

**START !**



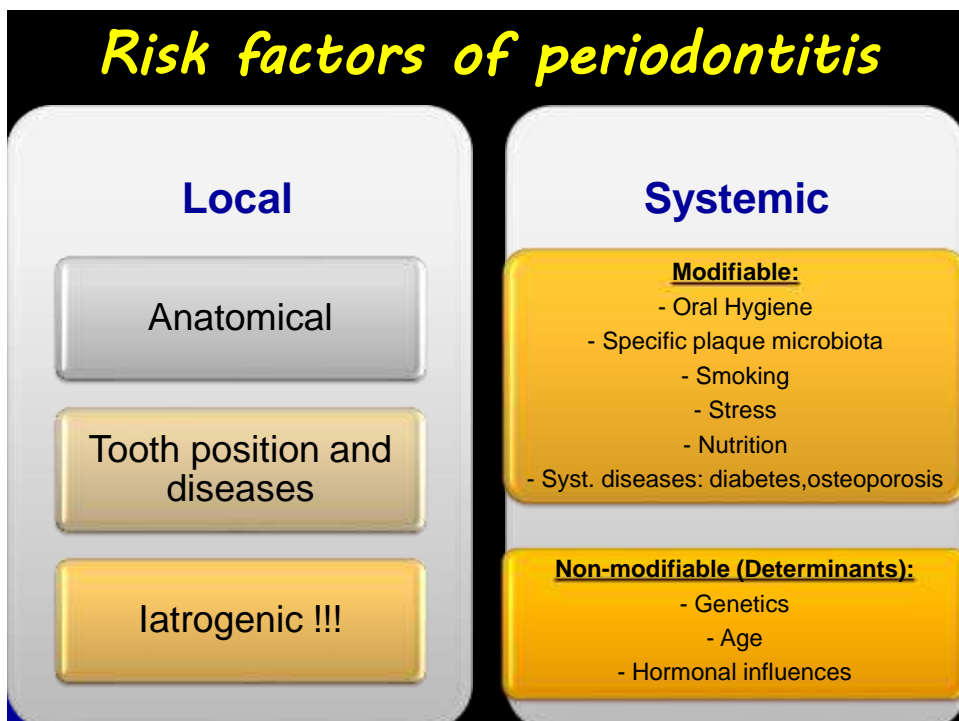
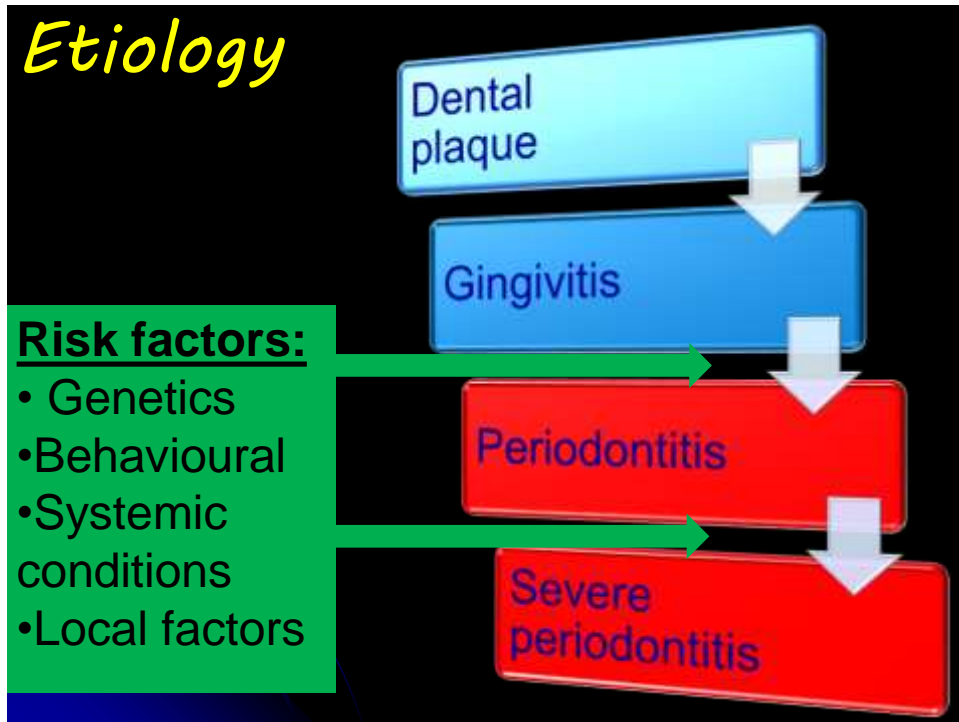
**Local plaque retentive factors**

Pal Nagy DMD  
Department of Periodontology



# LOCAL PLAQUE RETENTIVE FACTORS





**THE PRIMARY FACTOR IN THE ETIOLOGY OF PERIODONTAL DISEASES IS THE ACCUMULATION AND MATURATION OF A BACTERIAL PLAQUE ON THE TEETH NEAR THE GINGIVAL MARGIN OR/AND IN THE SULCUS OR POCKET**

**HOWEVER, PLAQUE ACCUMULATION IS INFLUENCED BY NUMEROUS LOCAL ANATOMICAL AND IATROGENIC FACTORS**



*Etiological factors which modifies plaque accumulation*



Anatomical factors



Tooth position and it's anomalies



Iatrogenic factors

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE



### I. ANATOMICAL FACTORS

- PALATAL SULCUS OF UPPER INCISORS
- FURCATION AREAS
- BUCCAL AND LINGUAL FRENULUMS
- ENAMEL PROJECTIONS AND PEARLS
- GINGIVAL RECESSION



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

STARTS FROM THE PALATAL TUBERCLE, BECOMES A FOCUS FOR PLAQUE ACCUMULATION AND ENHANCES POCKET FORMATION



### I. ANATOMICAL FACTORS

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- ◆ FURCATION AREAS
- ◆ ENAMEL PROJECTIONS AND PEARLS
- ◆ BUCCAL AND LINGUAL FRENULUMS
- ◆ GINGIVAL RECESSION

Lee KW, Lee EC, Poon KY. Palato-gingival grooves in maxillary incisors. A possible predisposing factor to localised periodontal disease. Br Dent J. 1968 Jan 2;124(1):14-8.








## *Destruction caused by palatal sulcus*



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### I. ANATOMICAL FACTORS

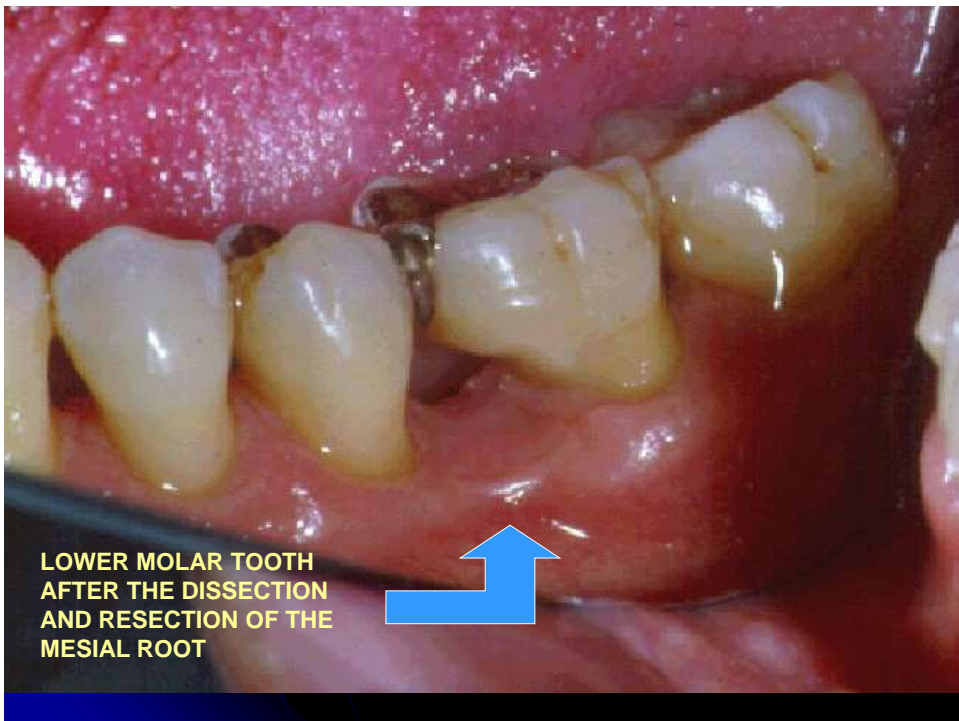
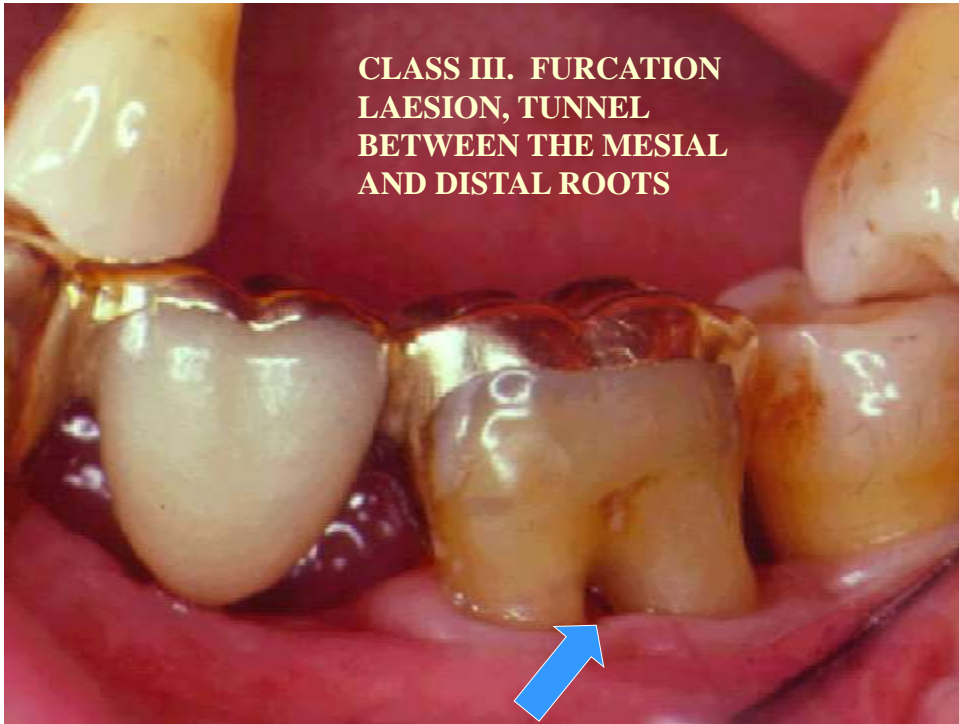
-  PALATAL SULCUS OF UPPER INCISORS
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-  BUCCAL AND LINGUAL FRENULUMS
-  GINGIVAL RECESSION

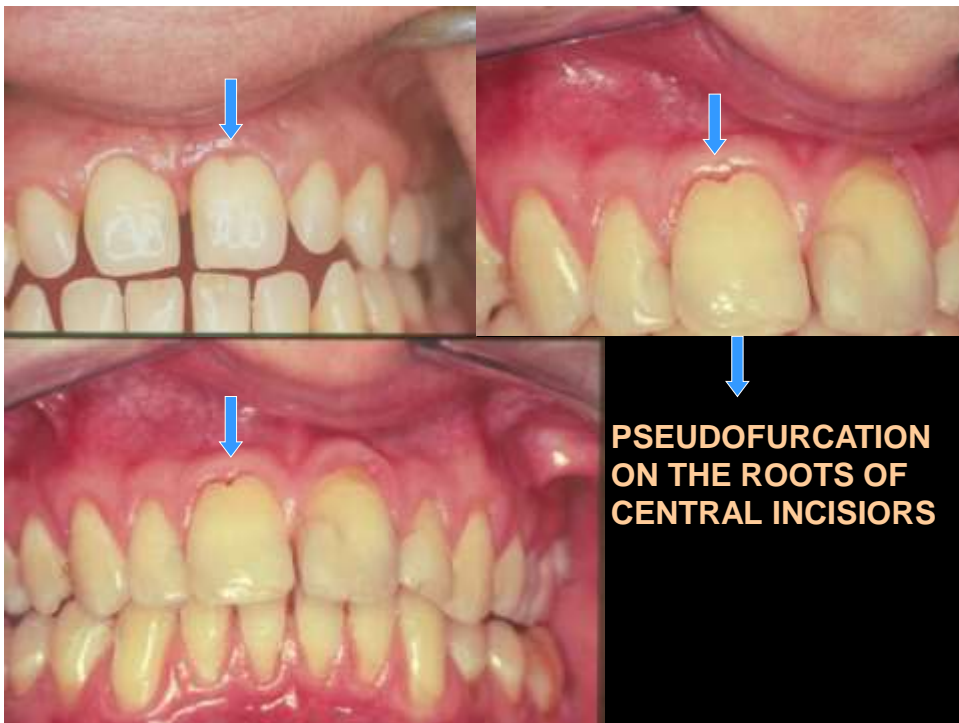


## *Furcation region*

- Hardly reach for subgingival scaling, root planing and plaque control











## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

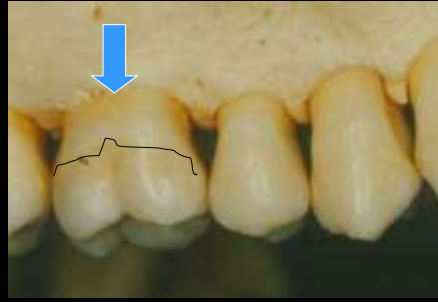
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## Cervical enamel projections

- No connective tissue attachment
- Furcation laesion can evolve



## Cervical enamel projections

- The frequency of furcation laesion was up to 82.5% next to enamel projections
- Furcation laesion on control tooth is only 17.5%



Hou G-L, Tsai C-C. Relationship between periodontal furcation involvement and molar cervical enamel projections. *J Periodontol* 1987; **58**: 715–721

## Enamel pearl

- 1.1–9.7% prevalence
- almost 70% at upper wisdomteeth.



Moskow BS, Canut PM. Studies on root enamel. (2) Enamel pearls. A review of their morphology, localization, nomenclature, occurrence, classification, histogenesis and incidence. *J Clin Periodontol* 1990; 17:



Enamel pearl and attachment loss on first molar tooth



No enamel pearl and attachment loss on contralateral tooth



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

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- ◆ **GINGIVAL RECESSION**



FRENUM PULL CAUSES INTERDENTAL PAPILLARY INFLAMMATION AND DESTRUCTION, ALONG WITH GINGIVAL RECESSION THEY PREVENT SUFFICIENT TOOTHBRUSHING





1. Preoperational

2. Frenulectomy

3. Postoperational

4. Years after surgery

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE



### II. TOOTH POSITION AND IT'S PATHOLOGICAL ANOMALIES

- CROWDING OF THE TEETH
- ROOT DIVERGENCE
- OCCLUSAL ANOMALIES
- OPEN CONTACT POINT (ROOT CONVERGENCE)
- CARIES
- (DENTAL CALCULUS ??)



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

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The interradicular septum is weakly developed between the crowded teeth, the papilla is thin or often missing and associated with mucogingival disorders. Oral hygiene is difficult



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

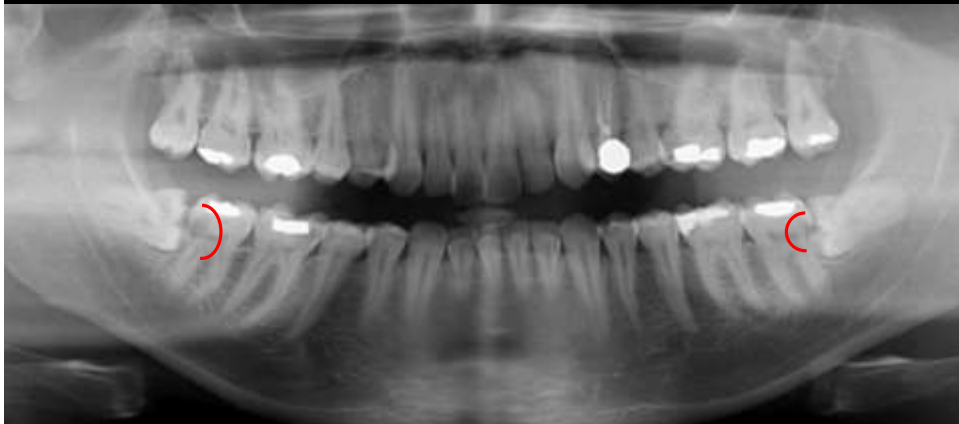
### II. TOOTH POSITION AND IT'S PATHOLOGICAL ANOMALIES

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- ◆ CARIES
- ◆ (DENTAL CALCULUS ??)



The divergence of the roots is also accompanied by small interdental space, and it makes plaque removal more difficult

### Partially erupted, impacted wisdom teeth



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### II. TOOTH POSITION AND IT'S PATHOLOGICAL ANOMALIES

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TRAUMATIC OCCLUSION CAN NOT BE REGARDED AS A DIRECT ETIOLOGIC FACTOR FOR PERIODONTITIS



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

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CAUSING DEGENERATIVE CHANGES IN THE DEEP PERIODONTAL STRUCTURES. THE INFLAMMATORY PROCESS IS ALLOWED TO SPREAD APICALLY MORE RAPIDLY, RESULT IN MORE SEVERE PERIODONTAL DESTRUCTION





## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### II. TOOTH POSITION AND IT'S PATHOLOGICAL ANOMALIES

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MISSING TEETH CAN LEAD TO MESIAL DRIFTING, TILTING AND EXTRUSION OF TEETH. RESULT: OCCLUSAL DISHARMONIES, INCREASE PLAQUE FORMATION, FOOD IMPACTION



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

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LEADS TO FOOD IMPACTION



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### II. TOOTH POSITION AND IT'S PATHOLOGICAL ANOMALIES

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- ◆ **CARIES**
- ◆ (DENTAL CALCULUS ??)



Ainamo (1970) drew attention first to the strong relation between the GI values and caries

**Ainamo J.: Concomitant periodontal disease and dental caries in young adult males. Suomen Hammaslaakariseuran Toimituksia 66:303, 1970.**

## Dental caries

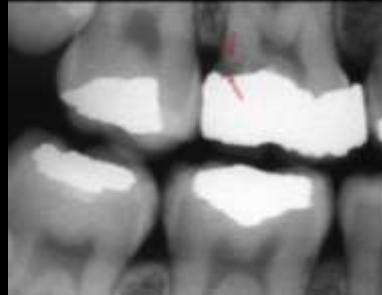


Dental caries enhance plaque retention promoting periodontal disease.

Ainamo J.: Concomitant periodontal disease and dental caries in young adult males. Suomen Hammaslaakariseuran Toimituksia 66:303, 1970

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### CARIES



Significantly more secondary caries around subgingivally placed margins than around supragingival margins.

#### **secondary caries after 5 years**

15.4% of the supragingivally located amalgam restoration

30.4% of the subgingivally located amalgam restoration

*Hammer B, Hotz P. [Inspection of 1 to 5-year-old amalgam, composite, and cast gold fillings]. SSO Schweiz Monatsschr Zahnheilkd. 1979 Apr;89(4):301-14. German.*

## Dental calculus ?



Sterile calculus of its own would not cause inflammation!

The rough surface of calculus is always covered by fresh, vital biofilm and bacterial aggregation. There is strong correlation between the amount of calculus and the severity and incidence of gingival inflammation.

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

- ★ ANATOMICAL FACTORS
- ★ TOOTH POSITION AND IT'S ANOMALIES
- ★ **IATROGENIC FACTORS**



Close association between iatrogenic factors and periodontal disease have been recognised since 1900's (Black 1912). Epidemiological as well as clinical experimental studies have repeatedly documented these relationships.

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ★ **III. IATROGENIC FACTORS**

- a) ORTHODONTIC APPLIANCE
- b) DENTAL MATERIALS AND PLAQUE RETENTION
- c) RESTORATION QUALITY, PROCEDURES
- d) POSITION OF THE CROWN MARGIN
- e) PONTIC DESIGN
- f) CONTOUR OF RESTORATIONS
- g) TEMPORARY RESTORATIONS
- h) OTHERS



## A. ORTHODONTIC APPLIANCE



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ★ IATROGENIC FACTORS


**B. DENTAL MATERIALS AND PLAQUE RETENTION-**  
Dental materials accumulate and retain plaque more than enamel and dentin



THE PLAQUE RETENTIVE PROPERTY OF A DENTAL MATERIAL DEPENDS ON SURFACE POROSITY

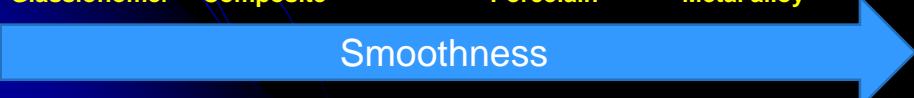


# SEM images



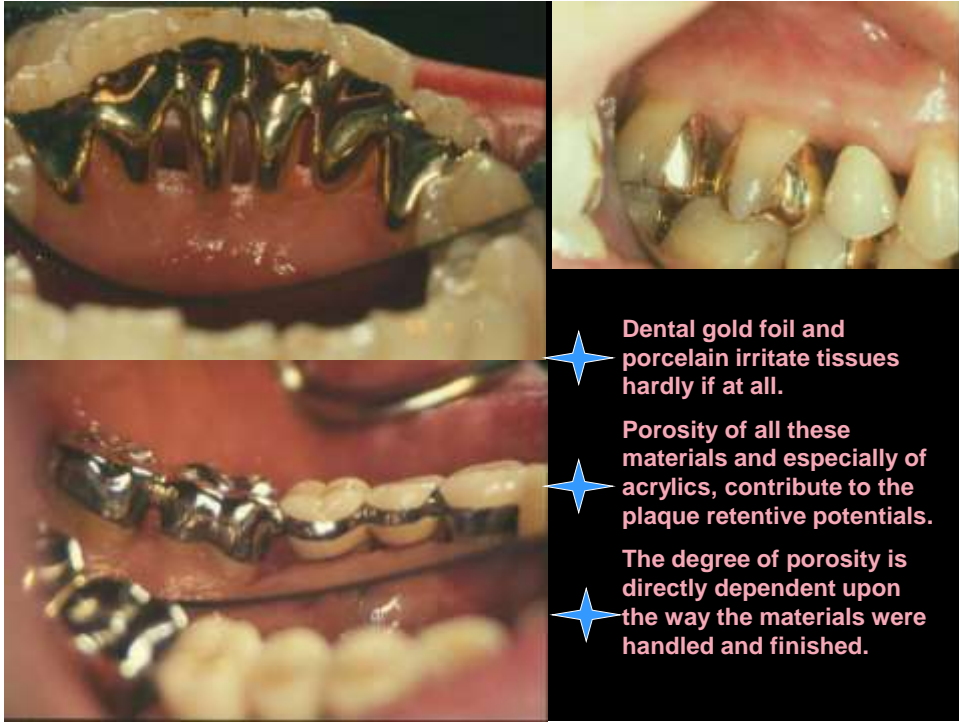
- Glassionomer
- Composite
- Porcelain
- Metal alloy

Glassionomer   Composite   Porcelain   Metal alloy

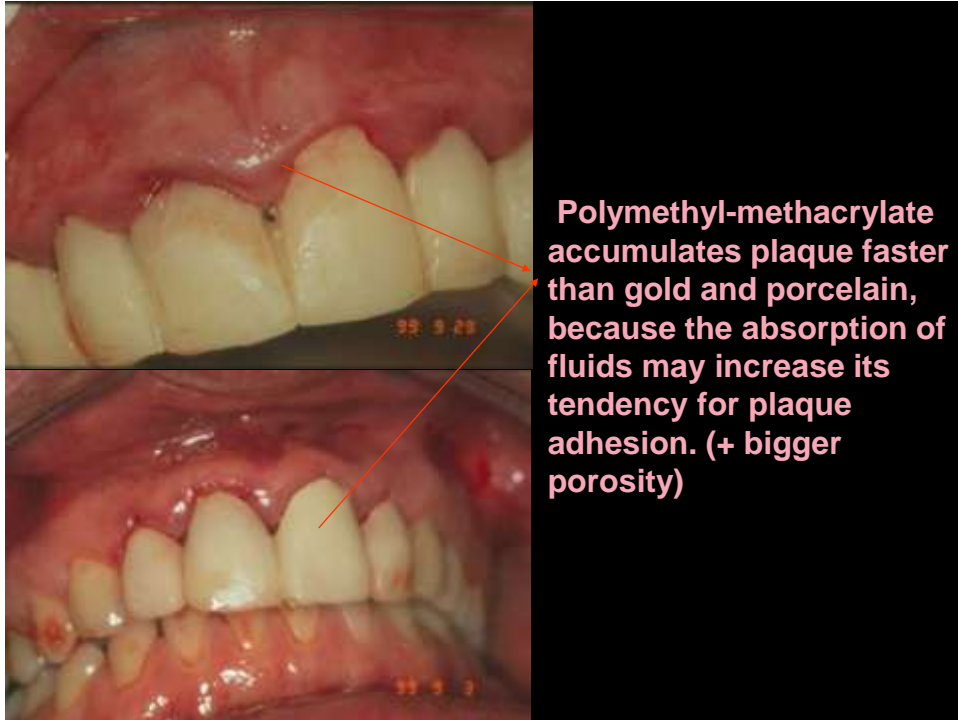
Smoothness 

CROWNS MADE WITH METAL- OR ZIRCONIUM MARGIN ARE THE LESS PLAQUE RETENTIVE









## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### IATROGENIC FACTORS

TRANSITION ZONE=  
PREDILECTION SITE

### B. DENTAL MATERIALS AND PLAQUE RETENTION



NO COMMERCIALLY AVAILABLE LUTING CEMENT PROVIDES A PERFECT SEAL, THE SURFACE OF THE CEMENT IS ALWAYS ROUGH AND POROUS.

Waerhaug's histological investigations have shown that subgingival cement roughness enhances plaque accumulation.

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

# PERIO-PROTHETIC RELATIONS

### IATROGENIC FACTORS

#### C. RESTORATION QUALITY

Black stated as far back as in 1912, that the inadequate marginal crown-fit is responsible for the presence of gingivitis.

He found in patients, from 20 to 35 years old, that from 1820 inflamed areas, 663 had inadequate margins and 421 had inadequate contact to the adjacent teeth.



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

# PERIO-PROTHETIC RELATIONS

### IATROGENIC FACTORS

#### C. RESTORATION QUALITY

The World Workshop in Periodontics (1966) reported that the overhanging at the margins of a restoration are local factors promoting periodontitis.



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

# PERIO-PROTHETIC RELATIONS

### ★ IATROGENIC FACTORS

#### C. RESTORATION QUALITY

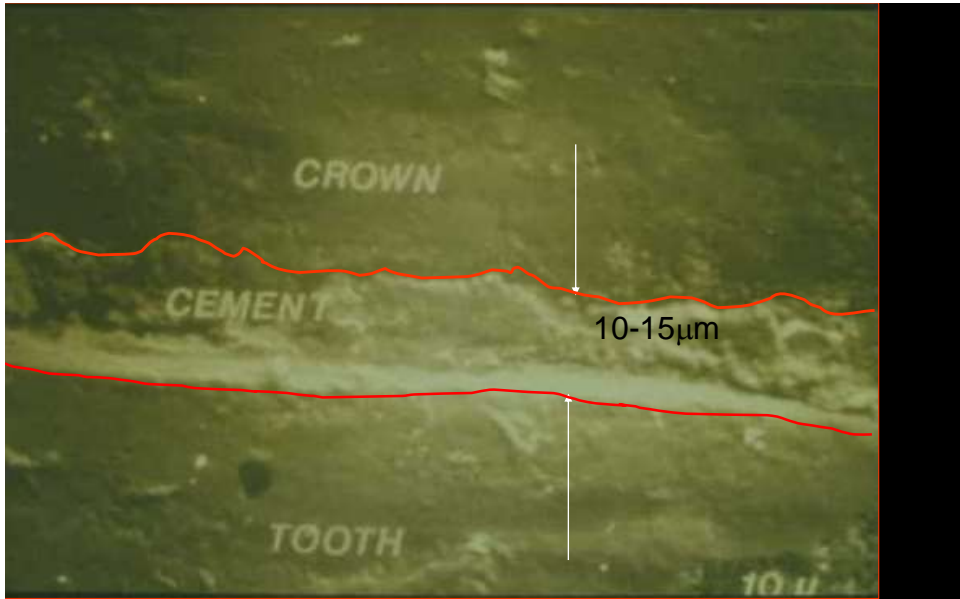
Bjorn et al. reported a generally poor marginal fit of the examined crowns.

80% of the radiographically studied reconstructions exhibited marginal defects on the proximal surfaces.

Margins were either overhangs or open.



MARGIN WITH OPEN EDGE



THE OBTAINABLE BEST CROWN EDGE ADAPTATION IS 20µm  
**(however, the gap is often between 1000-2000µm!!!)**



**CROWN MARGIN WITH OVERHANGS**



Teeth with inadequate restorations had significantly more plaque, gingivitis and periodontal pocket formation than adequately restored teeth. For both amalgam and crown restorations, **the health of the periodontium is adversely affected by the presence of a restoration.**

Grasso JE, Nalbandian J, Sanford C, Bailit H. Effect of restoration quality on periodontal health. J Prosthet Dent. 1985 Jan;53(1):14-9.



## The frequency of bad restorations

Reference	Diagnostic method for detection	% restored surfaces with overhangs (n = number of subjects)
Gilmore & Sheiham, 1971	Bitewing radiographs	25% (n = 1976)
Burch et al., 1976	Bitewing radiographs	30% (n = 825)
Hakkrainen & Ainamo, 1980	Orthopantograms	50% (n = 85)
Than et al., 1982	Calculus probe	60% (n = 240)
Lervik & Riordan, 1984	Bitewing radiographs, microscope	25% (n = 175)
Keszthelyi & Szabo, 1984	Bitewing radiographs, microscope	86% (n = 176)
Coxhead, 1985	Bitewing radiographs, mirror, probe	76% (n = 50)
Claman et al., 1986	Bitewing radiographs	27% (n = 826)
Jansson et al., 1994	Bitewing radiographs	18 % (n = 162)

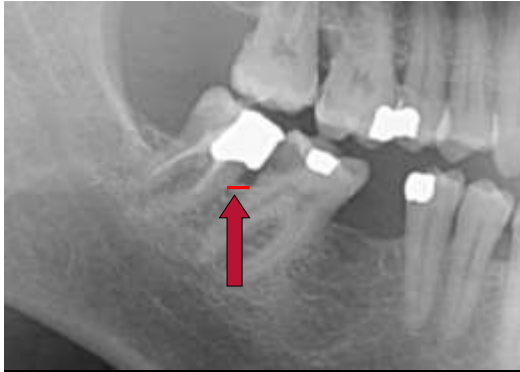
**BACTERIAL SAMPLES GATHERED UNDER OVERHANGING MARGINS SHOWED HIGH CORREALTION WITH PERIODONTOPATHOGENIC ORGANISMS, GRAM-NEGATIVE ANAEROBIC BACTERIAS (Porphyromonas, Prevotella, Fusobacterium )**

**THE OVERHANGING RESTORATIONS DISTURB THE ECOLOGIVAL BALANCE IN THE PERIODONTAL POCKET AND ALLOW A GROUP OF DISEASE ASSOCIATED ORGANISMS.**

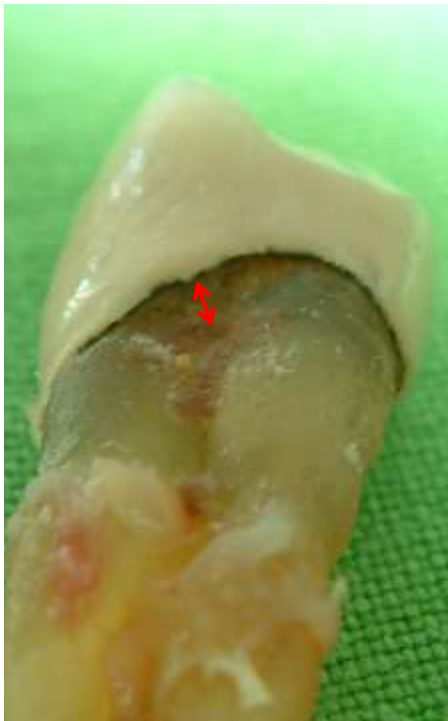
**SAMPLES COMING FROM THE CLINICALLY PERFECT MARGINS WERE CHARACTERISTIC OF GINGIVAL HEALTH.**

Lang P. N., Kiel A. R., Anderhalden: Clinical and microbiological effects of subgingival restorations with overhangings or clinically perfect margins. J. Clini Periodontol 1983; 10: 563-578





The subgingivally located overhanging crown- and filling margins result periodontal attachment loss in patients with susceptibility.



## *Correctional possibilities I- Correction of overhanging crown margins*

- Superficial, local or block anesthesia
- Removal of porcelain edge with fissure or torpedo shape diamond burs (turbine), position crown margin supragingivally
- Metal edge contouring with carbide crown-bill (accelerator)
- Smooth surface formation with carbide and arkansas stone finishing- and polishing burs (contra angel hand piece)

## *Correction of overhangs*







*Correctional possibilities II·  
Correction of open crown margins*





## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### IATROGENIC FACTORS

#### C. QUALITY OF RESTORATIONS – EVERY PROCEDURE STEPS:

- PREPARATION
- IMPRESSION
- CEMENTATION



**PREPARATION:**

- ✓ Shoulder
- ✓ Supra- or paragingival
- ✓ contourpreparation

**IMPRESSION:**

- ✓ Correct sulcus retraction

**CEMENTATION:**

- ✓ Total removal of luting material





### ACCEPTABLE QUALITY

Conclusion: better restoration will help, but improving restorative quality alone is unlikely to have major effects on the health of the periodontium without effective plaque control.

Grasso JE, Nalbandian J, Sanford C, Bailit H. Effect of restoration quality on periodontal health. J Prosthet Dent. 1985 Jan;53(1):14-9.

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ★ IATROGENIC FACTORS

#### D. THE POSITION OF THE CROWN MARGIN: SUPRA- OR SUBGINGIVAL???

BLACK'S THEORY (1908): „EXTENSION FOR PREVENTION” = SUBGINGIVALLY PLACED MARGINS



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

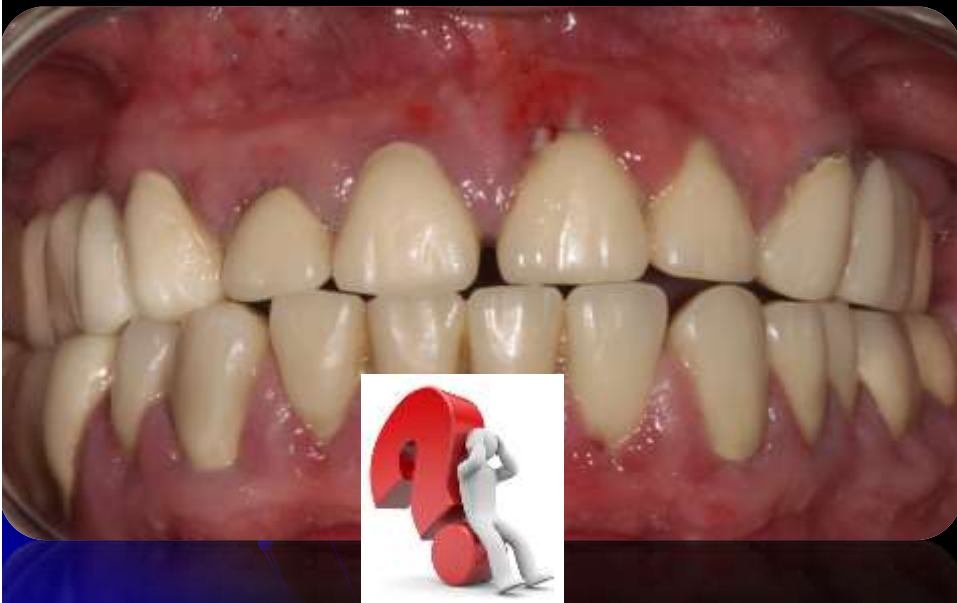
### ETIOLOGIC FACTORS

#### D. THE POSITION OF THE CROWN MARGIN: SUPRA- OR SUBGINGIVAL



1. Bodecker and Applebaum (1934) were the first to question black's theory.
2. Waerhaug (1967, 1968) gave scientific proof that subgingival crown margins create periodontal destruction due to plaque retention.
3. Loe(1968), Zander and Kennedy (1970) supported the position of the crown margins above the free gingiva.

### Subgingivally localised crown margins, made with not shoulder preparation



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ★ IATROGENIC FACTORS

#### D. THE POSITION OF THE CROWN MARGIN: SUPRA- OR SUBGINGIVAL



Experimental studies have shown that the supragingival margins should be chosen whenever possible. Crowns made earlier with subgingival margin should be transformed to supragingivally location, with the use of an apically transpositioned flap or with a crown margin correction.

Morman W. et al.: Gingival reaction to well fitted subgingival proximal gold inlays. J. Clin. Periodontol. 1:120, 1974.

### Newly made subgingivally placed crowns, but with shoulder preparation



# Apically transpositioned flap



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

Secunder caries ????

### DIATROGENIC FACTORS

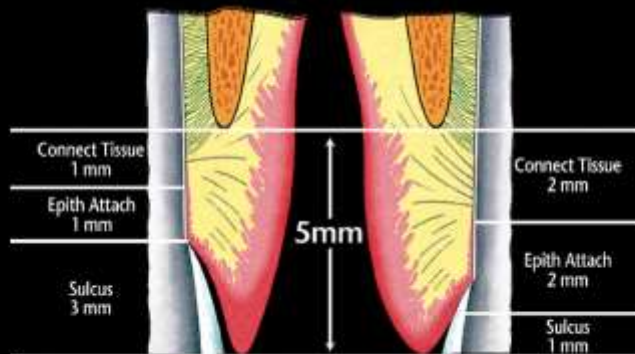
#### D. THE POSITION OF THE CROWN MARGIN: SUPRA- OR SUBGINGIVAL

- There is no significant difference in the incidence of secunder caries comparing the supra- and subgingivally positioned crown margins.
- From a secunder caries preventive point of view, the location of crown margins does not seem to be of great importance, if the patient maintains a satisfactory oral hygiene.

Valderhaug J., H.Loe .: Oral hygiene in a group of supervised patients with fixed prosthesis. J. Periodontol. 1977; 48:221- 224



## Biological width



**Left.** An average biologic width of 2mm, with a connective tissue attachment of 1 mm and an epithelial attachment of 1mm. The total height of gingiva above bone is 5mm, with a 3mm sulcus. This is a patient in whom recession might be likely following any restorative procedure.

**Right.** A variation on normal biologic width in the low-crest patient with a connective tissue attachment of 2 mm, an epithelial attachment of 2 mm, for a total biologic width of 4 mm, resulting in only a 1-mm sulcus and minimal risk of recession. Variations in biologic width can occur in the low-crest patient.





**MINIMAL GINGIVAL  
RECESSION WITHIN  
1 YEAR AFTER  
LUTING**

**VIOLATION OF THE  
BIOLOGICAL WIDTH**



2004. 12. 02.



2012. 01. 30.



ALTHOUGH ESTHETICALLY PLEASING, SUBGINGIVAL CROWN MARGINS ARE CONSIDERED BIOLOGICAL UNDESIRABLE, BUT CAN BE DONE IF THE QUALITY IS PERFECT!!

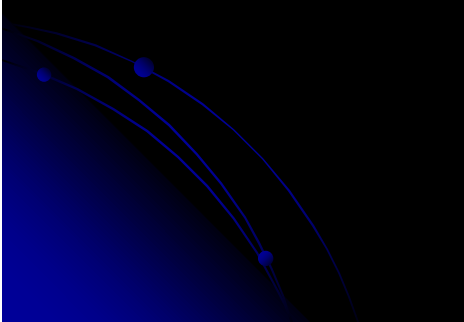


Today supragingival margins can provide excellent aesthetic results!

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ❖ IATROGENIC FACTORS

#### E. PONTIC DESIGN AND IT'S CORRELATION TO THE EDENTOLOUS MUCOSAL AREA



## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ❖ IATROGENIC FACTORS

#### E. PONTIC DESIGN AND IT'S CORRELATION TO THE EDENTOLOUS MUCOSAL AREA

*Badly designed pontics are very frequently the cause of tissue damage, gingival inflammation, hyperplasia of the underlying mucosa and bone resorption.*



## A PLAKK AKKUMULÁCIÓT ELŐSEGÍTŐ ETIOLÓGIAI TÉNYEZŐK

### ❗ IATROGENIC FACTORS

#### E. PONTIC DESIGN AND IT'S CORRELATION TO THE EDENTULOUS MUCOSAL AREA

*It is forbidden to put the pontic intermediary into the fresh extraction socket.*





## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ★ IATROGENIC FACTORS

#### E. PONTIC DESIGN AND IT'S CORRELATION TO THE EDENTOLOUS MUCOSAL AREA

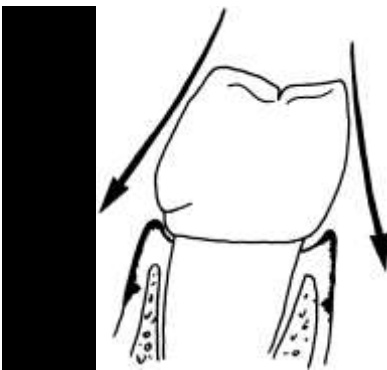
*The most ideal is the total convex, egg shape gingival surface, which is not in touch with the mucosa of the gingiva, or just slightly touches it*



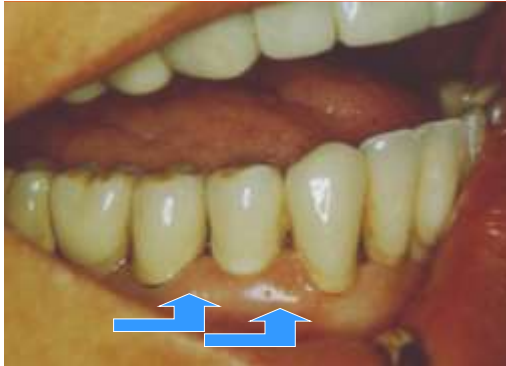
## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### ★ IATROGENIC FACTORS

#### F. Contour of restorations



- ★ GINGIVAL PROTECTION THEORY: OUT OF DATE, DOES NOT PROTECT SULCUS FROM FOOD IMPACTION!!
- ★ SCHLUGER: „THE SO CALLED PROTECTIVE CERVICAL CONVEXITY PROTECTS NOT THE GINGIVA, RATHER THE DENTAL PLAQUE BEDDING
- ★ THERE ARE NO SELF-CLEANSING MECHANISMS AROUND THE SULCUS
- ★ ORAL HYGIENE PRACTICES MAY BE SEVERLY JEOPARDIZED BY OVERCONTOURED RESTORATIONS



★ THE INTERDENTAL AREAS OF CROWNS AND BRIDGES SHOULD BE ACCESSIBLE WITH INTERDENTAL BRUSHES OR WITH SUPERFLOSS



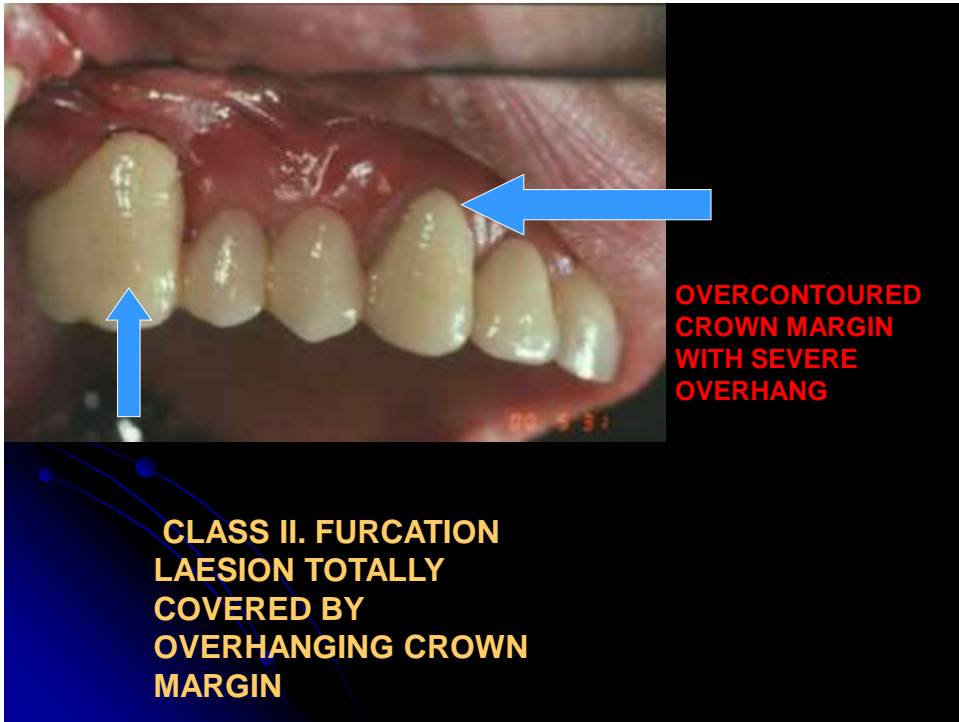
★ TO ENSURE THIS WE HAVE TO CREATE ADEQUATE INTERDENTAL SPACES

★ CORRECT CONTACTPOINTS! (EVEN THE QUITE HUGE INTERDENTAL AREAS WILL NOT LEAD TO FOOD IMPACTION)



THE CORRECT CONTOUR OF THE CROWNS DEPEND NOT ONLY ON DENTAL TECHNICIANS, DENTISTS HAVE TO DO ABUTMENT PREPARATION ADEQUATELY IN ORDER TO MAKE A GOOD QUALITY CROWN WITH CORRECT CONTOUR AND PROPER MARGINAL ADAPTATION IN THE LABORATORY. CONTACTPOINTS ARE IN THE CORONAL THIRD OF THE CROWN.









**Furcation areas:** root concavities are one of the most susceptible to plaque accumulation



**CLASS II FURCATION LAESIONS RESTORED WITH PFM CROWNS PREPARED WITH SUPRAGINGIVAL MARGINS:** contourpreparation, undercontoured, cleanable furcation access

## ETIOLOGIC FACTORS FOR THE DEVELOPMENT OF DENTAL PLAQUE

### IATROGENIC FACTORS

#### F. TEMPORARY RESTORATIONS





The quality of the temporary restoration can not be either bad, it's margin and adaptation can neither enhance plaque accumulation.



## ★ IATROGENIC FACTORS

### E. OTHERS

Radiofrequency used for root canal disinfection may result in recession of the gingival margin and loss of attachment, if the needle goes through the apex.



## ❄ IATROGENIC FACTORS

### E. OTHERS- reconstruction procedures

During cavity and tooth preparation the rotating instruments used beneath the gingival margins traumatized the gingiva and even the attachment.



## ❄ IATROGENIC FACTORS

### E. OTHERS- Sulcus retraction



The retraction cord and the astringent solution put in the gingival sulcus cause damage to the periodontal tissue



*Further  
avoidable*

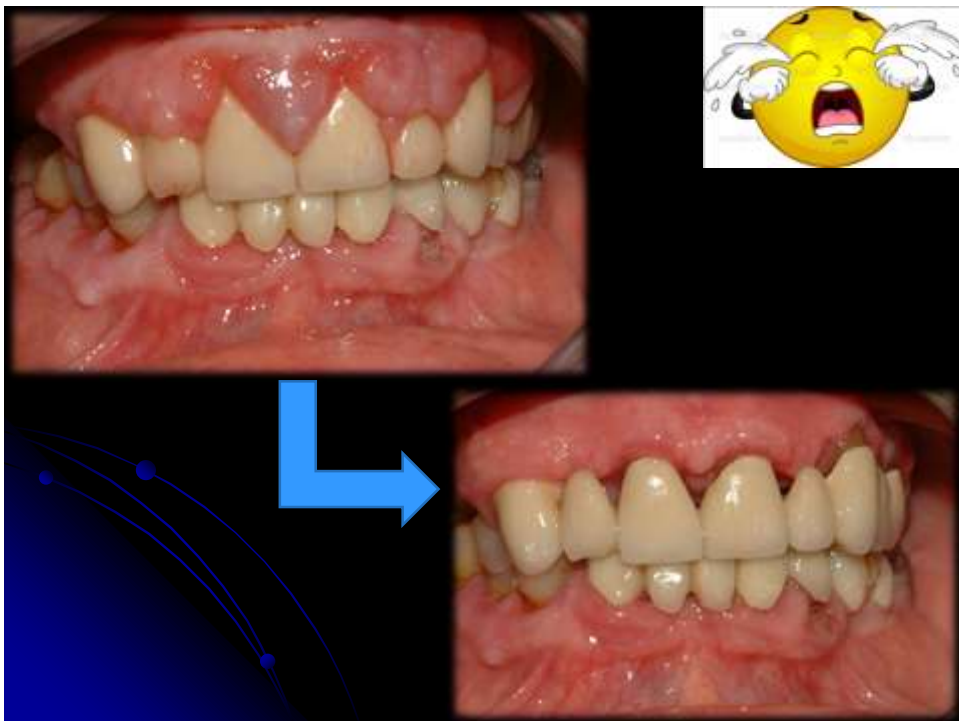
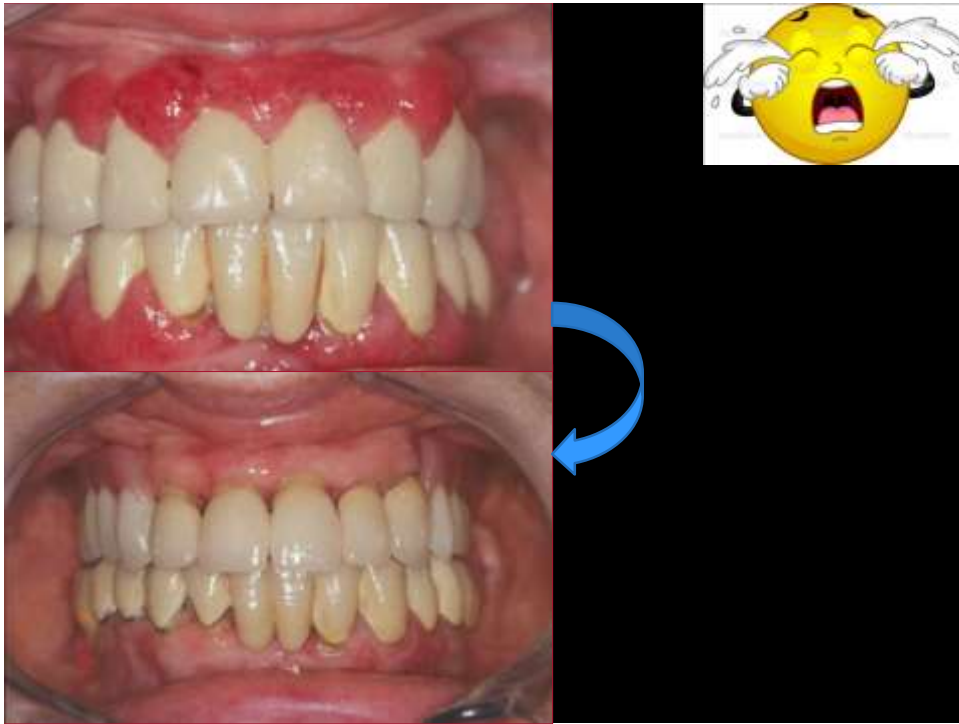


*and preferable*



**EXAMPLES**



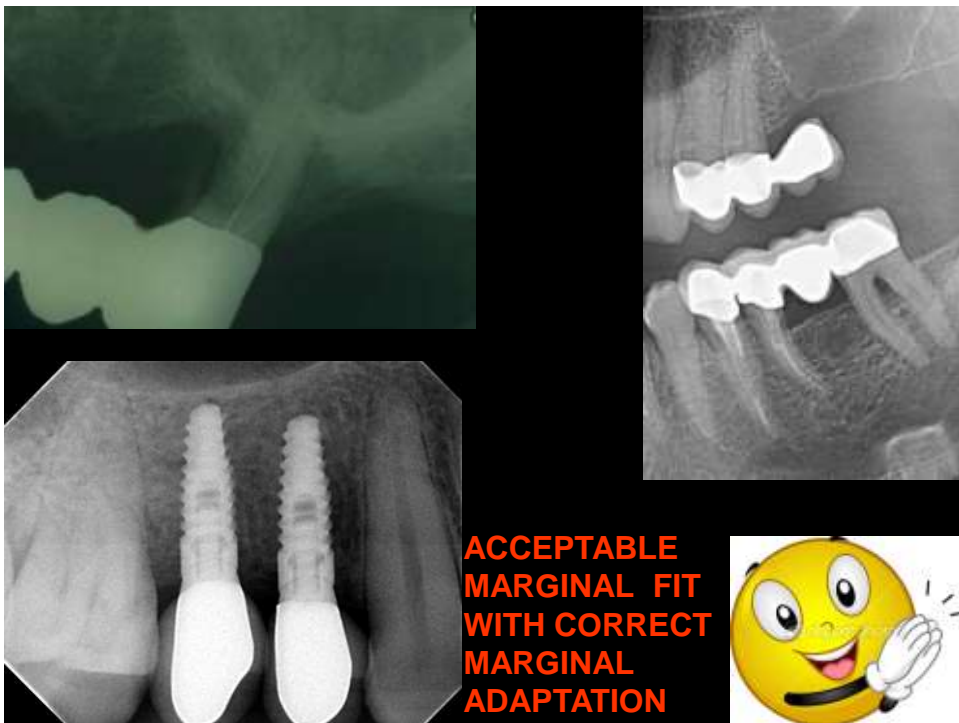
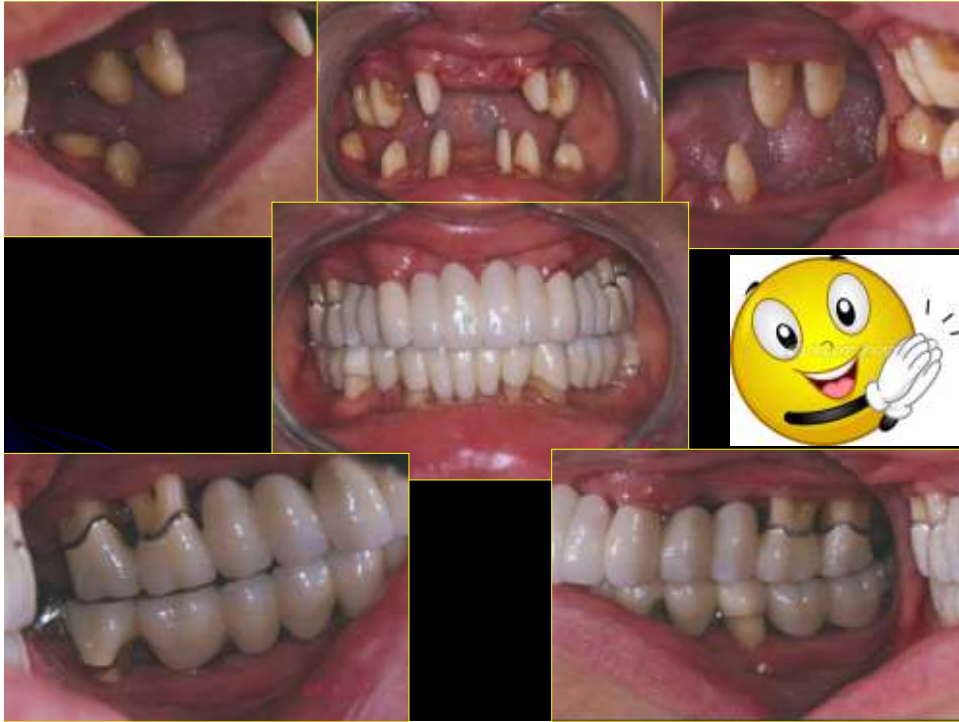






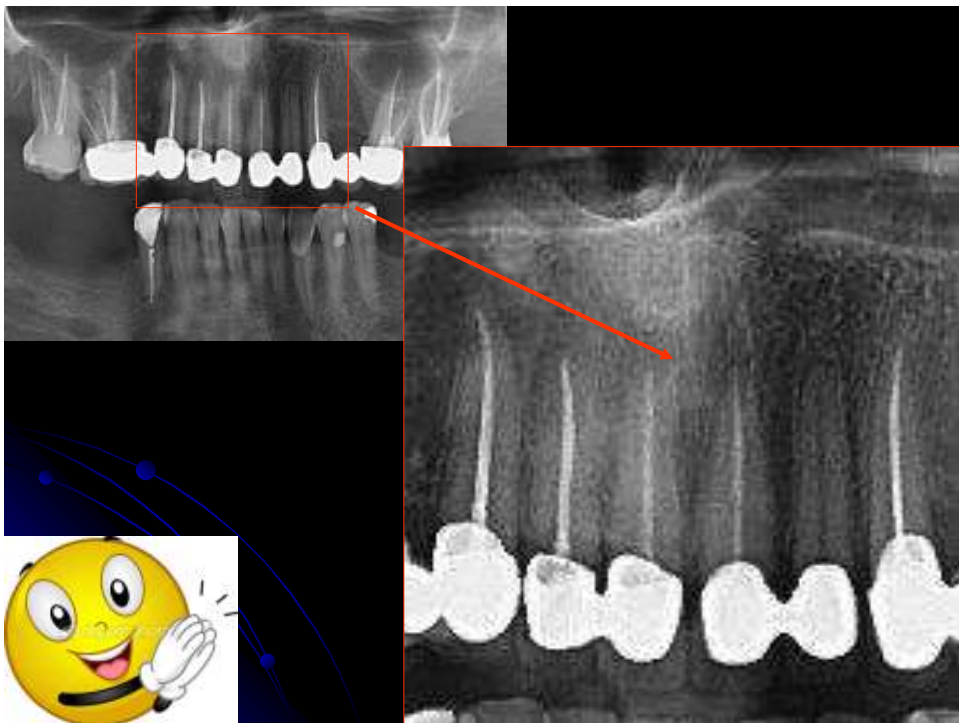
**PERIIMPLANTITIS**



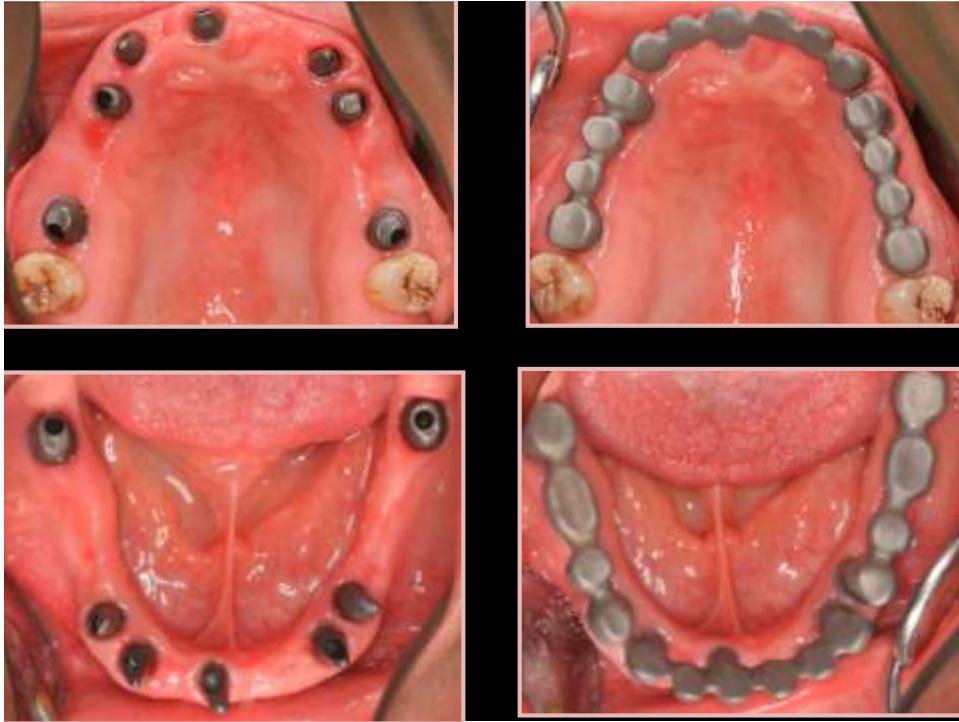


**ACCEPTABLE  
MARGINAL FIT  
WITH CORRECT  
MARGINAL  
ADAPTATION**



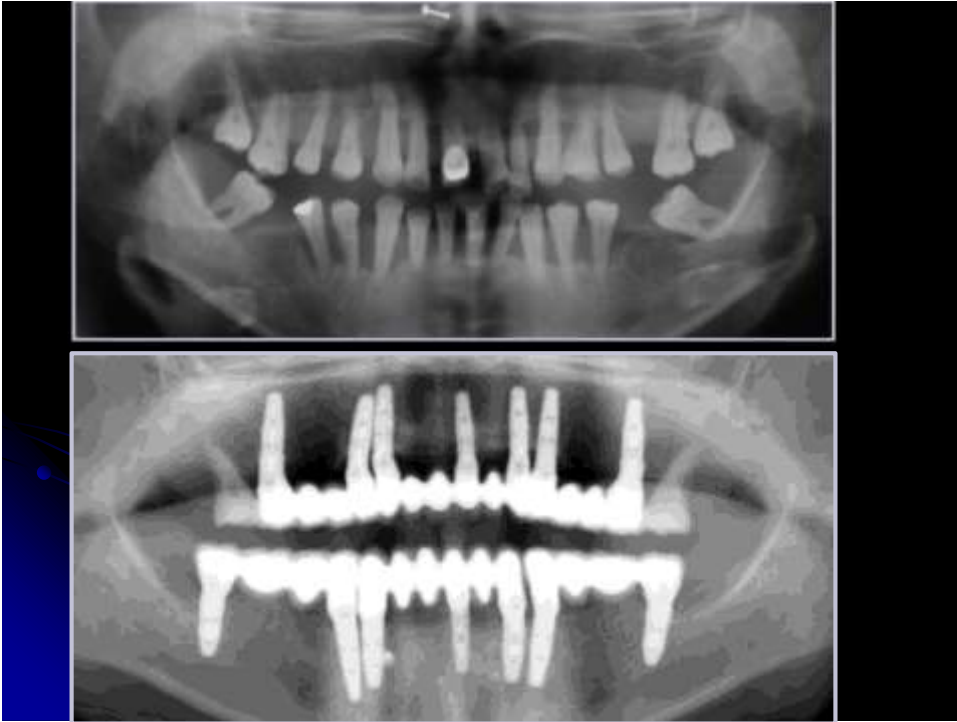






## BASELINE AND FINAL





## *MAINTENANCE THERAPY*



**THANK YOU FOR YOUR KIND  
ATTENTION!!**

