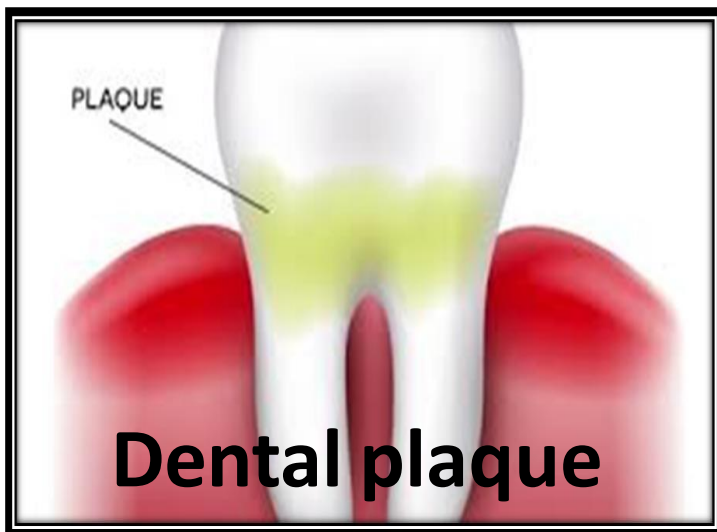




Third stage/ Microbiology



Dental plaque

&



Dental caries

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Colonization

Presence of a microorganism on/in a host, with growth and multiplication of the organism, but without interaction between host and organism (no clinical expression, no immune response).

Colonization is the presence of bacteria on a body surface (like on the skin, mouth, intestines or airways) without causing disease in the person.

Infection is the invasion of a host organism's bodily tissues by disease-causing organisms. Infection also results from the interplay between pathogens and the defenses of the hosts they infect.

Microbiology of dental caries

Various variety of microorganisms are found in carious lesions which are as follow: Mutans group of streptococci -*S. mutans*, *S. sobrinus*, *S. rattus*, *S. ferus*, *Streptococcus mutans*, Lactobacillus and Actinomyces species.

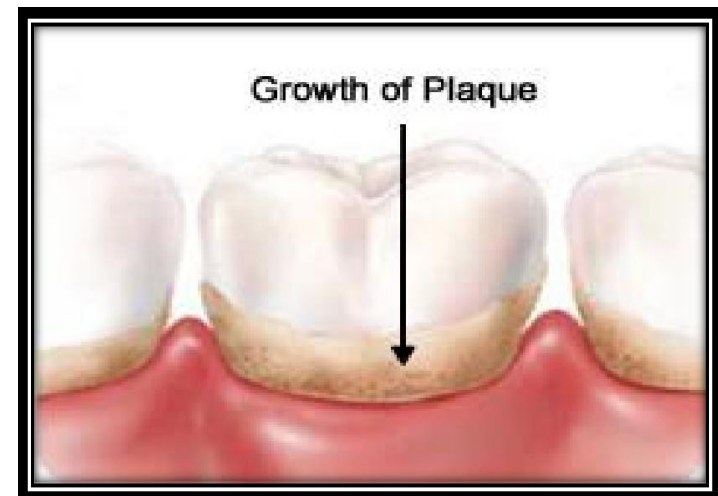
Streptococcus mutans: It is Gram positive and facultative anaerobe and colonize the host only after the first teeth erupt.

They are mostly found on the surfaces of the teeth and their percentage in the plaque is more at starting of dental caries over initiated by consumptions of sugar content. They are generally found in initial sites on carious lesion.

What is dental plaque

Is material adhering to the teeth which consists of:-

- Bacterial cells
- Salivary polymers
- Bacterial extracellular products.



Plaque is a naturally-constructed biofilm, in which the accumulation of bacteria may reach a hundreds of cells on the surfaces of the teeth.



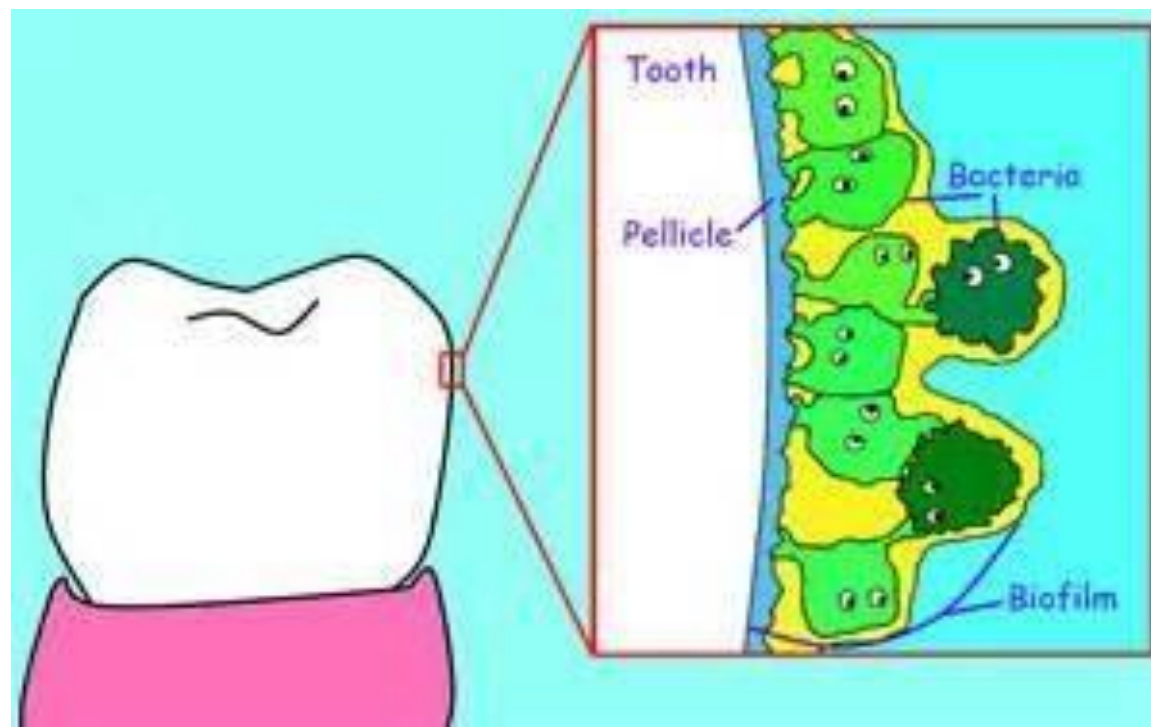
The accumulations of bacterial cells will affect the teeth and gingival tissues to high concentrations of bacterial metabolites, which lead to dental disease .

The dominant bacterial species in dental plaque are *Streptococcus sanguis* and *Streptococcus mutans* , both of which are considered responsible for plaque.

Composition of Dental plaque

- bacteria which form 50-70% of dental plaque
- glycoprotein together with extracellular polysaccharides form the plaque matrix
- Muco-poly-saccharides such as glucans and fructans
- Inorganic components
 - calcium
 - phosphorus
 - fluorides

Steps of Plaque Formation	Description
Association	Dental pellicle forms on the tooth (normally on tooth), and provides bacteria surface to attach
Adhesion	Within hours, bacteria loosely binds to the pellicle.
Proliferation	Bacteria spreads throughout the mouth and begins to multiply.
Microcolonies	Microcolonies are formed. Streptococci secrete protective layer (slime layer).
Biofilm formation	Microcolonies form complex groups with metabolic advantages.
Growth or maturation	The biofilm develops a primitive circulatory system



The Formation of dental plaque is due to the following:

- The lowering of oral pH level to acidic zones.
- Poor oral hygiene.
- Predominance of carbohydrates in food.
- Increase of ionic concentration, especially in the saliva.
- Increase the concentration of mucine in saliva.

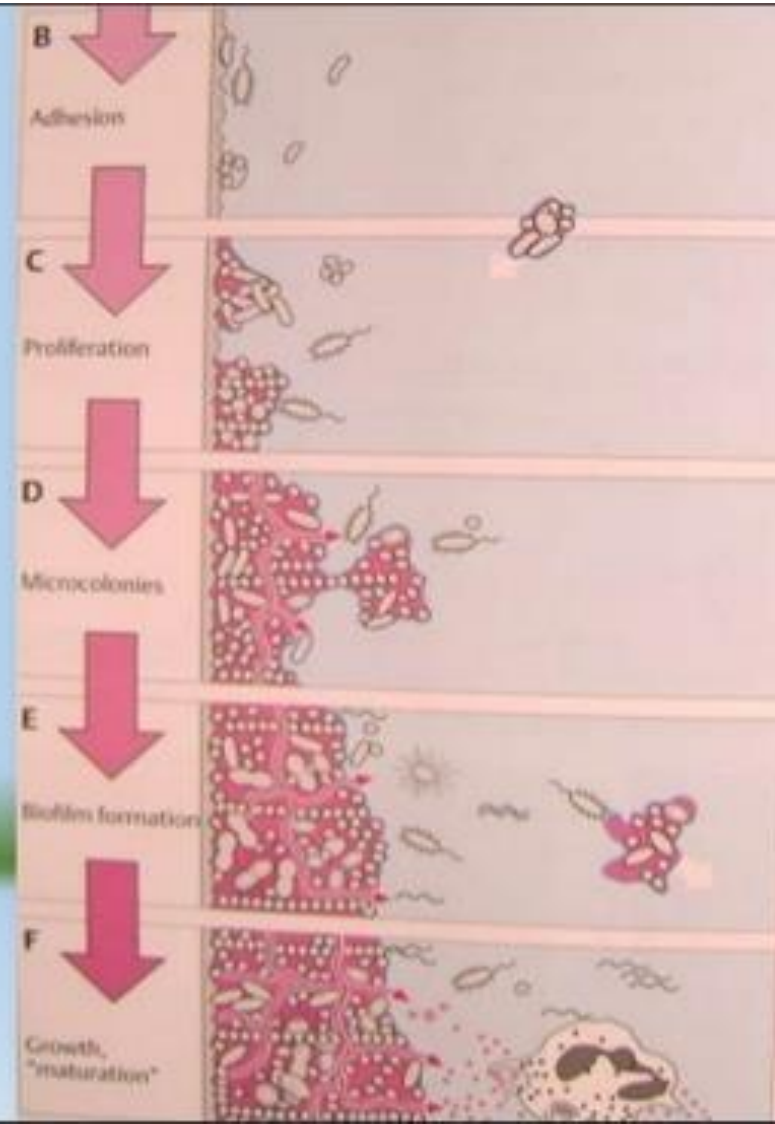
Dental plaque could be classified according to its relationship to the gingival margin.

- Supragingival plaque
- Subgingival plaque.

summary

dental plaque

1. Formation of pellicle
2. Attachment of bacteria to pellicle
3. Bacterial multiplication and colonization
4. Plaque growth and maturation
5. Matrix formation.



Dental Caries



Dental caries is a pathological process of destruction of tooth structure by microorganisms.

It is also known as **tooth decay** and is commonly called "cavities."

Definition:

Dental caries is an irreversible microbial disease of the calcified tissues of the teeth, characterized by demineralization of inorganic portion and destruction of organic substance of the tooth which often leads to cavitations.

- To understand dental caries, remember the oral microflora.

Dental plaque (the oral flora which adhere to teeth) leads to breakdown of tooth enamel leading to caries.

Organisms predominant in plaque are of the genus *Streptococcus*, with ***Streptococcus mutans*** being the species most important in the formation of dental caries.

- ***S. mutans* have several properties that are important in the carious process:**

First, they colonize on tooth surfaces.

Second, they synthesize insoluble polysaccharides from sucrose. This allows their adhesion to smooth surfaces and appears to be important in the formation of smooth surface caries.

Third, they ferment sucrose to form lactic acid.



Streptococcus mutans and ***Lactobacillus*** are important in the formation of dental caries. Both bacteria are acidogenic, meaning that they can produce acids and can survive and even produce acids in a low pH environment.

Lactic acid is a strong acid that is effective in demineralization of tooth structure. It can dissolve the tooth substance (calcium phosphate in the form of hydroxyapatite crystals).

Streptococcus mutans initiate the process of dental caries, while ***Lactobacillus*** species are not important in the initiation of caries but in its continuation.

How dental caries occur

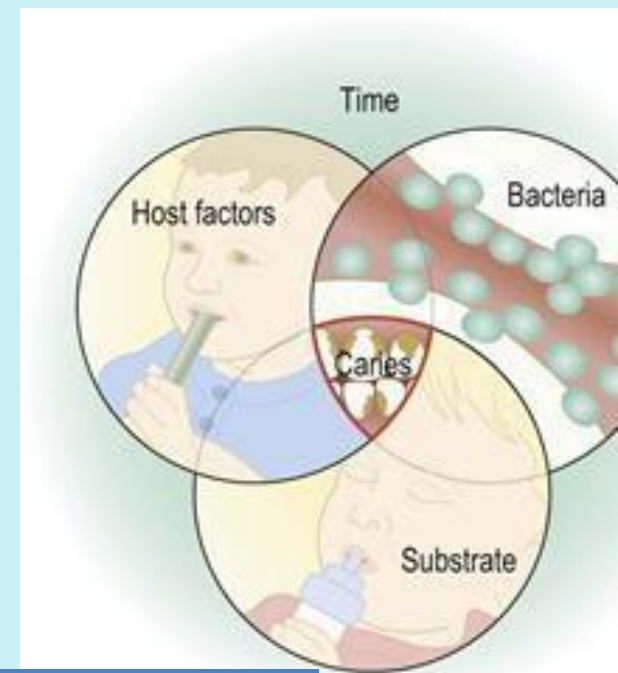


- ❖ Lactic acid is produced by lactic acid producing bacteria in the plaque (mostly *S. mutans*) from the fermentation of sugar and other carbohydrates in the diet of the host.
- ❖ Lactic acid and other organic acids which accumulate in dental plaque initiate caries by causing localized demineralization and initial weakening of the enamel.
- ❖ *Streptococcus mutans* and *Streptococcus sanguis* are most consistently been associated with the initiation of dental caries. It is not ,however , the only cause of dental decay . After initial weakening of the enamel ,various oral bacteria gain access to interior regions of the tooth .
- ❖ Lactobacilli , *Actinomyces* , and various bacteria are `secondary invaders` that contribute to the progression of the lesions to dentin and cementum.



Factors Necessary for Tooth Decay

1. Bacteria: *Streptococcus mutans*
2. Food: fermentable carbohydrates (break down quickly)
3. Susceptible tooth
4. Exposure time



Tooth brushing can reduce the likelihood of caries by reducing number of cariogenic organisms and removing the substrate .

Prevention of Dental Caries

The prevention of dental caries can be approached in three ways:

- Use fluorides
- Reduce frequent consumption of sugars
- Apply pit and fissure sealants.

Specific & non specific plaque hypothesis

Non-specific
plaque
hypothesis

Indigenous bacteria, all may
contribute to periodontal diseases

Specific
plaque
hypothesis

Specific pathogens responsible
for periodontal diseases

Ecological
plaque
hypothesis

Microbial balance and homeostasis
exist but periodontal diseases may
result from upset in balance

Antimicrobial factors in saliva

Antimicrobial agents (antibody and non-antibody) present in human saliva protect oral tissues by a variety of mechanisms, such as:-

- prevention of bacterial adhesion
- agglutination of micro-organisms
- inhibition of multiplication and metabolism

Antimicrobial agents either synthesized in the salivary glands or leak into the mouth from blood, usually via gingival crevices.

Examples:

Secretory IgA and IgM

Salivary peroxidase

Histidine-rich polypeptides

Lysozyme

Lactoferrin

Vaccination against dental caries

- **Dental Caries Vaccine:** It can be developed by identifying **specific bacterial cause** of dental caries and the **function of salivary glands** as an effector site of the **mucosal immune system**.
- The cariogenic mutans streptococci are the principal bacteria causing this disease.
- Specific immune defense against these bacteria is provided mainly by secretory immunoglobulin (Ig) A antibodies present in saliva, which are generated by the common mucosal immune system.
- Virulence factors of the mutans streptococci, including the cell-surface fibrillar proteins, which mediate adherence to the tooth surface, and the glucosyltransferase enzymes, which synthesise adhesive glucans and allow microbial accumulation on the teeth.

ROUTES OF IMMUNIZATION

Common mucosal immune system

- Oral route
- Intranasal route
- Tonsillar route
- Minor salivary gland
- Rectal

Systemic (subcutaneous)

- Active gingivo-salivary
- Passive dental immunization



Thank you...