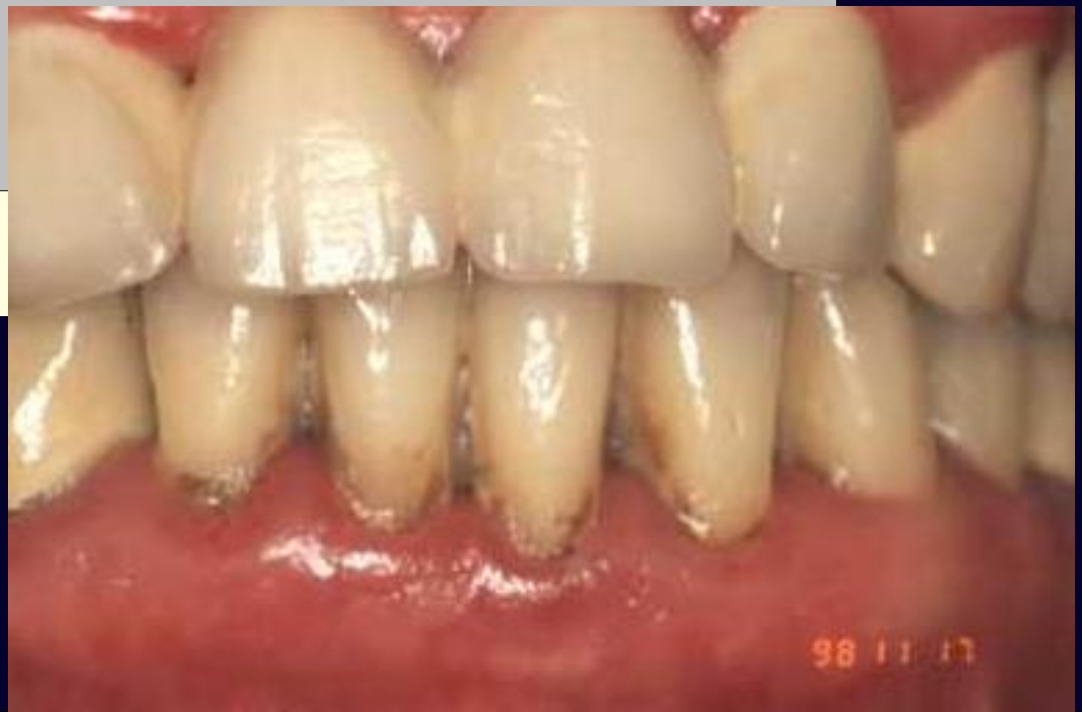


Dental calculus

Subgingival calculus

Many times it can be detected by naked eyes.
If the gingiva is thin the dark grey calculus can be seen as a blue discoloration on the gum line.

The superficial subgingival calculus can be visualized be pressing down the gingival margin or by blowing air from air syringe into the sulcus.



Dental calculus

Subgingival calculus

Its mineral content originates from the sulcular fluid and from the serum.

The is no predilection for its deposition. It occurs in every periodontal pockets, extending from the cemento-enamel junction apically to the bottom of the pocket.

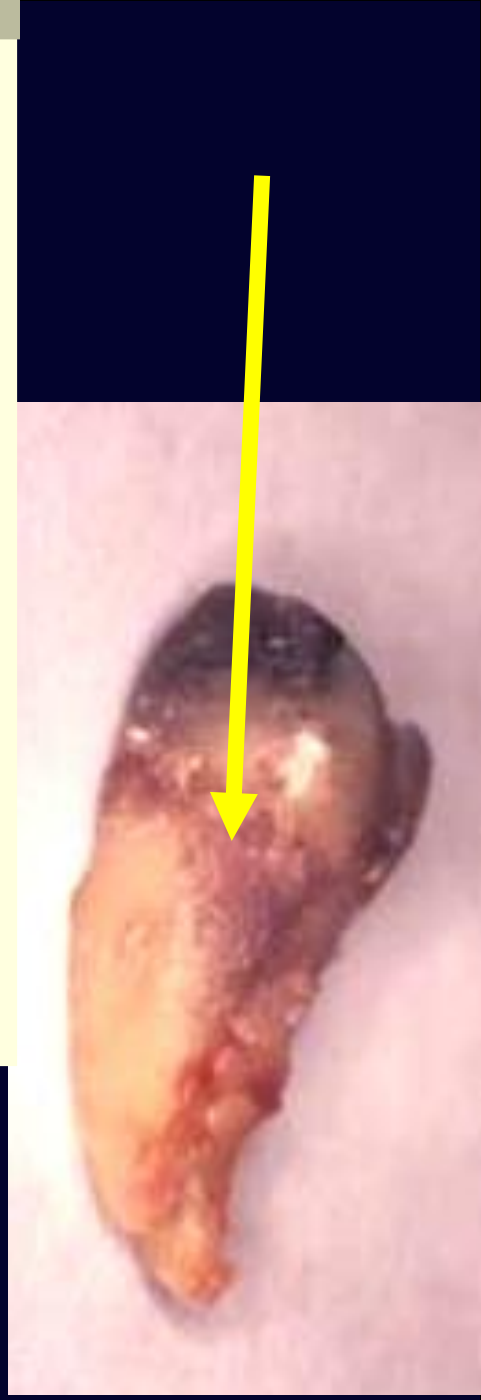
Dental calculus

Subgingival calculus

The calculus, especially the old one attaches to the tooth very hard.

Subgingivally also the acquired dental pellicle is mineralized.

Subgingivally the adhesion of calculus is also enhanced by the surface irregularities

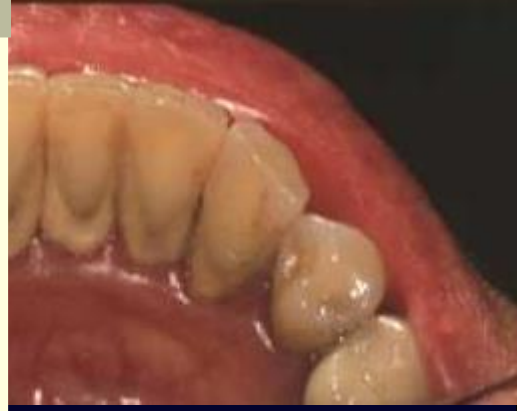


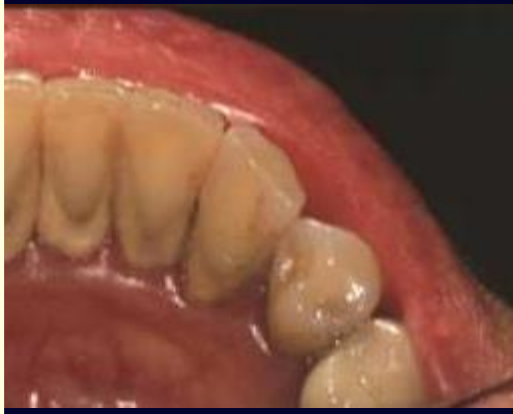
Dental calculus

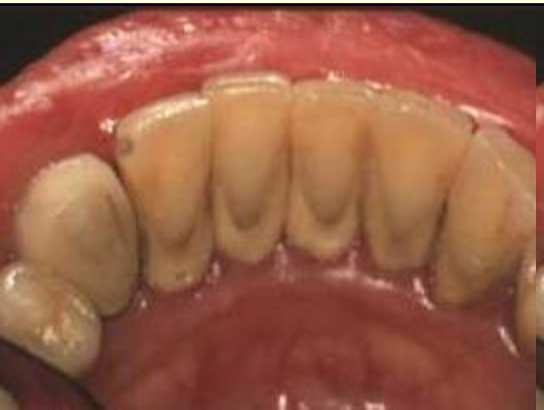
ITS CLINICAL RELEVANCE

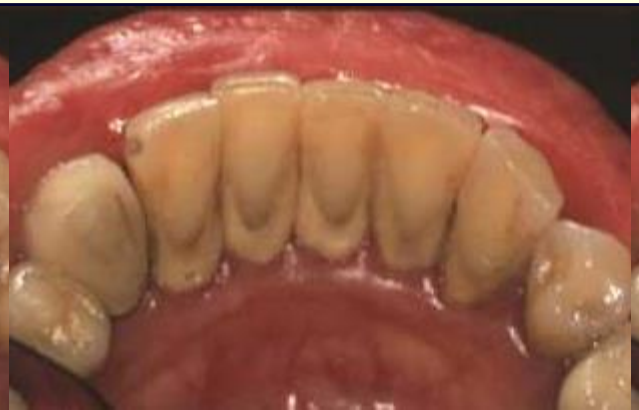
The calculus per se is not a primary etiologic factor.

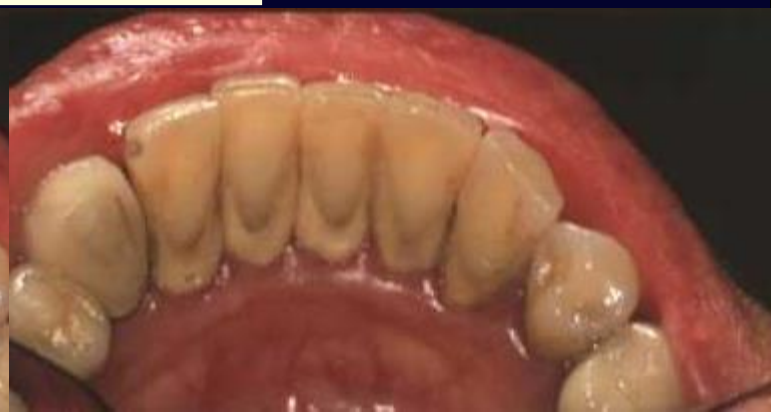
In the practice the calculus deposition is always an important factor in the development and especially in the sustain of destructive periodontitis.
Dental calculus always develops on those surfaces where the plaque can accumulate undisturbed.
It is a plaque retentive factor. Its surface is always covered by fresh bacterial plaque and it can also guide the plaque bacteria subgingivally

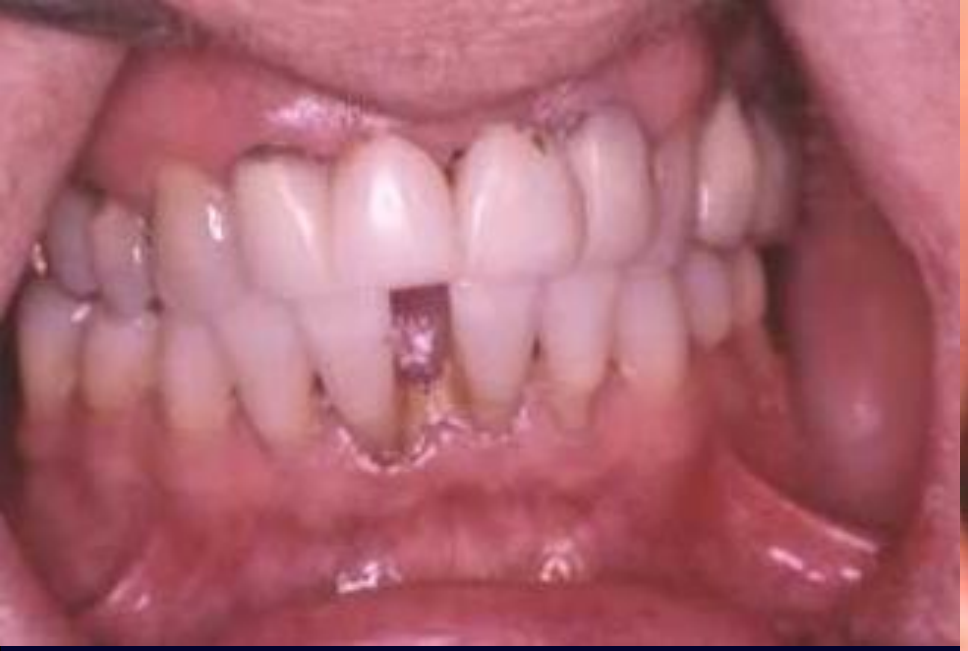


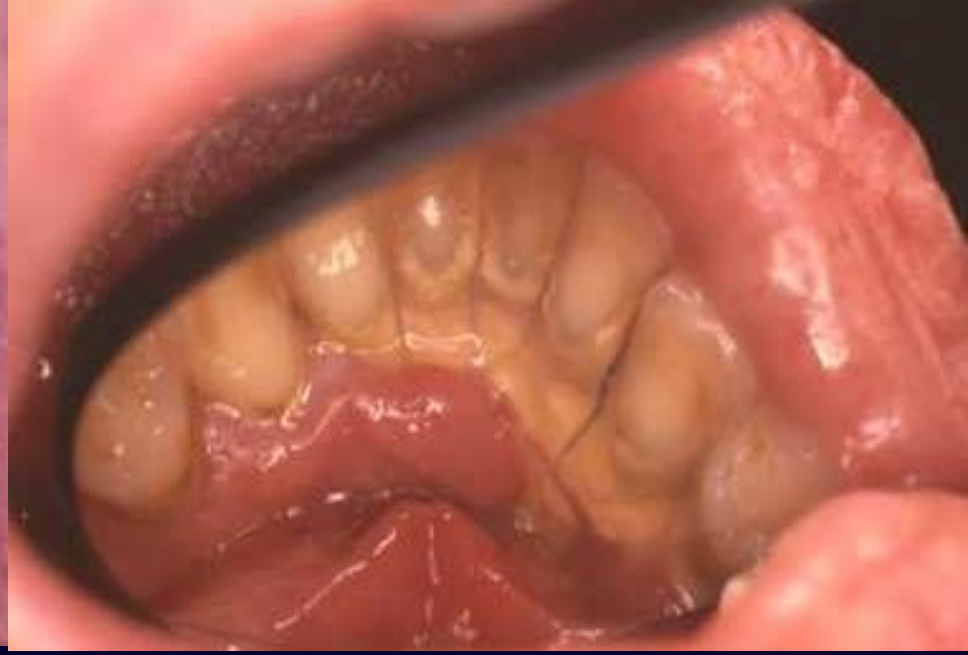


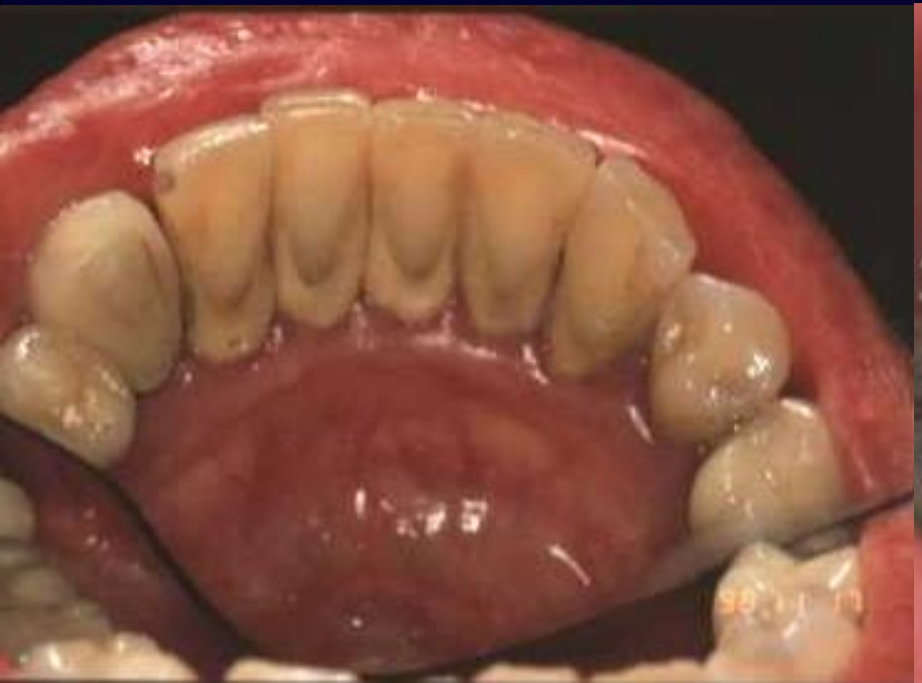


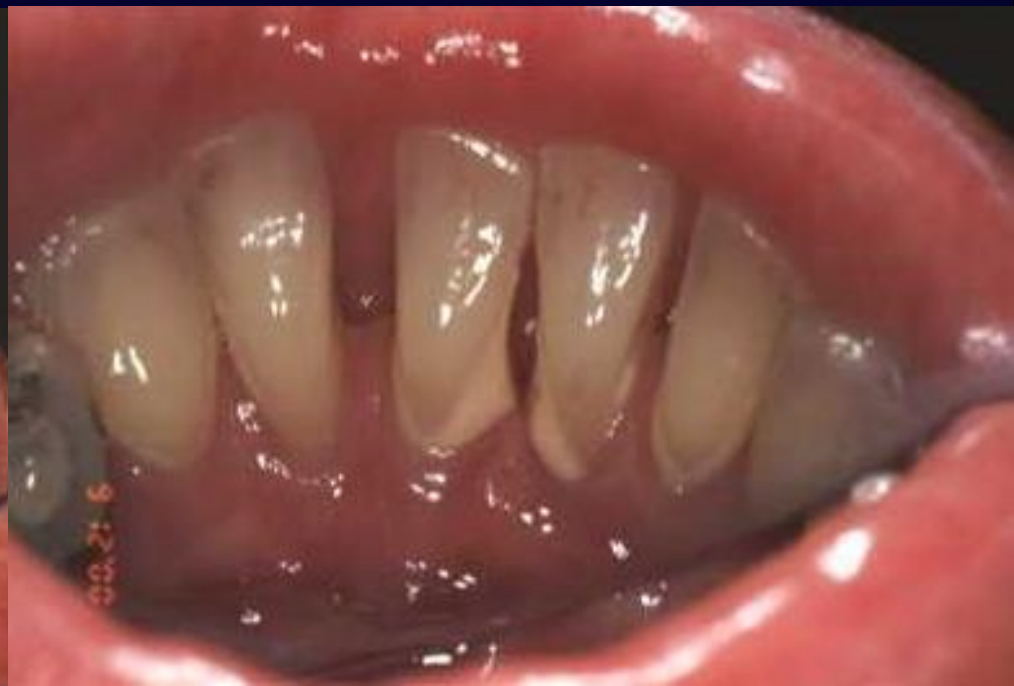


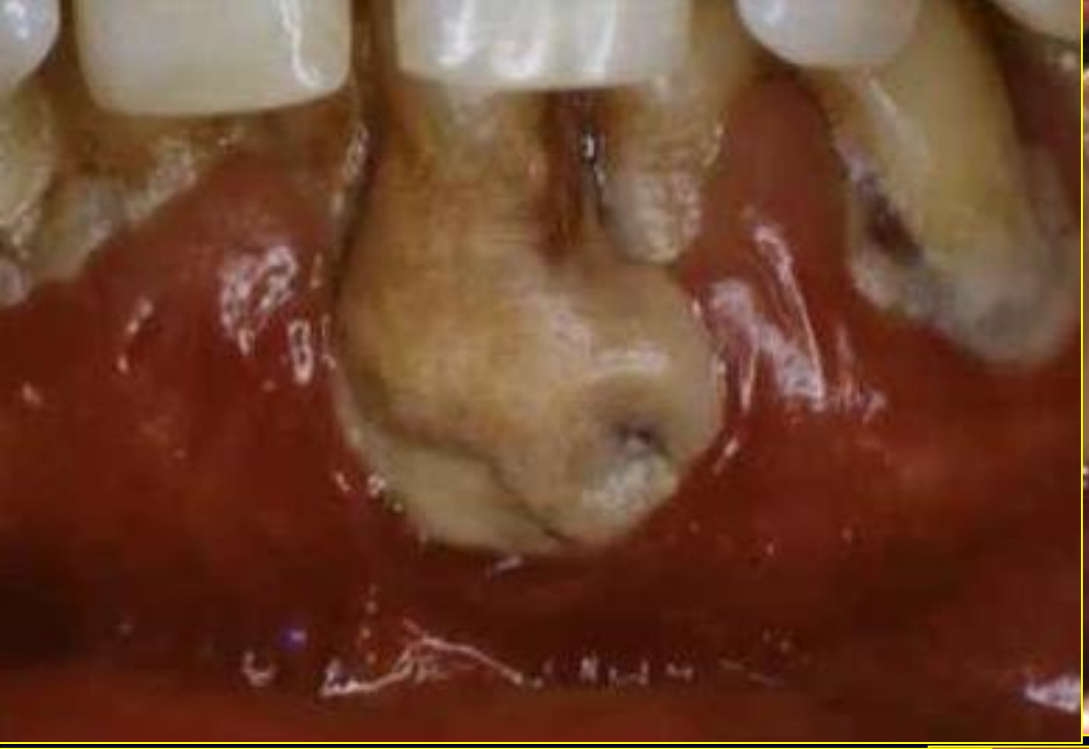
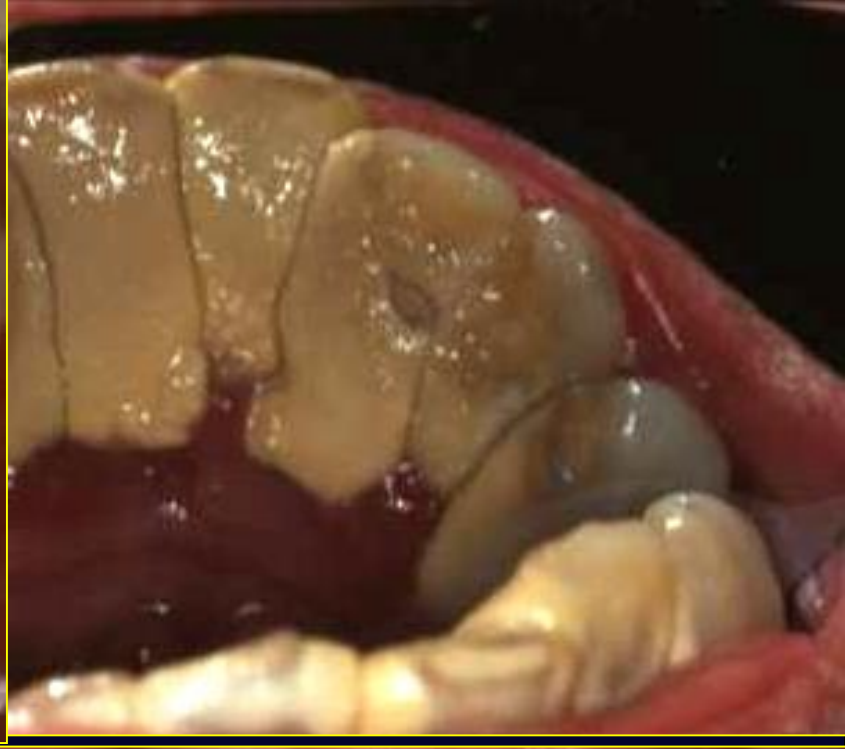
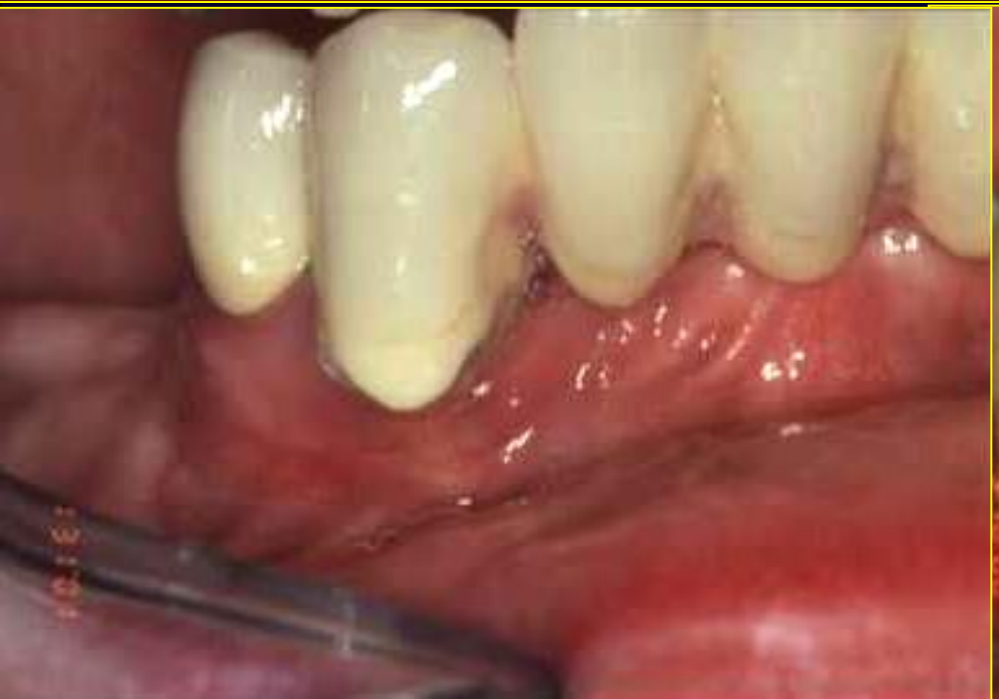
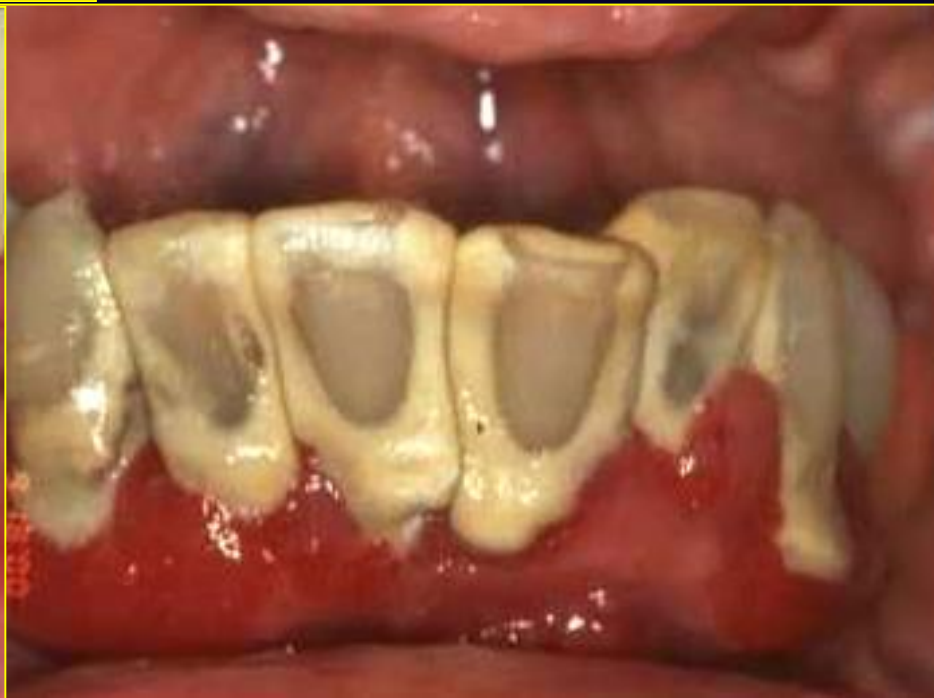








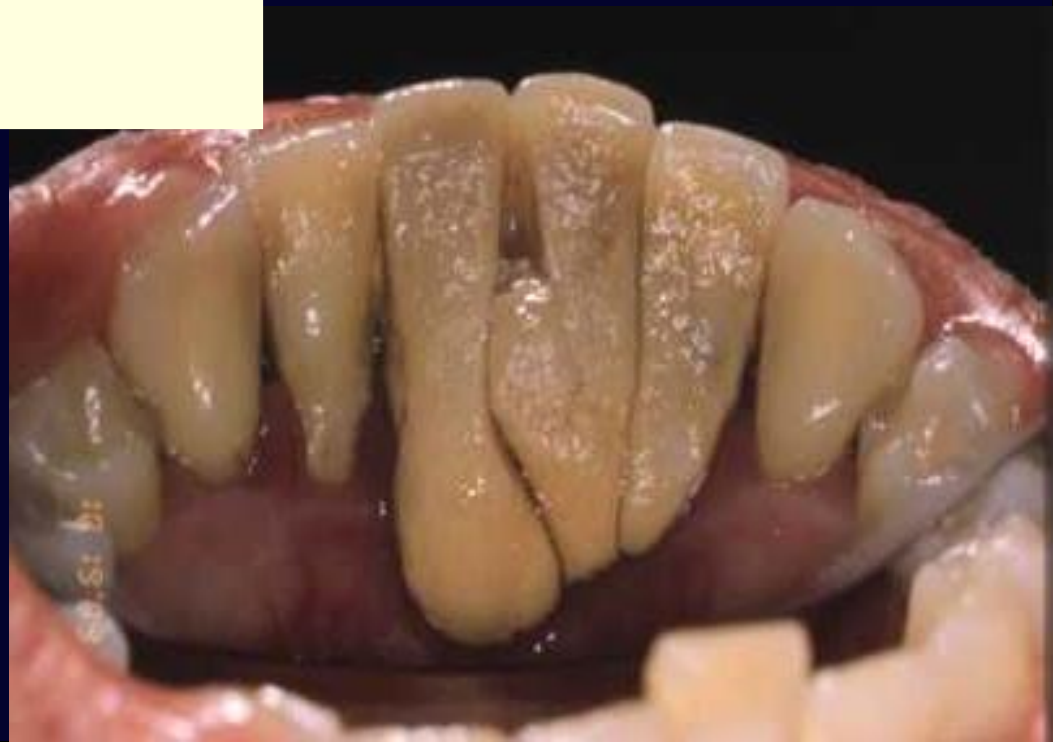


The chemical composition of dental calculus

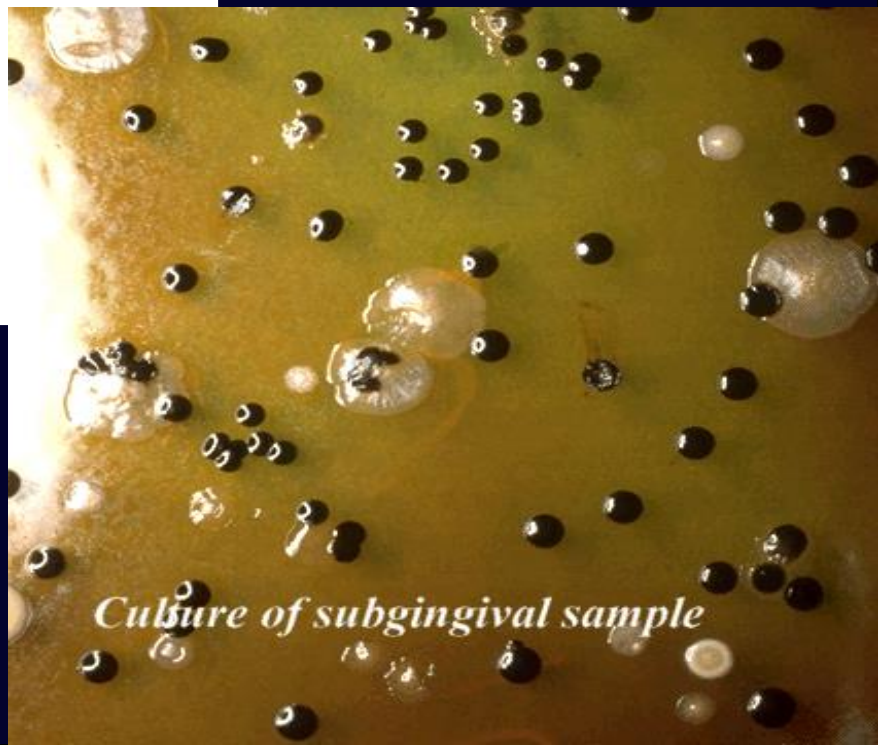
The recent and old calculus consists of four different crystals of calcium phosphate

1. $CaH(PO_4) \times 2H_2O$= Brushite (B)
2. $Ca_4H(PO_4)_3 \times 2(H_2O)$ = octa calcium phosphate (OCP)
3. $Ca_5(PO_4)_3 \times OH$ = Hydroxyapatite (HA)
4. β-$Ca_3(PO_4)_2$ = tricaciumphosphate Whitelockte

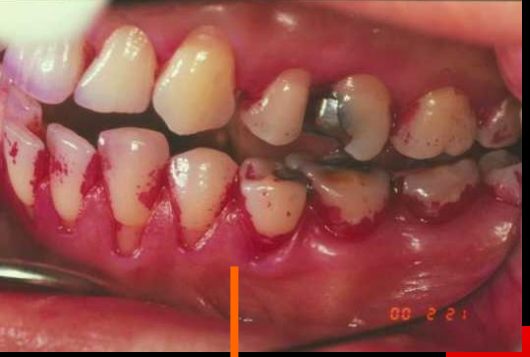


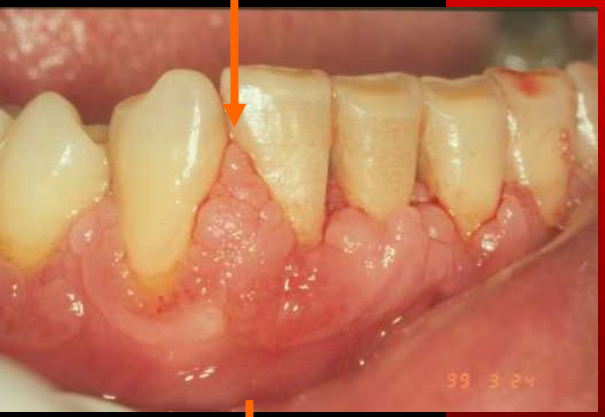
Microbiology of periodontal disease

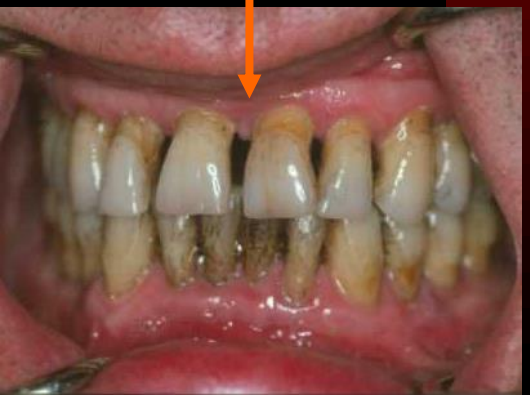
More than 700 bacterial species can be cultured
One single tooth can harbor 10^9 microorganisms
The sulcus is not sterile.
The healthy, shallow sulcus contains at least 10^3,
The inflamed pocket might harbor at least 10^8 microorganisms



LÖE CLASSIC EXPERIMENTAL GINGIVITIS STUDIES



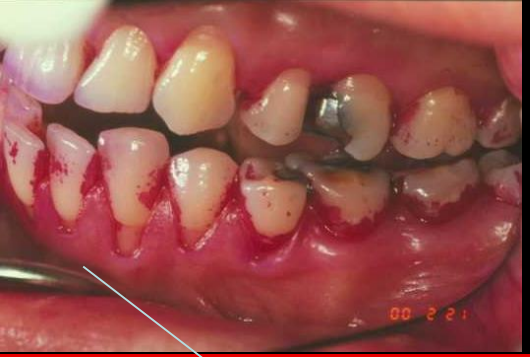




DENTAL PLAQUE

GINGIVITIS

PERIODONTITIS



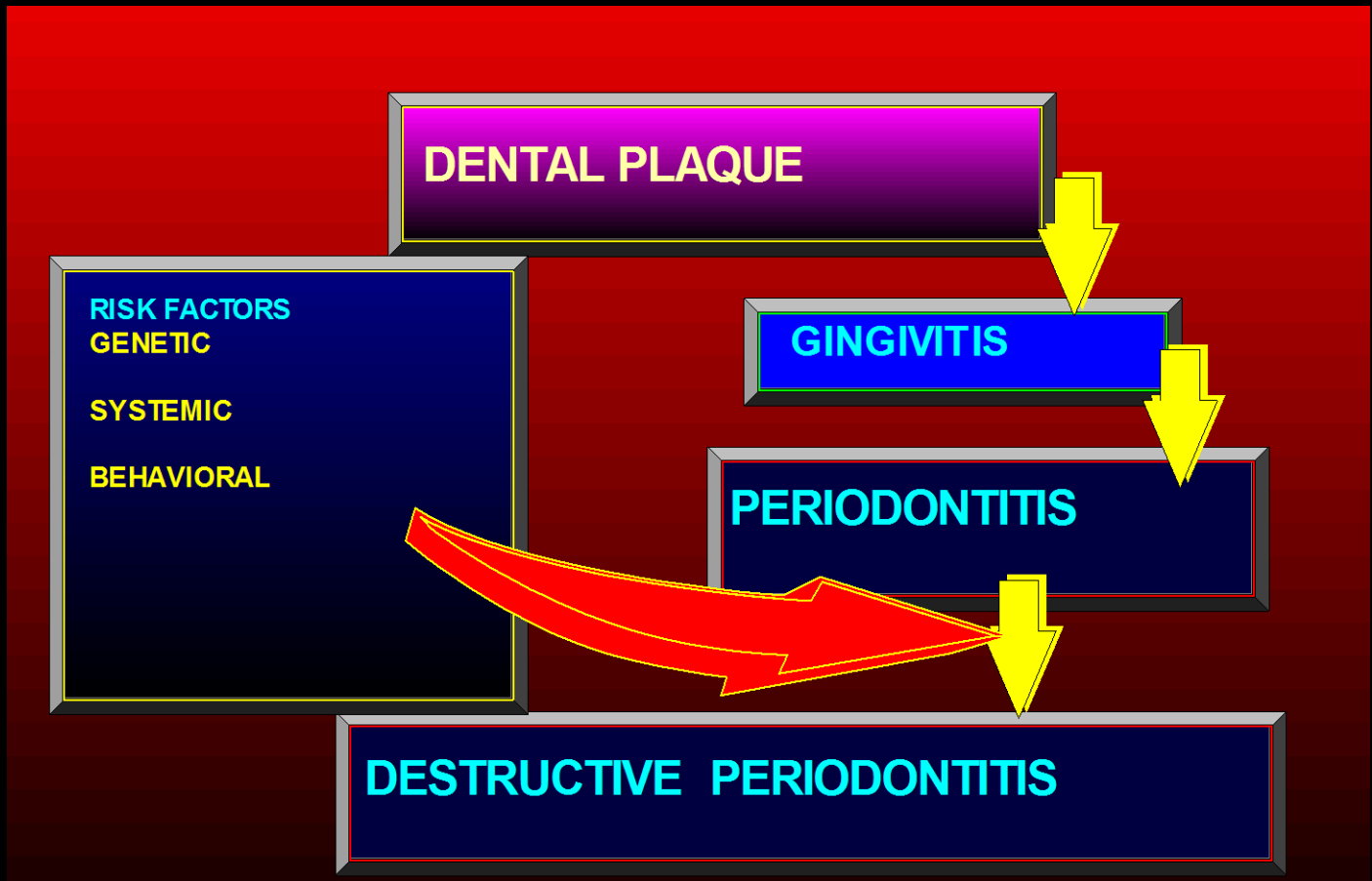
WHY NOT NECESSARILY ALL GINGIVITIS PROGRESSES TO DESTRUCTIVE PERIODONTITIS????

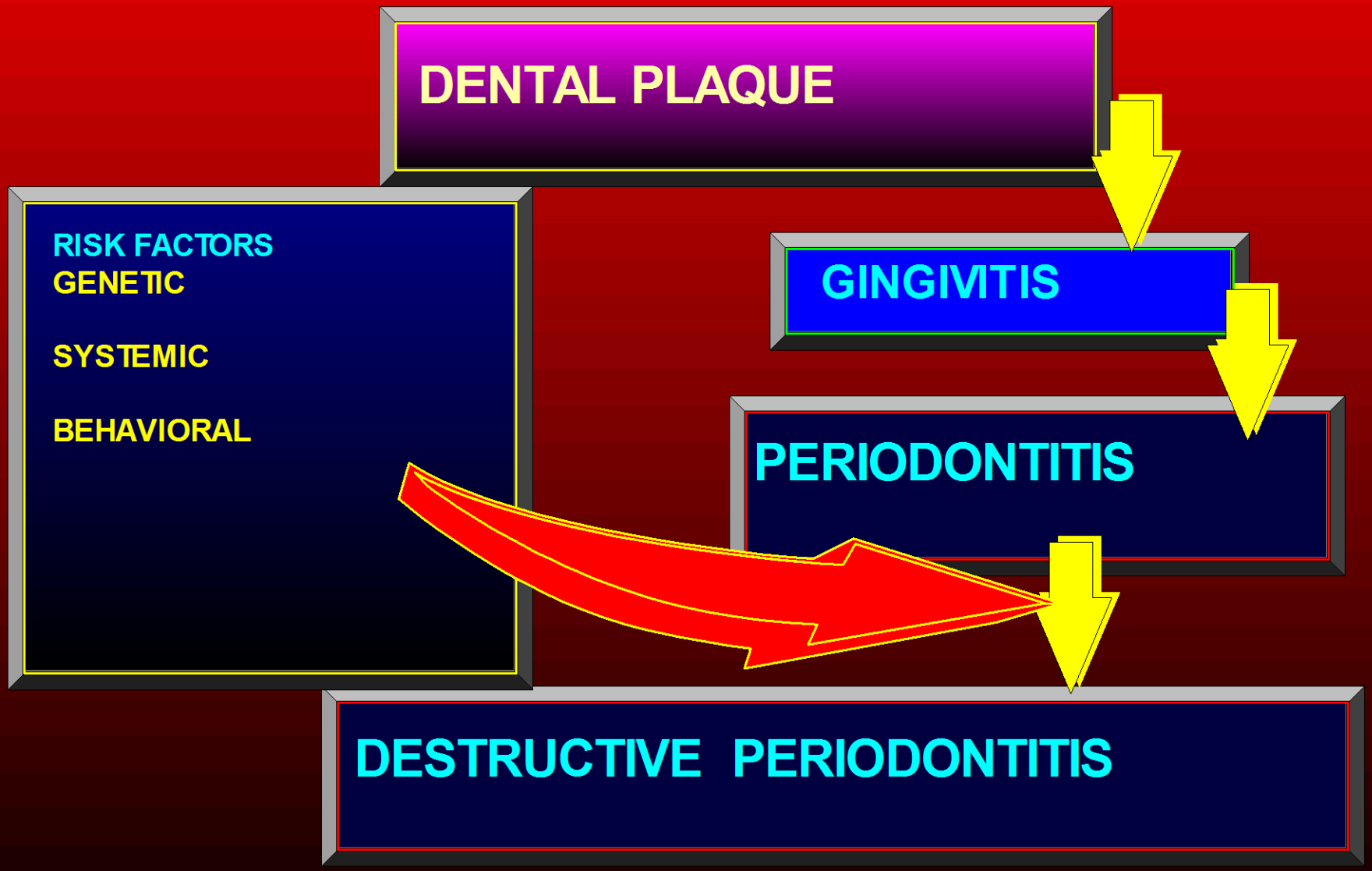
DENTAL PLAQUE

GINGIVITIS

PERIODONTITIS

DENTAL PLAQUE IS NECESARRY BUT NOT SUFFICIENT ETIOLOGIC FACTOR OF DESTRUCTIVE PERIODONTITIS




DENTAL PLAQUE
RISK FACTORS
GENETIC
SYSTEMIC
BEHAVIORAL
GINGIVITIS
PERIODONTITIS
DESTRUCTIVE PERIODONTITIS

RISK FACTORS:

GENETICS
1(IL-1)
TNF

SYSTEMIC
ENDOCRINE
CARDIOVASCULAR
IMMUNOLOGICAL

BEHAVIORAL
STRESS
DIET
SMOKING
WAY OF LIFE

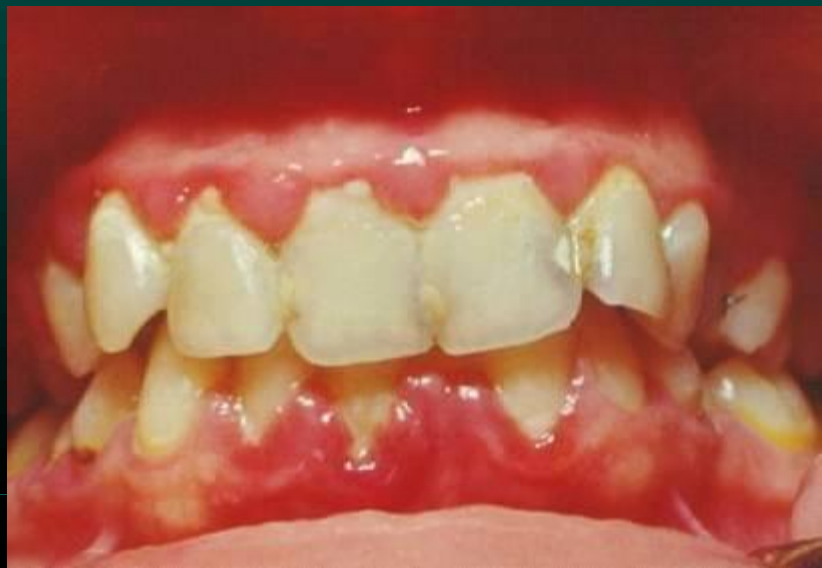
- QR CODE NEXT

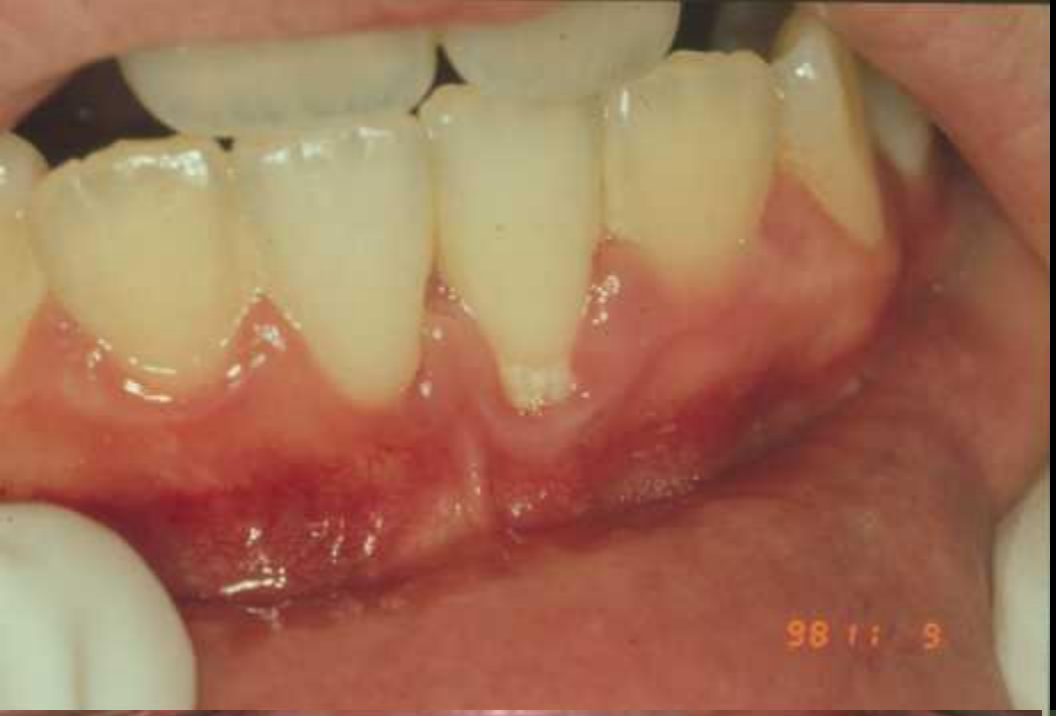
ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

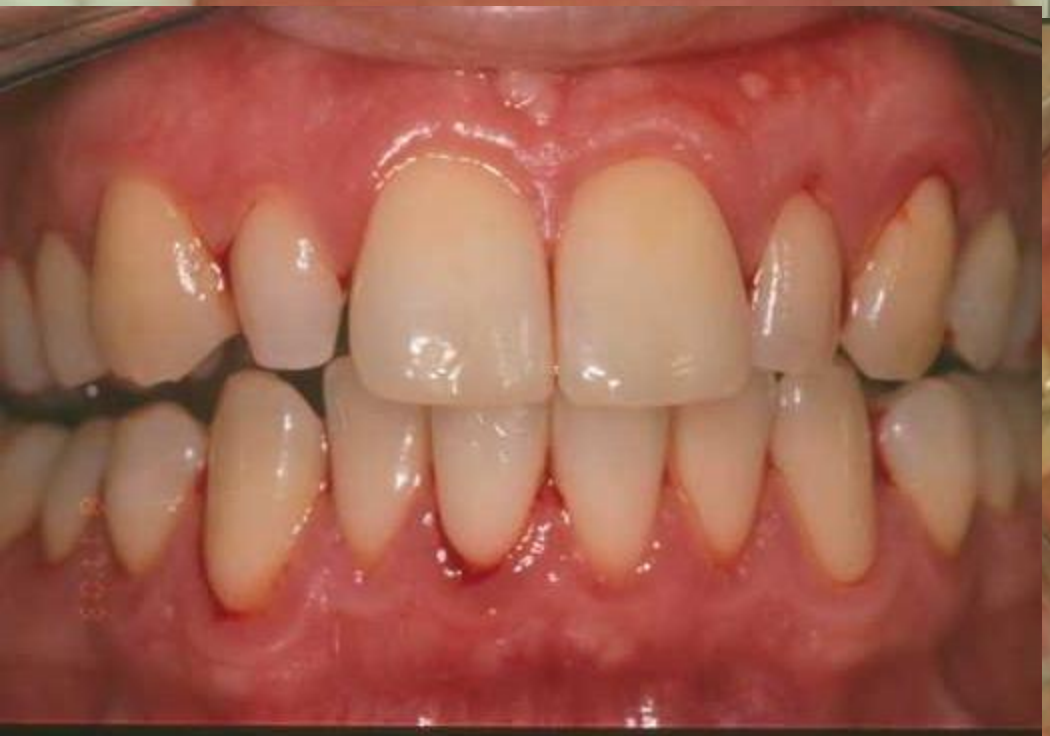
ETIOLOGIC FACTORS

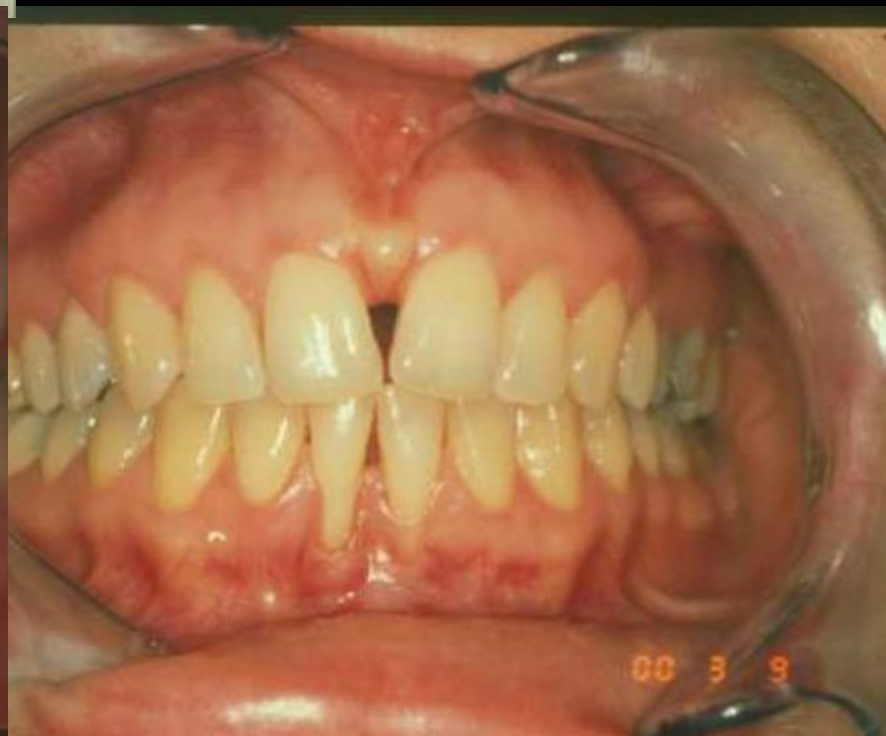
- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

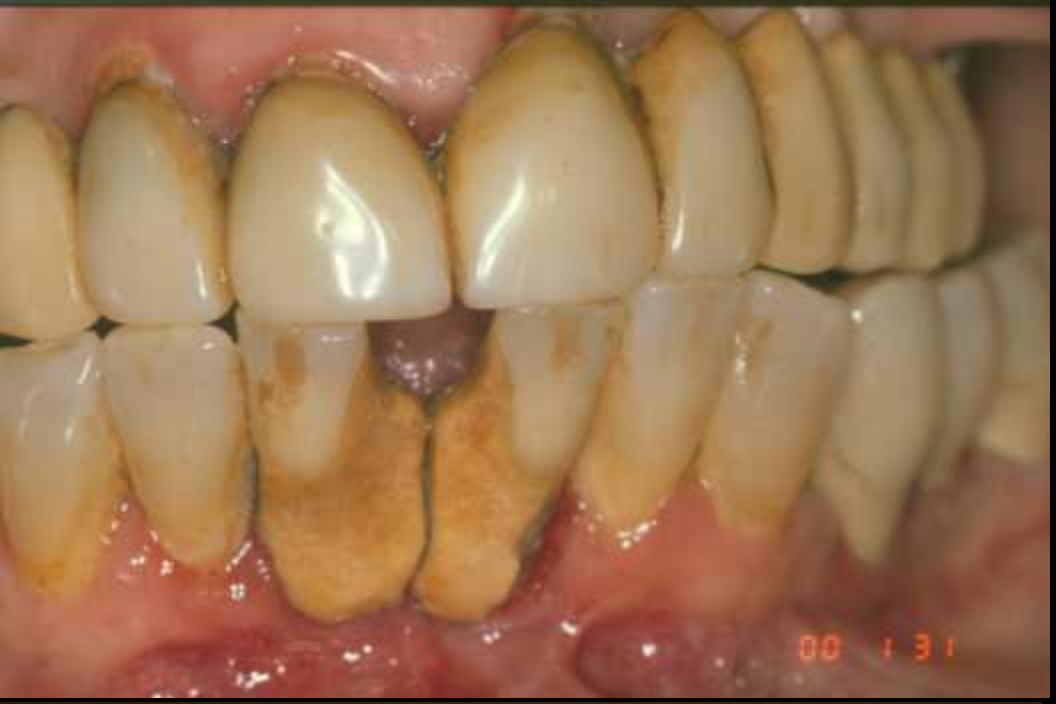


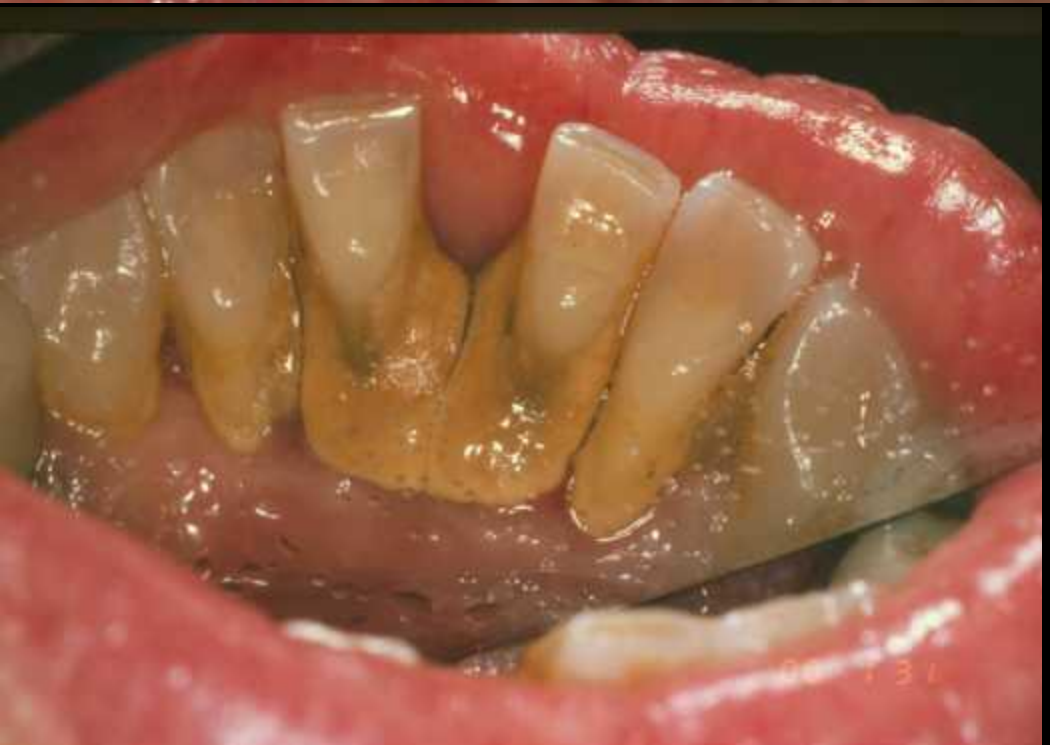


SEVERAL SYSTEMIC AND LOCAL MODIFYING FACTORS

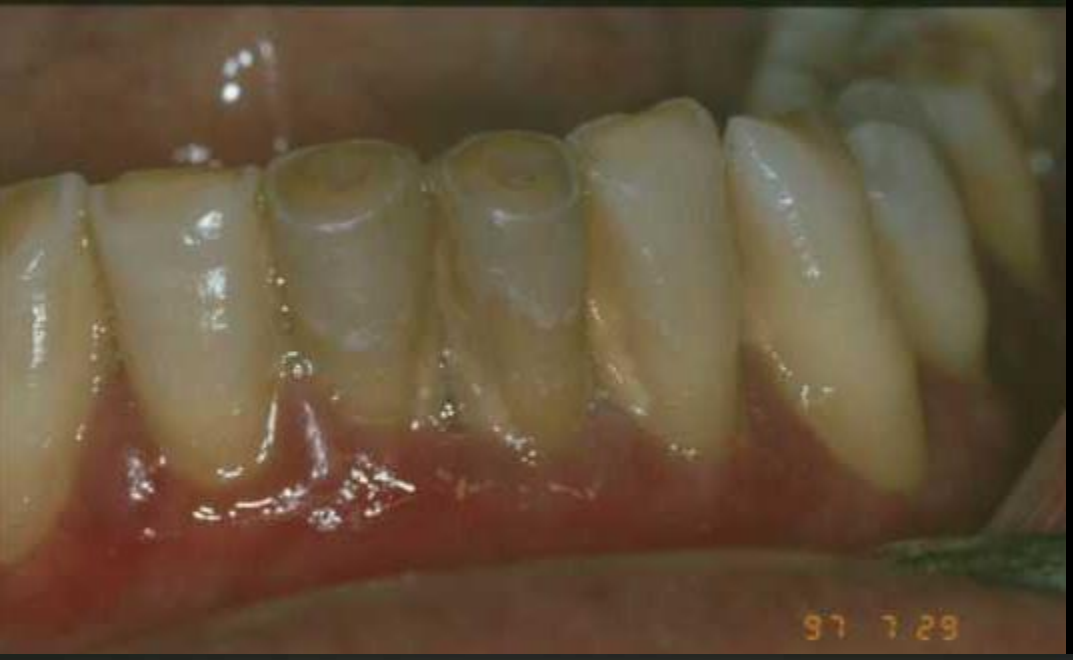


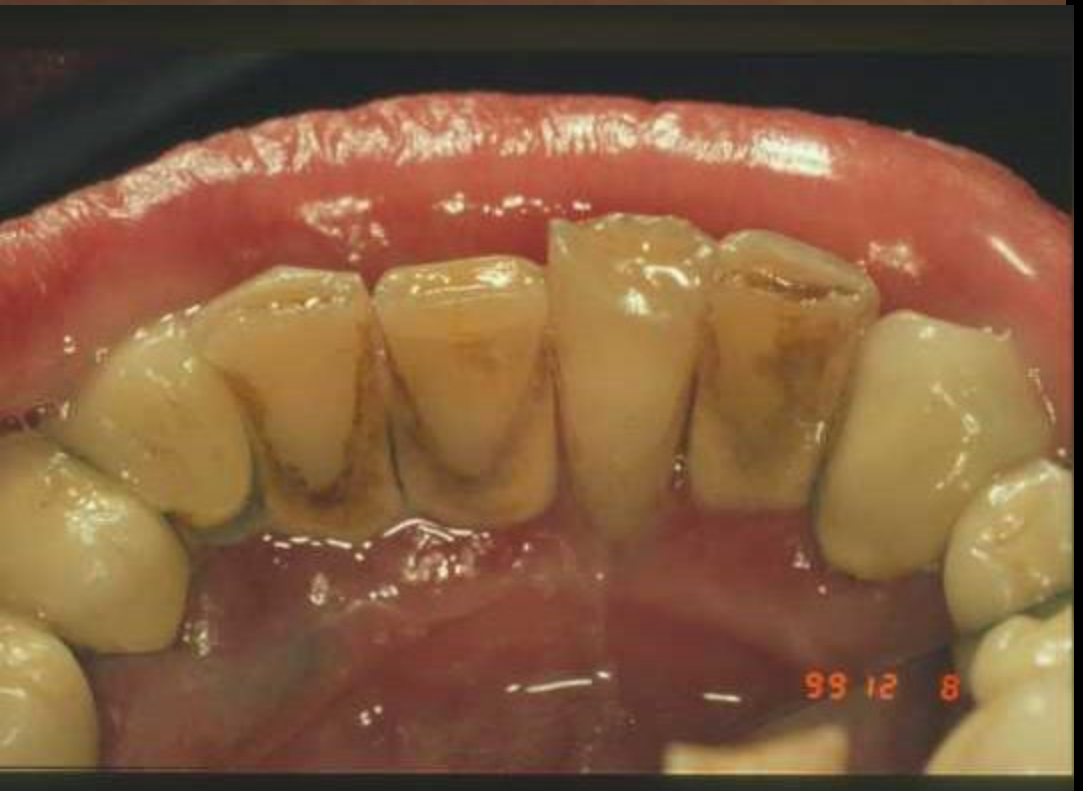




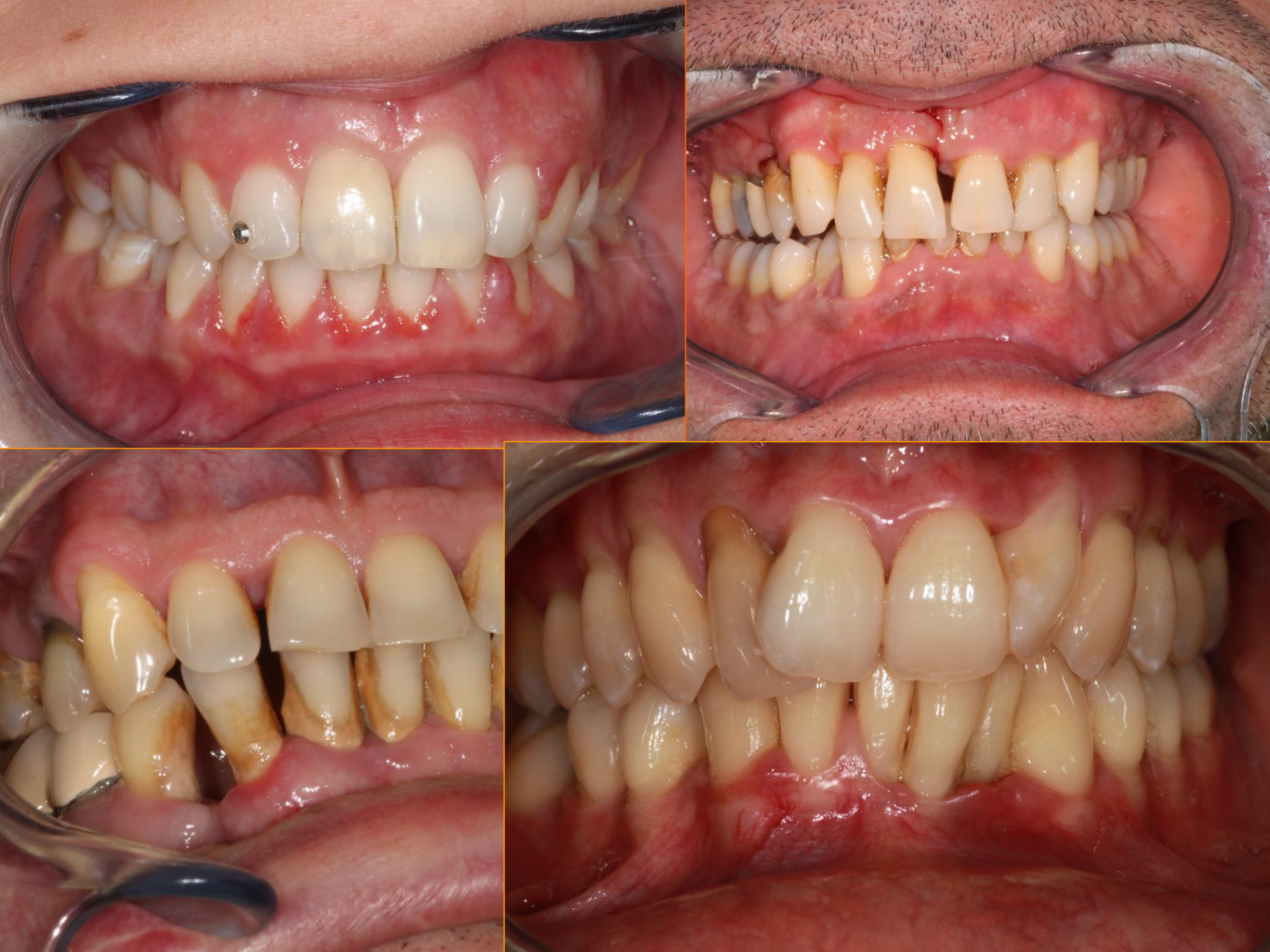


HEAVY SUPRAGINGIVAL DENTAL CALCULUS DEPOSITION MECHNICALLY SEPARATING FRONT TEETH



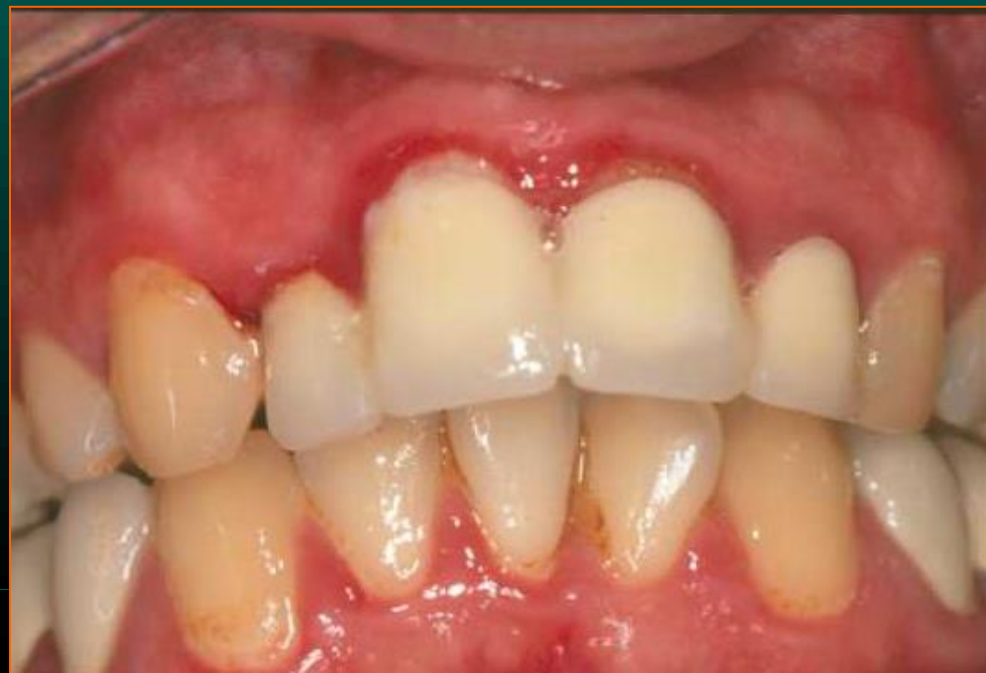


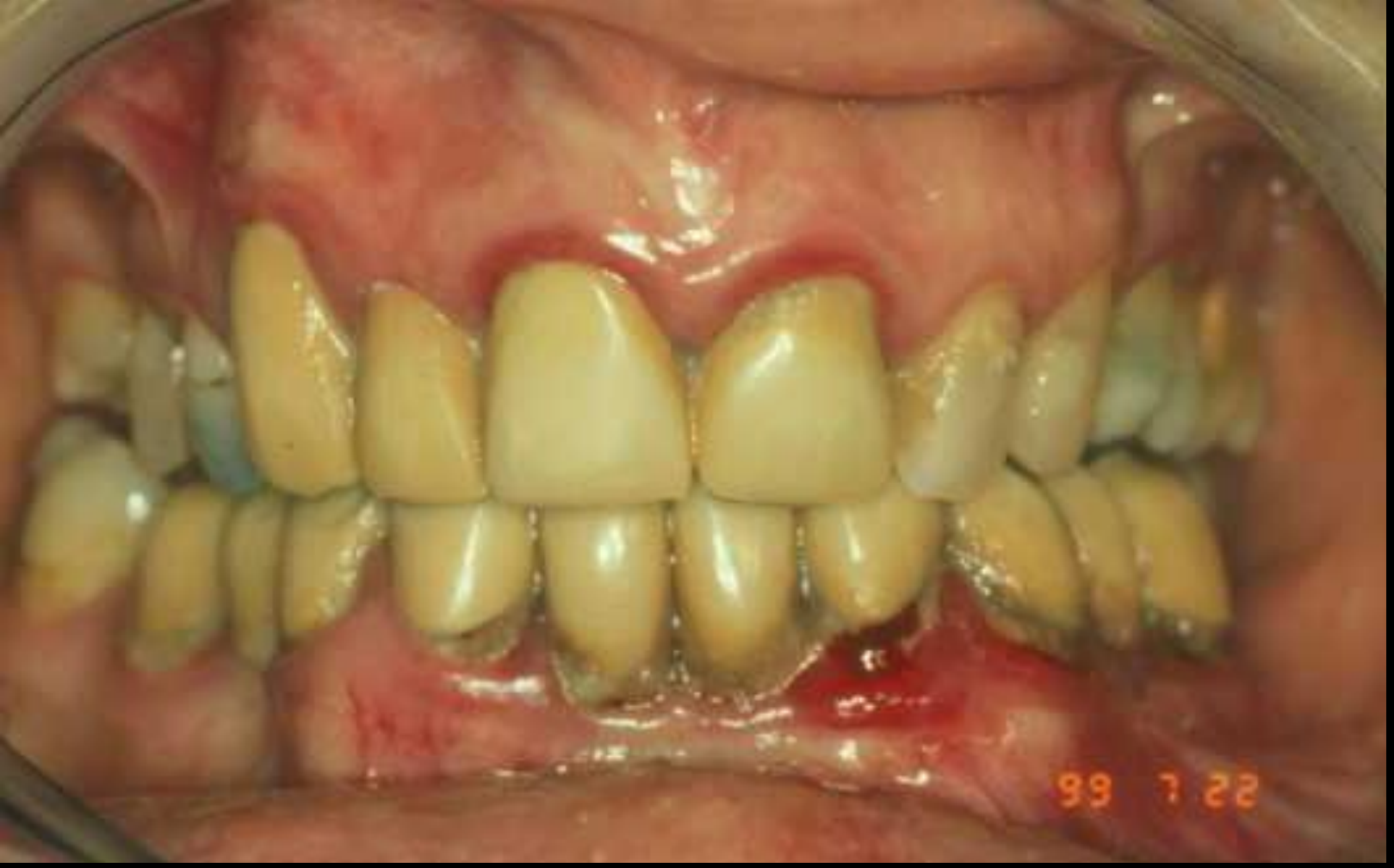
HEAVY SUPRAGINGIVAL PLAQUE AND DENTAL CALCULUS DEPOSITION



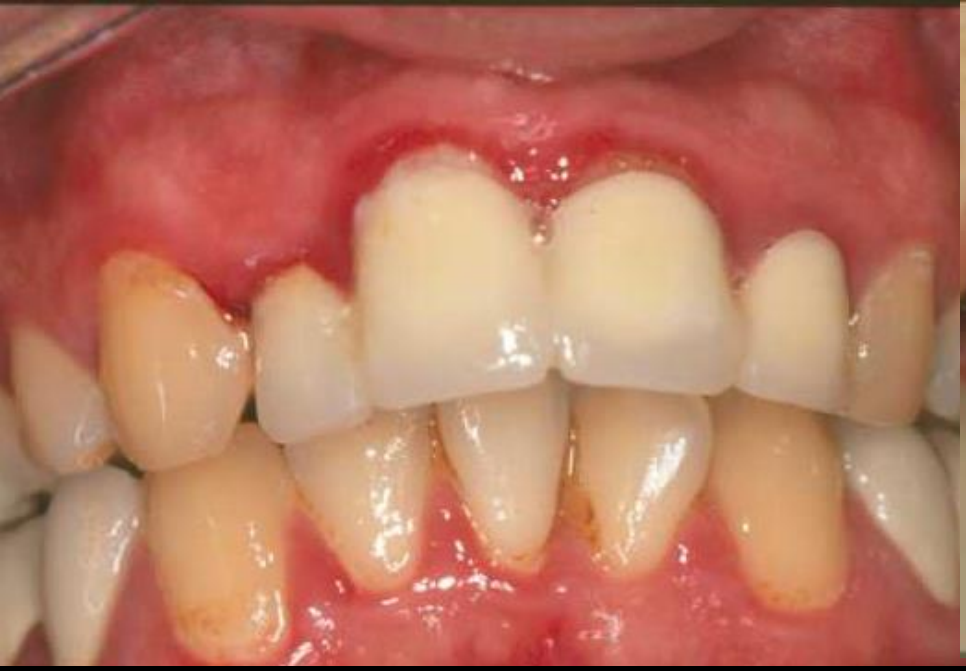
ETIOLOGIC FACTORS

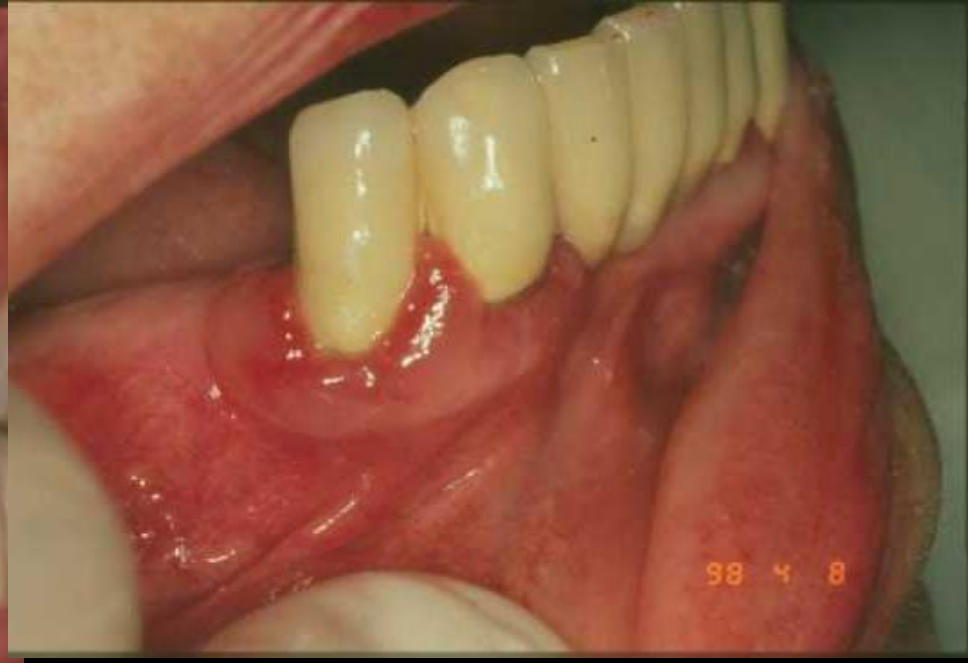
- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics





FAULTY RESTAURATIONS

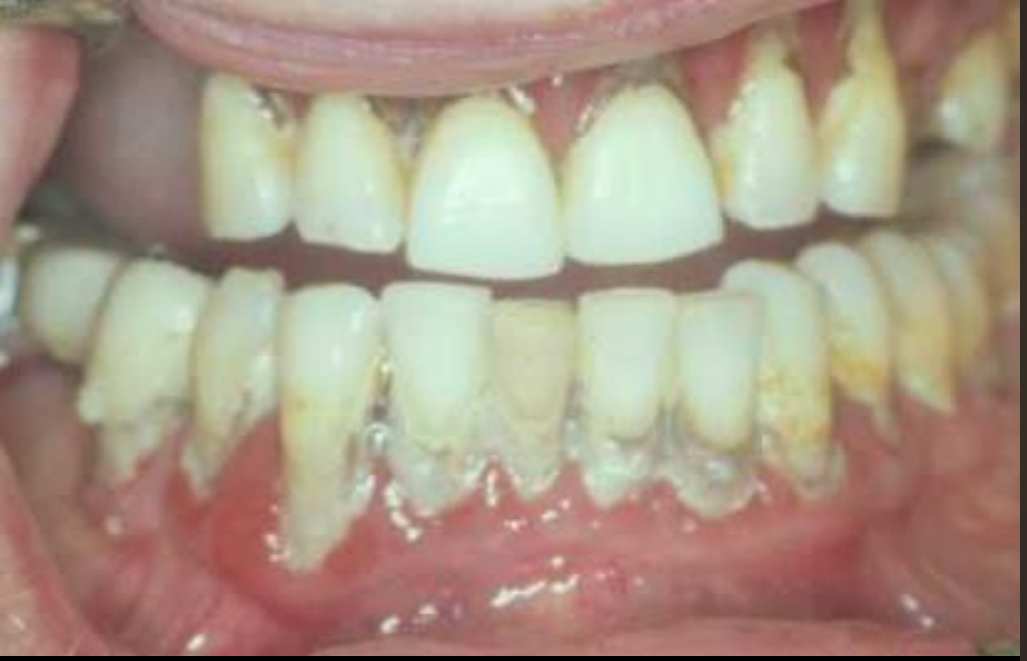




LOCAL PLAQUE RETENTIVE FACTORS

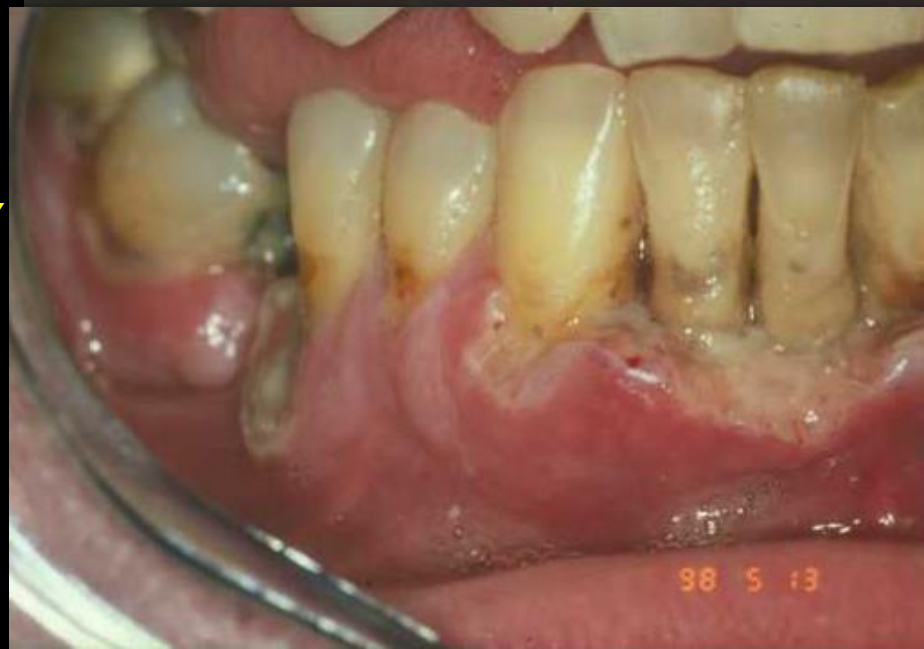
ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics



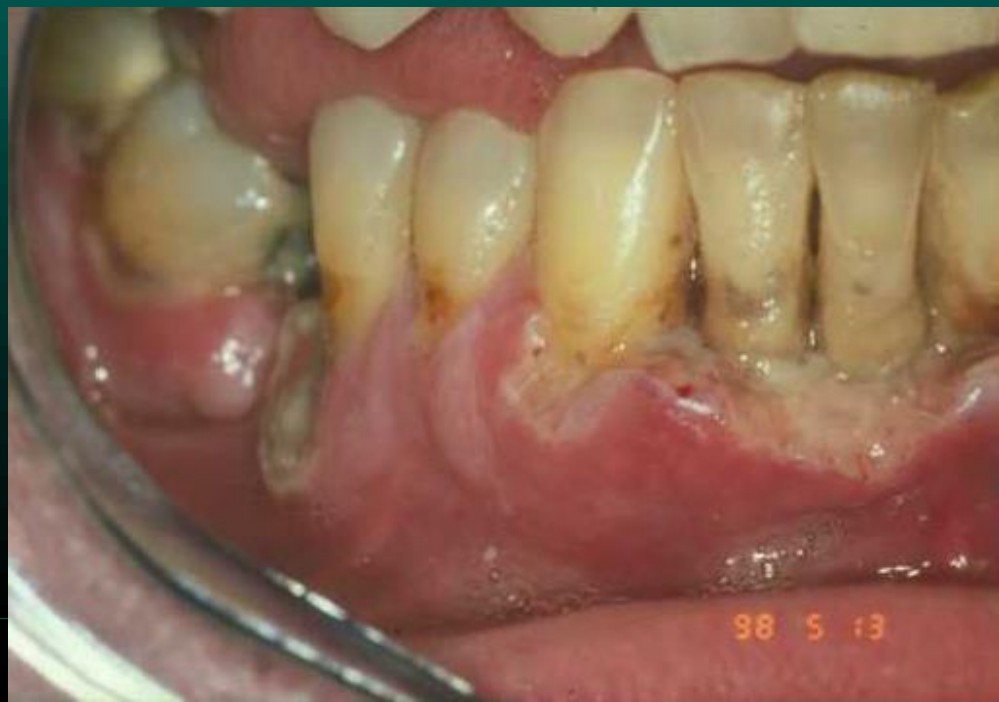
LARGE MASS OF SUPRAGINGIVAL PLAQUE AND CALCULUS

THE SUBGINGIVAL PLAQUE IS TOTALLY INDEPENDENT OF THE SUPRAGINGIVAL ORAL ENVIRONMENT FORMS A BIOFILM, THAT CAN ONLY BE REMOVED BY PROFESSIONAL MECHANICAL DEBRIDEMENT



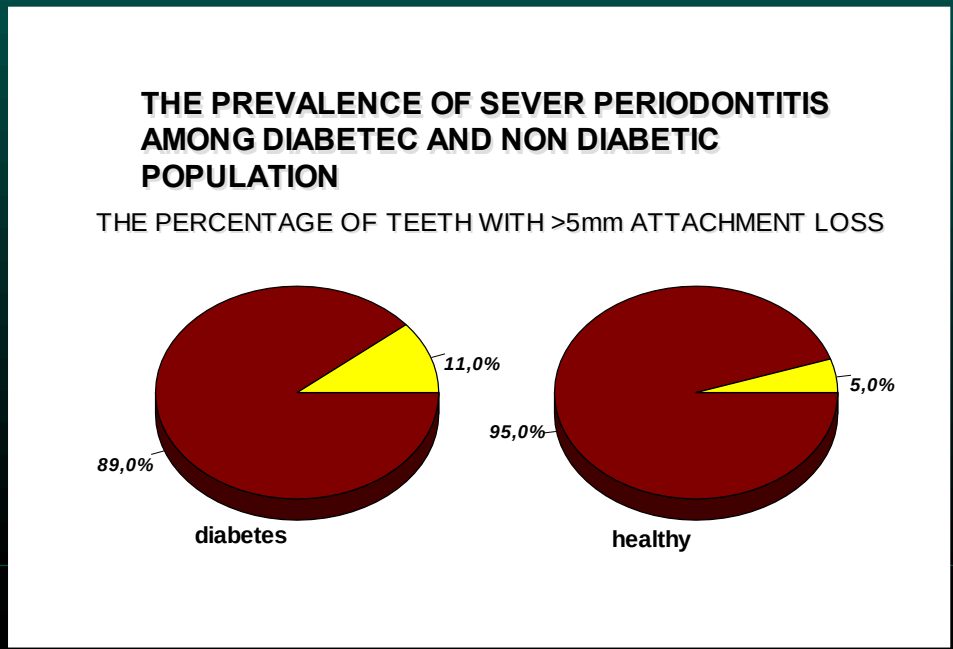
ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics



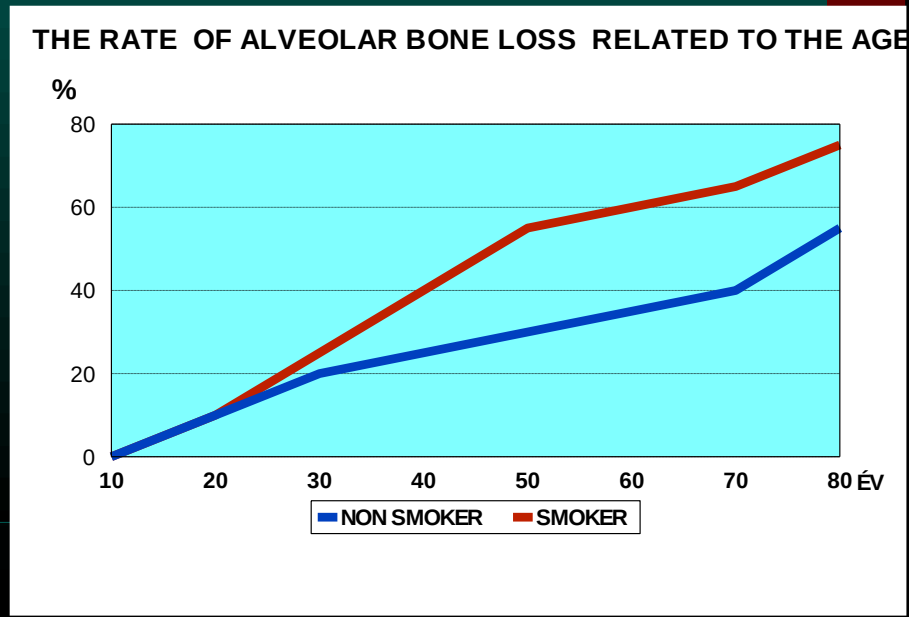
ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics



ETIOLOGIC FACTORS

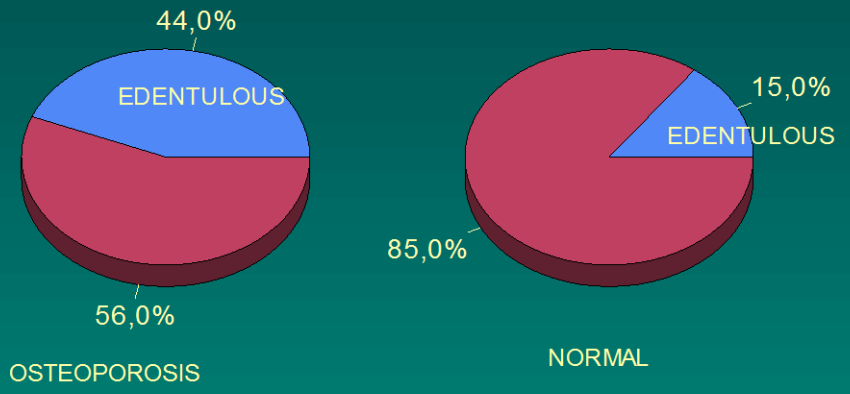
- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics



ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

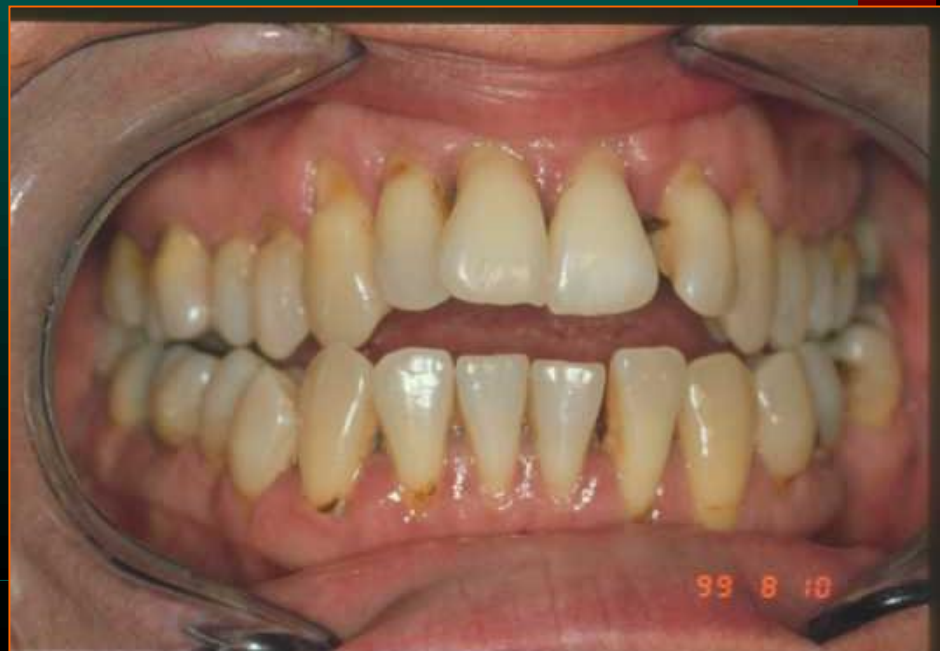
TOTAL EDENTULOUSNESS IN OSTEOPOROTIC AND NORMAL AGE MATCHED POPULATION

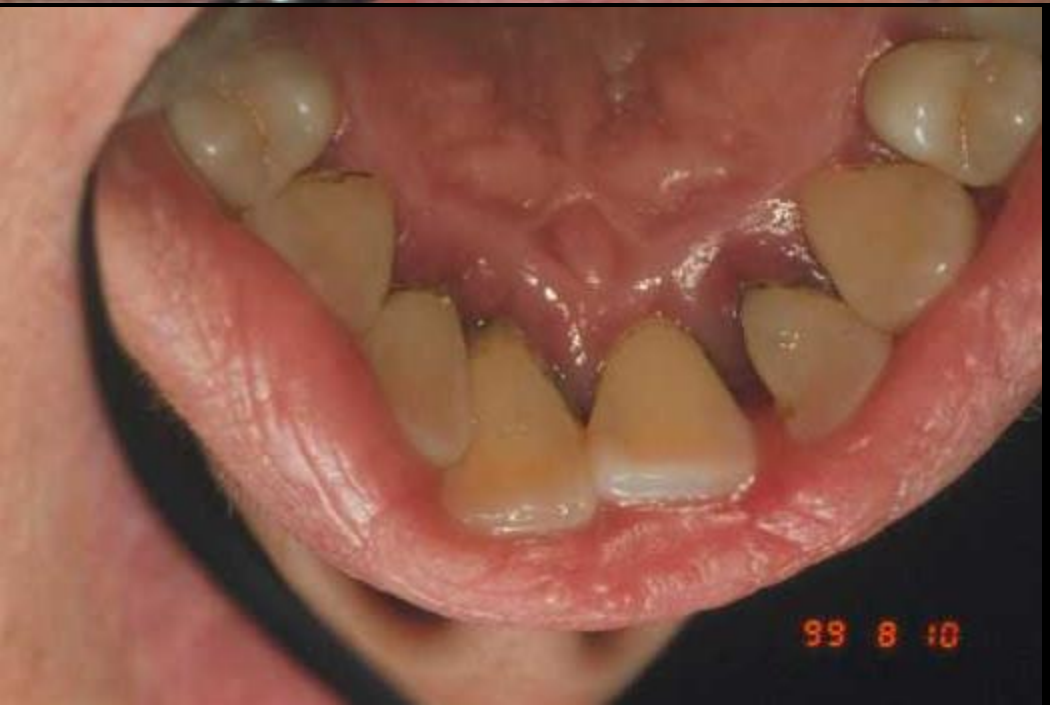


Taguchi A et al. Tooth loss and mandibular osteopenia Oral Surg Oral Med Oral Path 1995;79:127-132

ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics





THERE IS NO CORRELATION BETWEEN LOCAL ETIOLOGIC FACTORS AND THE SEVERITY OF TISSUE DESTRUCTION

ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

CPITN scores in Hungary in 1985 and 1991.

WHO pathfinder studies

CPITN scores	12 year old	12 year old	35-44 year old	35-44 year old
	1985	1991	1985	1991
Deep pocket (CPITN 4)	0,1	0	8	2,3
3-5mm Pocket (CPITN 3)	4,1	0	26,4	15,41
Calculus (CPITN 2)	30,9	30,1	50,8	71,3
Initial gingivitis (CPITN 1)	38,5	30,8	7,6	6,8
Healthy (CPITN 0)	26,2	39,1	5	4,3

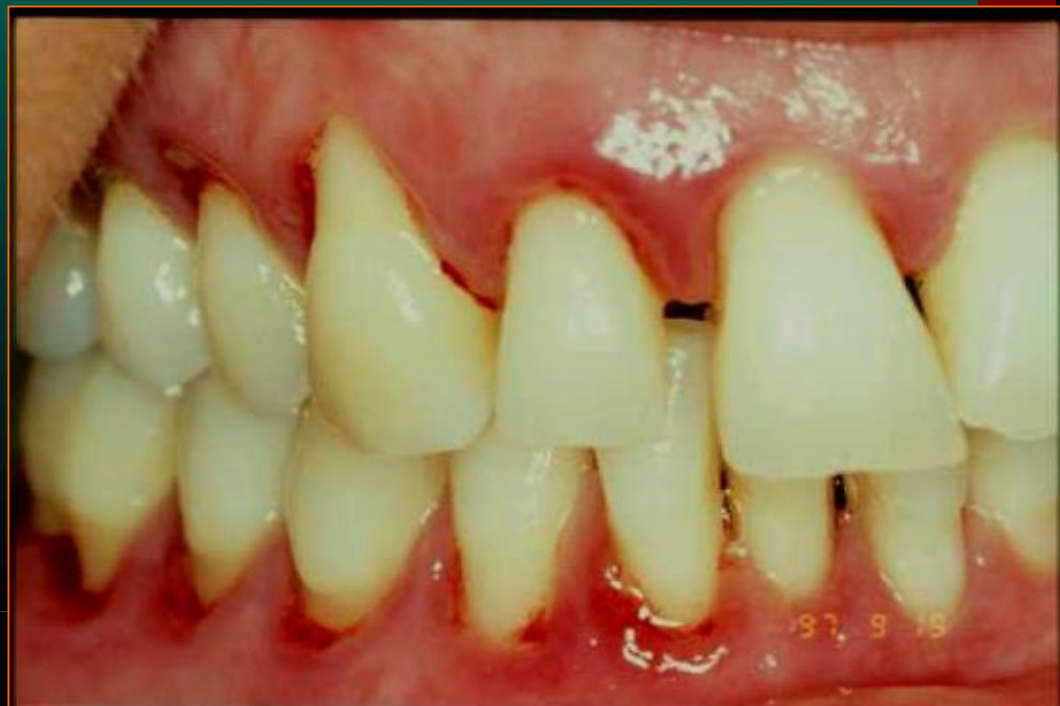
Czukor J.: National Oral Health Pathfinder surveys in Hungary in the years 1985 and 1991. Fogorv. Szl. 1994; 87: 223-235

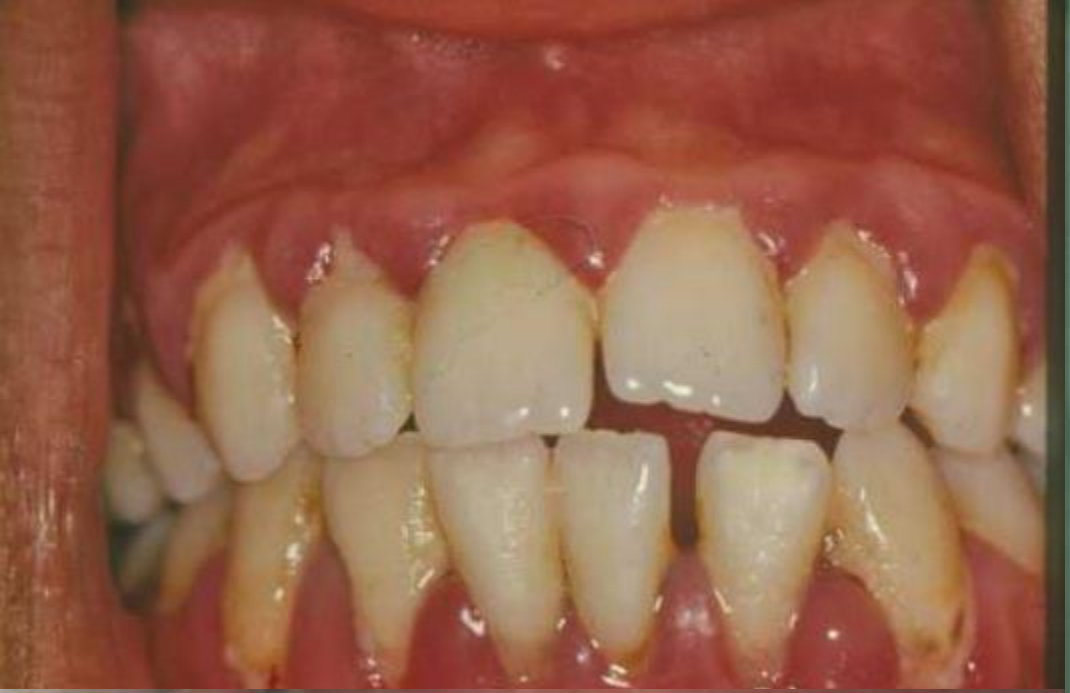
ETIOLOGIC FACTORS

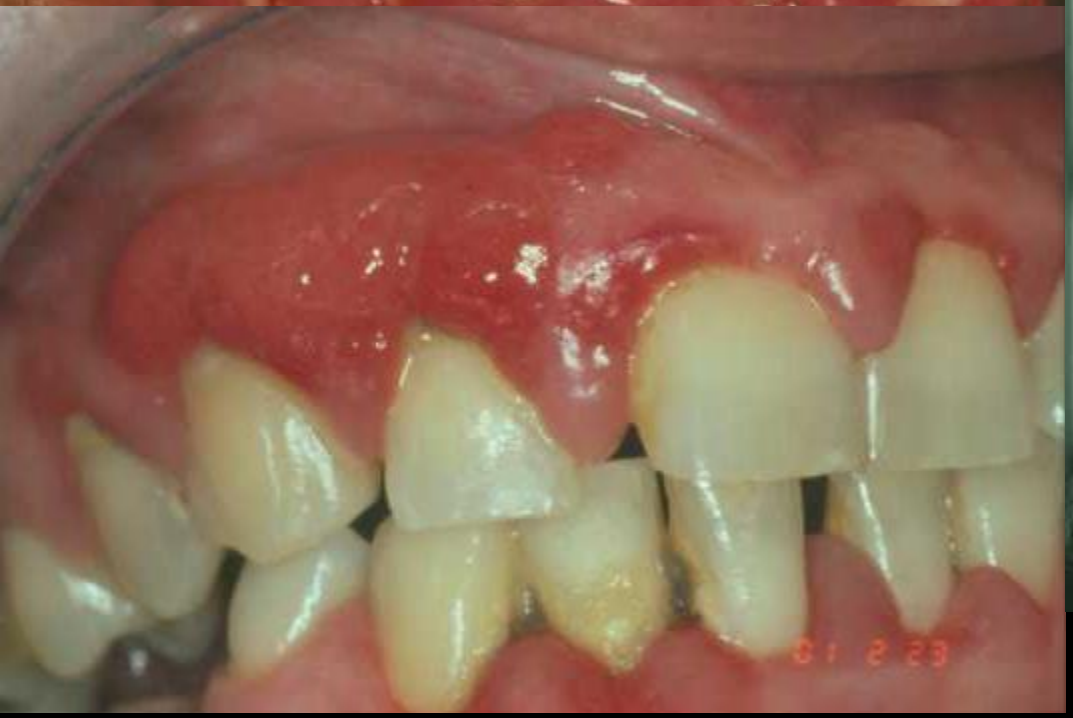
- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

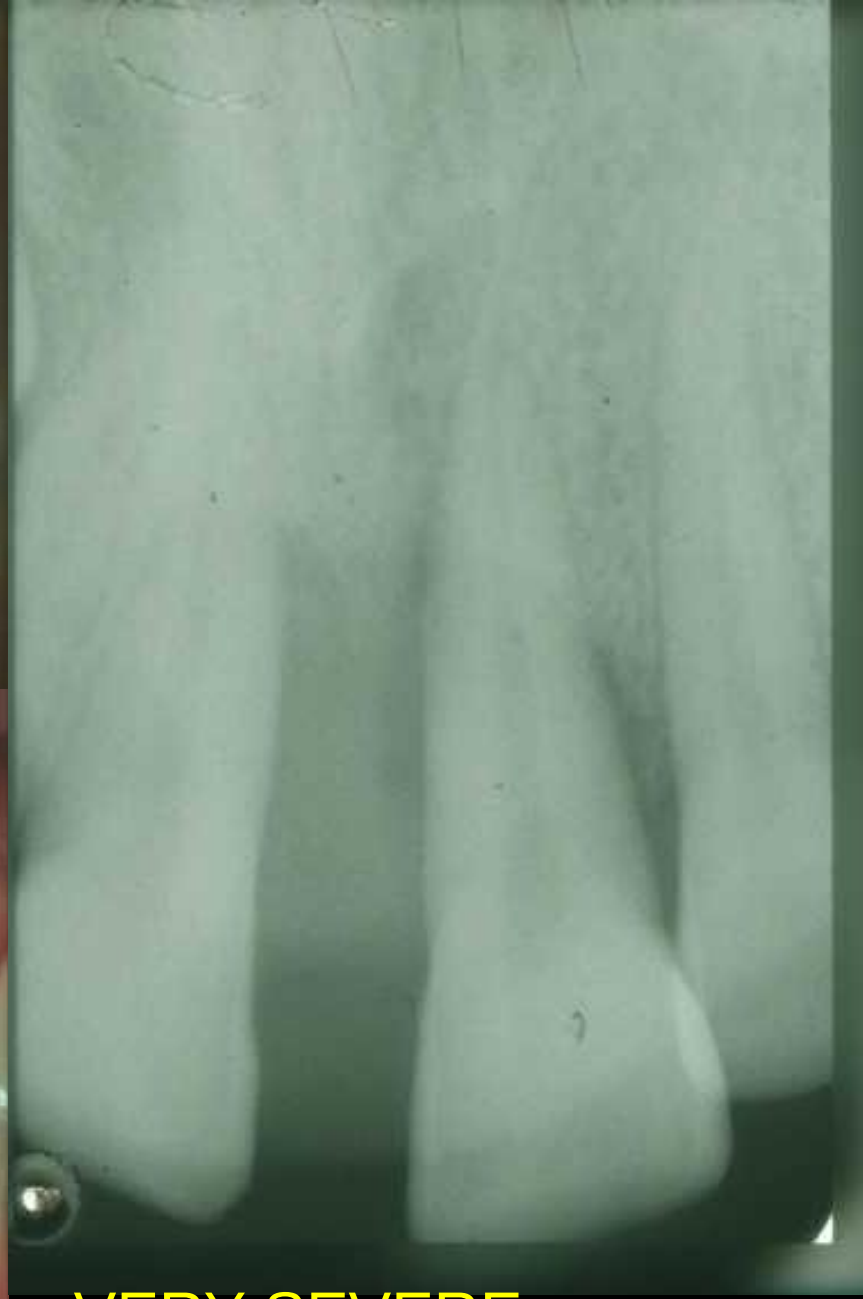
ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics









VERY SEVERE
ALVEOLAR BONE LOSS

ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
  Stress
  Socio-economics

ETIOLOGIC FACTORS

- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

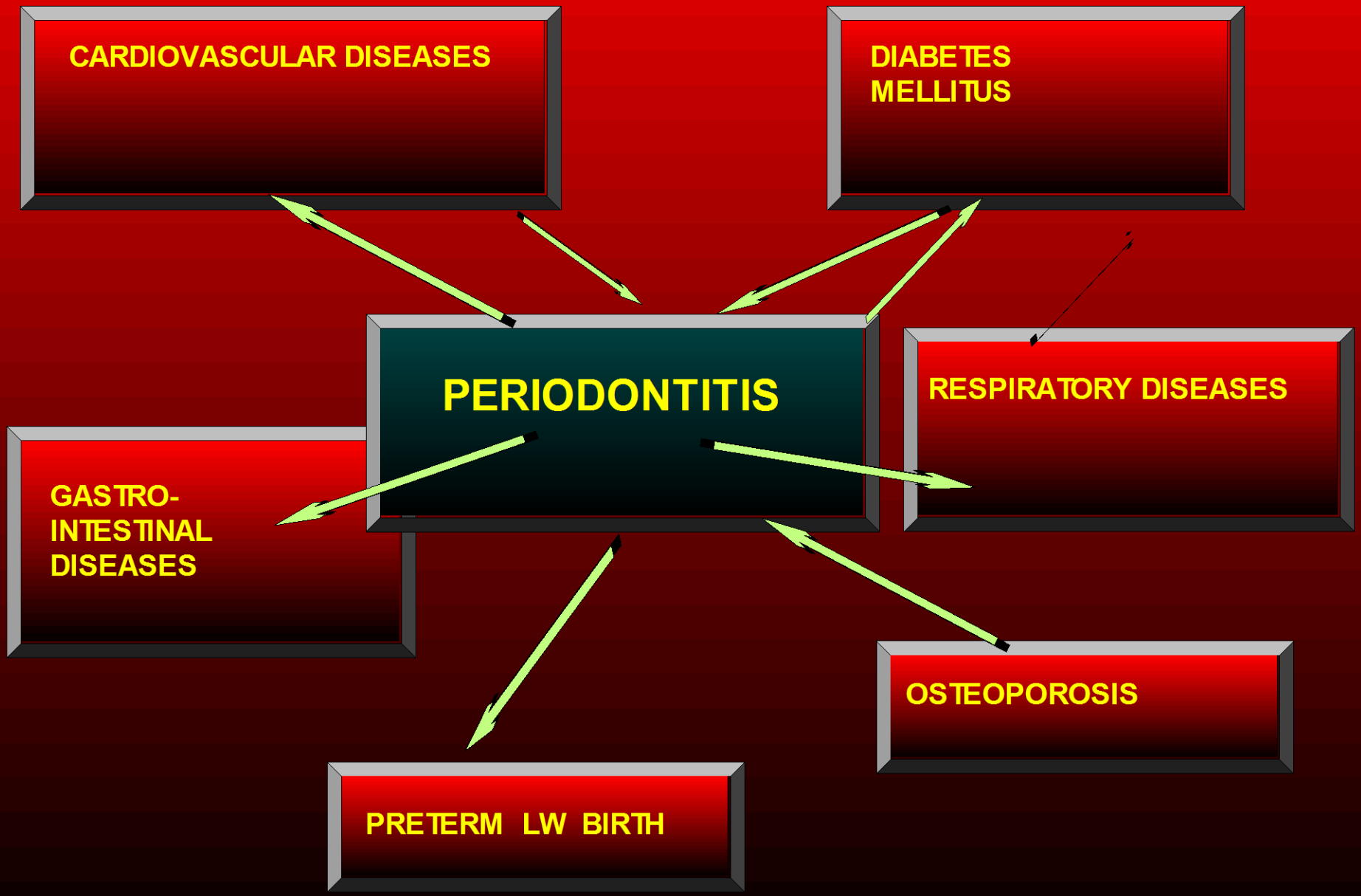
Many studies have indicated that lower income groups have a much higher prevalence of gingivitis and periodontitis than people living on a much higher living standards *(Oliver et al. 1998, Micheelis & Bauch 1996)*.

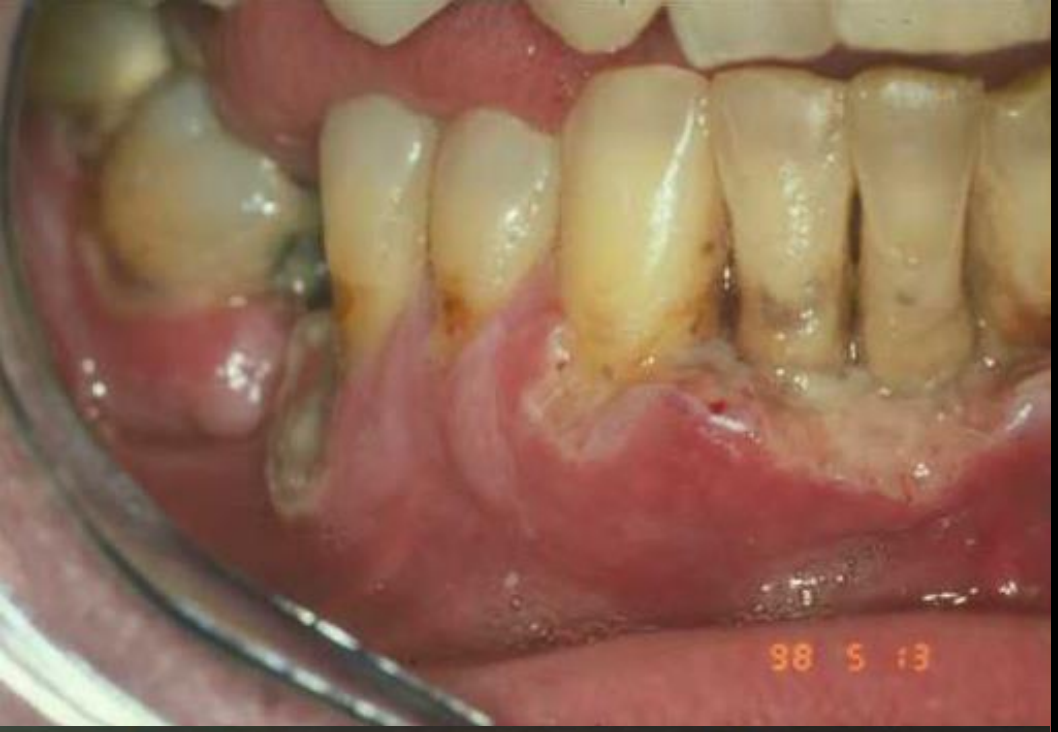
These can be attributed to the inferior oral hygiene, the lack of sophisticated oral hygienic aids, the inferior standards in dental care and the limited access to dental services

ETIOLOGIC FACTORS

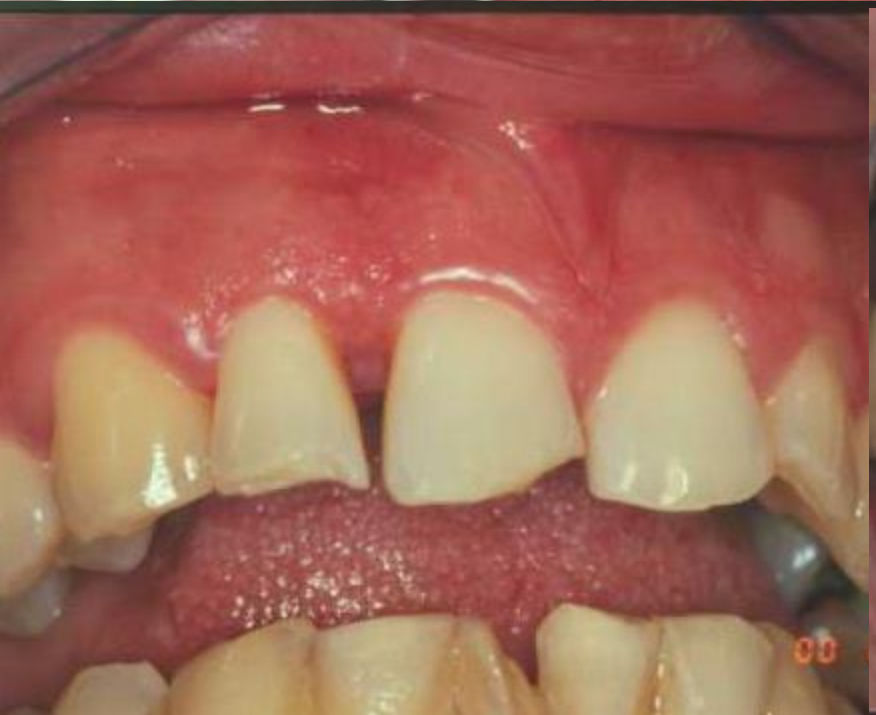
- Oral hygiene
  Local plaque retentive factors
  bacterial specificity
  systemic immune status
  Diabetes mellitus
  Tobbaco smoking
  Osteoporosis
  Ethnic background
  Age
  Diet
  Genetics
- Stress
  Socio-economics

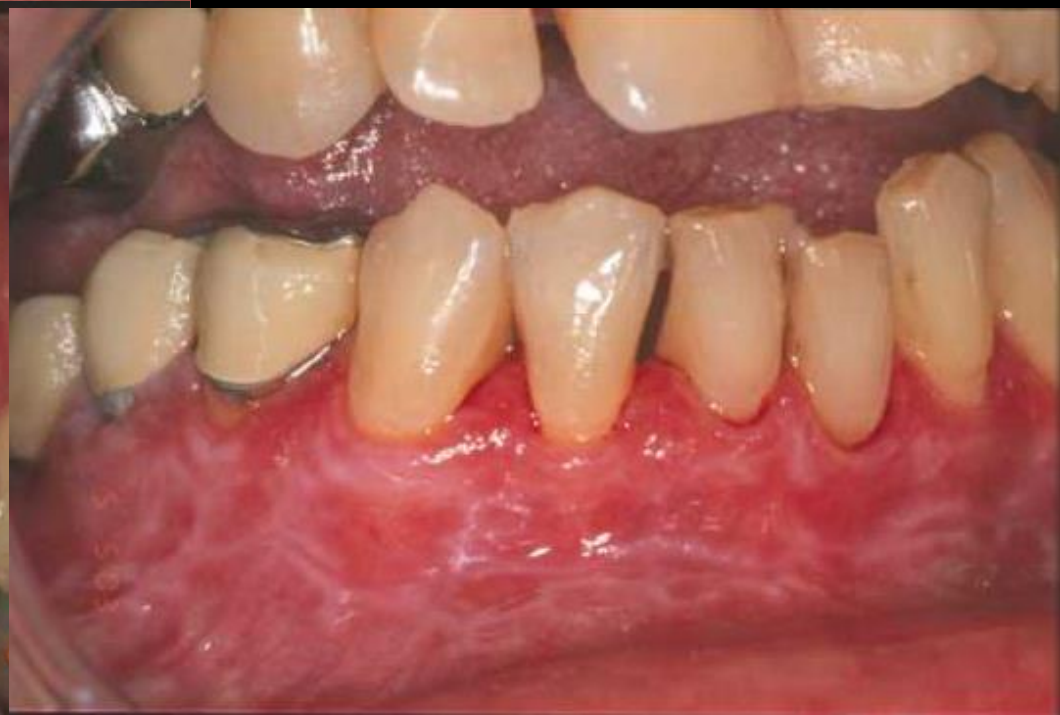
According to a survey from eastern Germany **62,4% of all people** with a qualification equivalent to **junior high school certificate** had advanced periodontitis and none of them had healthy periodontium,
while **only 37.7%** of the participants with **university degree** had advanced periodontitis *(Mengel et al. 1993)*

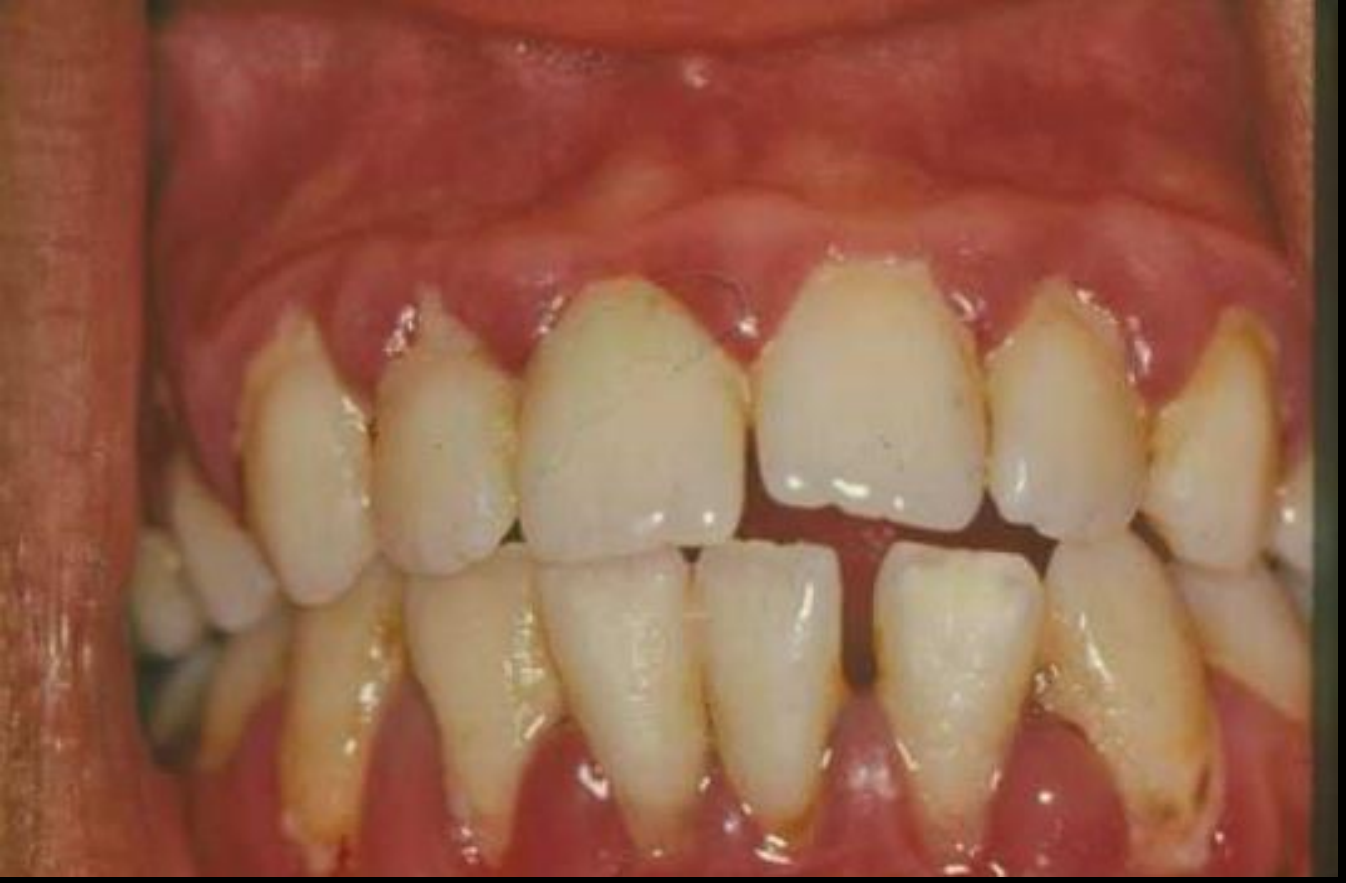

CARDIOVASCULAR DISEASES
DIABETES MELLITUS
PERIODONTITIS
RESPIRATORY DISEASES
GASTRO-INTESTINAL DISEASES
OSTEOPOROSIS
PRETERM LW BIRTH



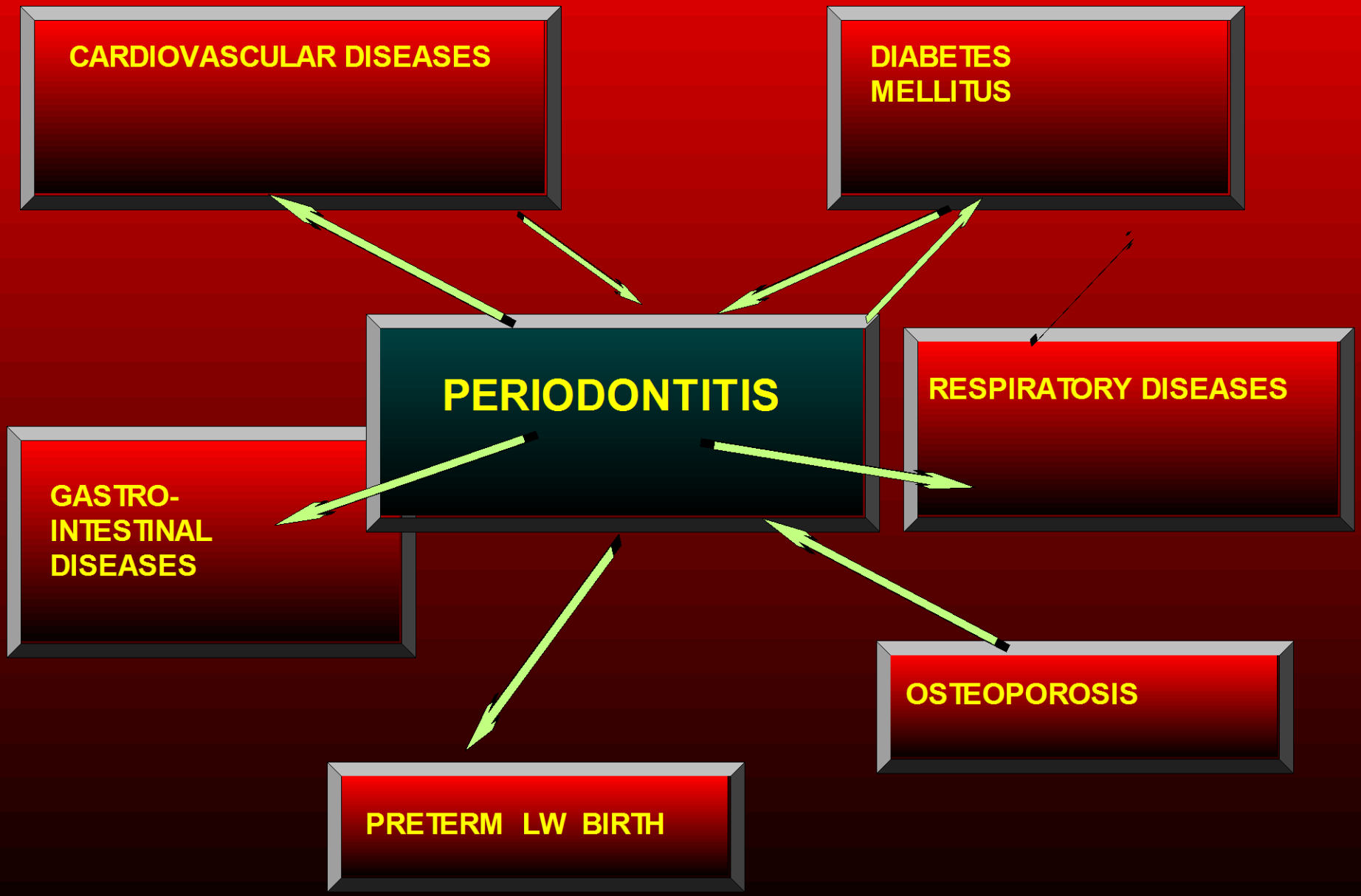
SEVERAL SYSTEMIC AND LOCAL MODIFYING FACTORS

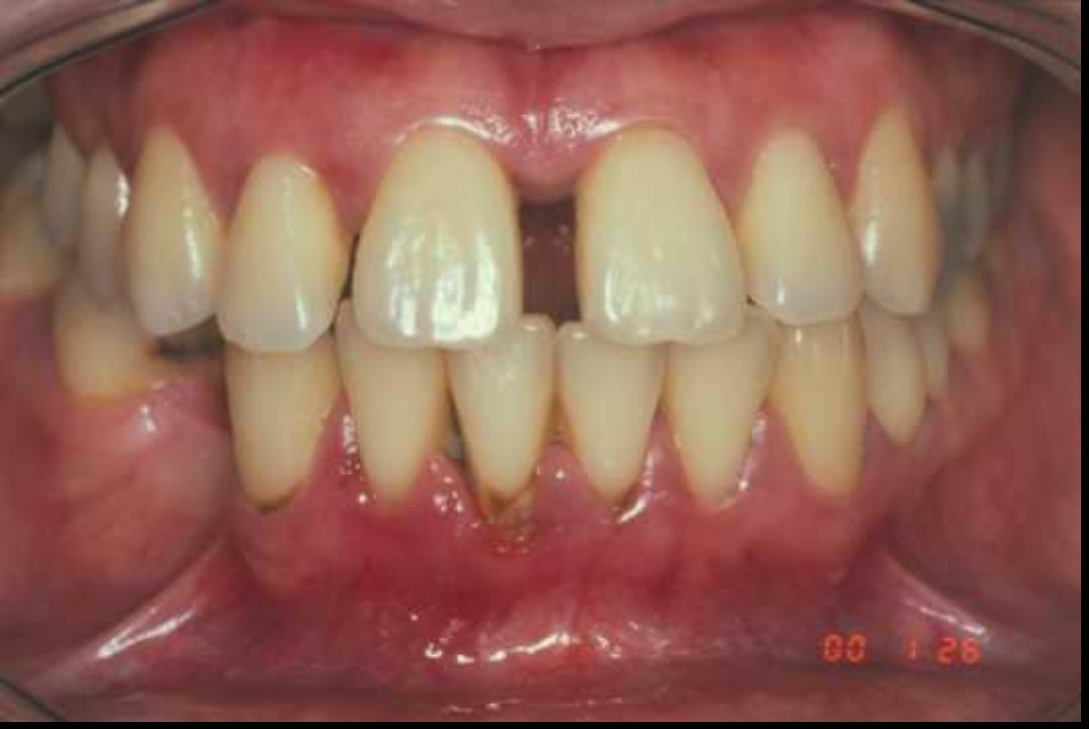


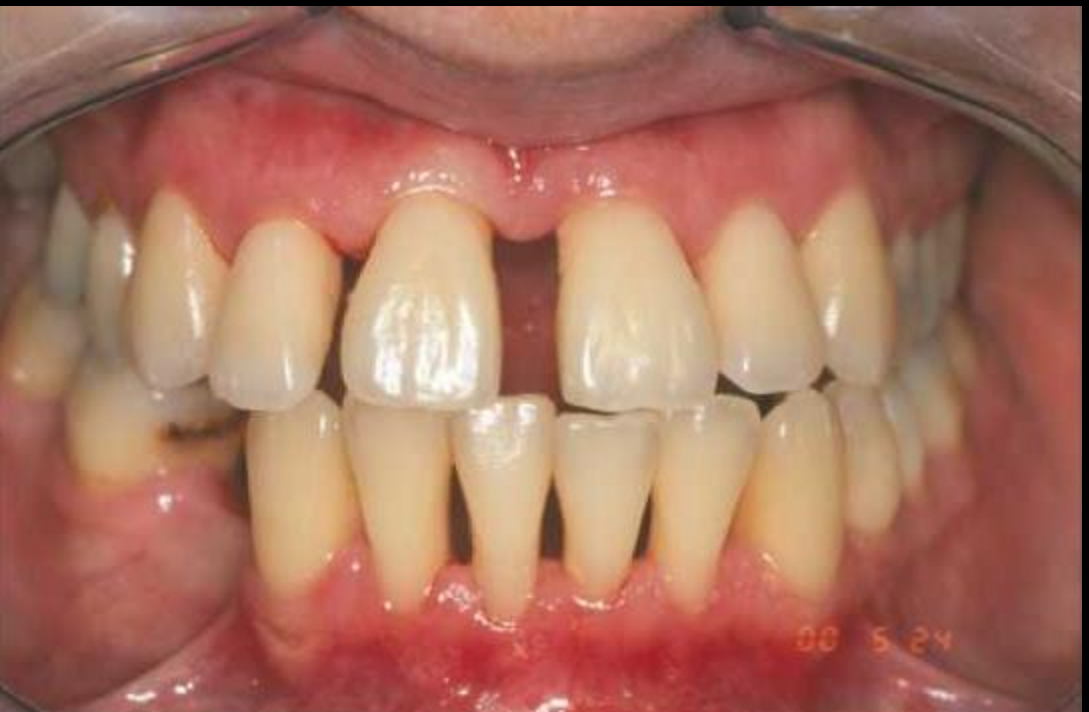




THE INFECTED PERIODONTAL POCKET CAN BE A DENTAL FOCUS


CARDIOVASCULAR DISEASES
DIABETES MELLITUS
PERIODONTITIS
RESPIRATORY DISEASES
GASTRO-INTESTINAL DISEASES
OSTEOPOROSIS
PRETERM LW BIRTH





THE MAJOR GOAL OF ANY CAUSE RELATED PERIODONTAL TREATMENT IS:

TO CLEAN TEETH AND RESTORE ORAL HYGIENE