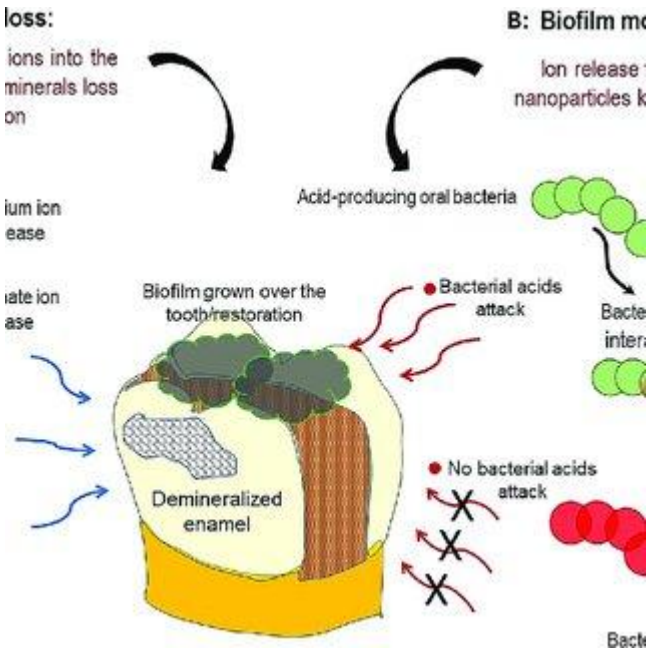
Dental caries development



Lec 2

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The term **dental caries** (tooth decay) is used to describe the results – the signs and symptoms – of a **localized chemical dissolution of the tooth surface caused by metabolic events taking place in the biofilm (dental plaque) covering the affected area.**

It is a **multifactorial disease** characterized by "demineralization of the mineral components and dissolution of the organic matrix". The destruction can affect enamel, dentin and cementum . Dental caries affecting a large number of population.

Carious process is

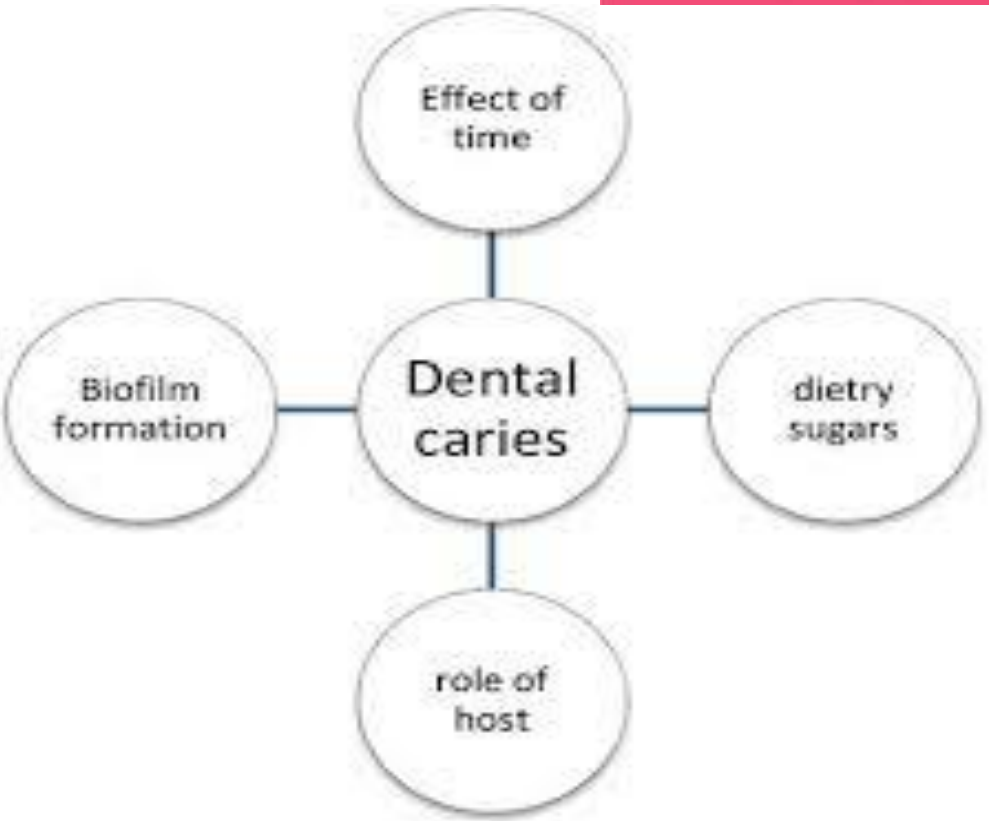
the result of an interaction of the following:

1- Host.

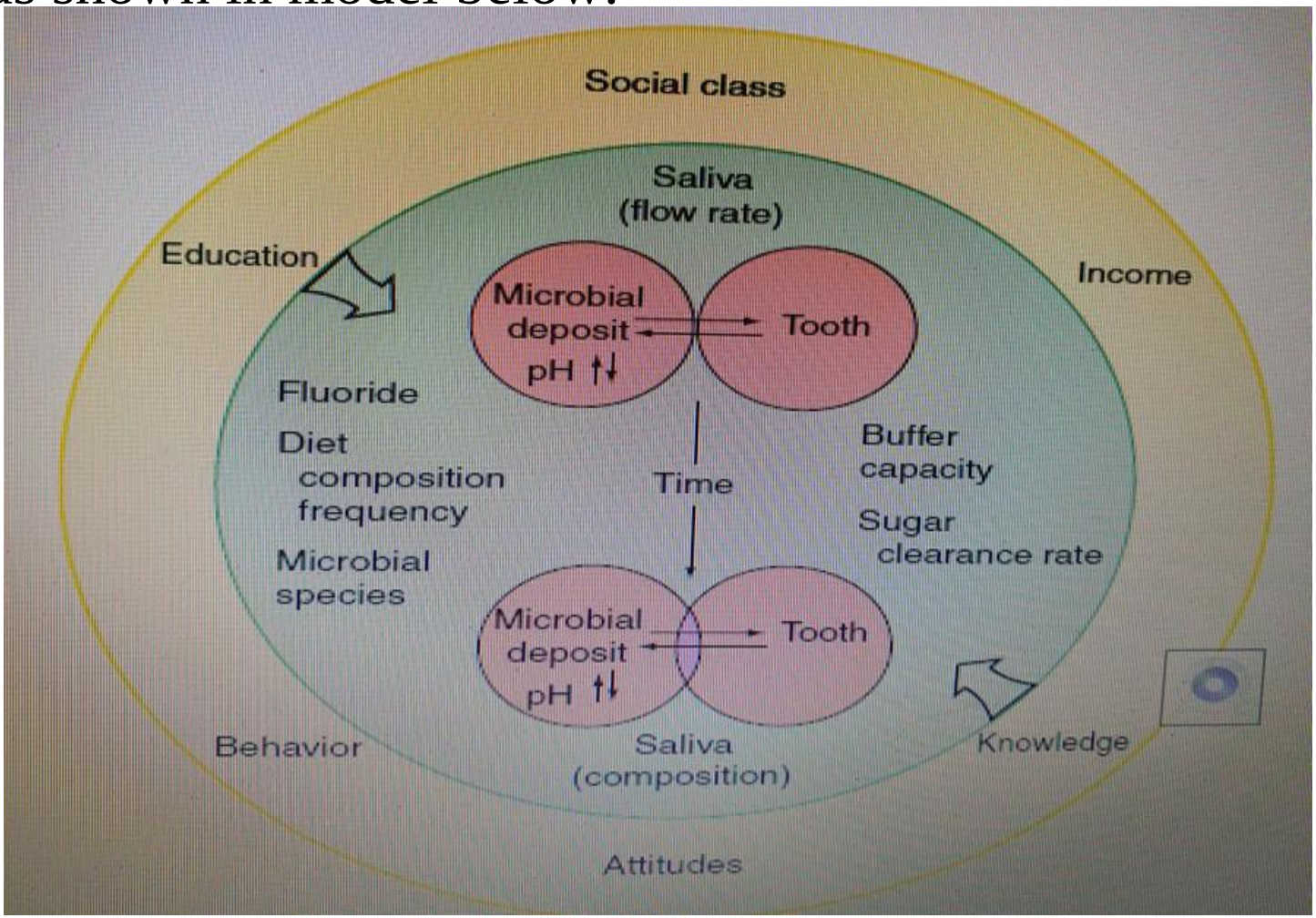
2- Plaque.

3- Diet.

4- Time.



Some multifactorial models have suggested determinant as any factor which may influence an outcome (in case of dental caries). Many determinants of caries process may act at the level of individual surface or at the individual/population level as shown in model below:



Host Factor: This involves **susceptible tooth and saliva**. Several factors affecting tooth susceptibility are:

1- Morphology of teeth:

---pits, grooves and fissures in occlusal surfaces, especially during eruption

----approximal surfaces cervical to the contact point/area and along the gingival margin.

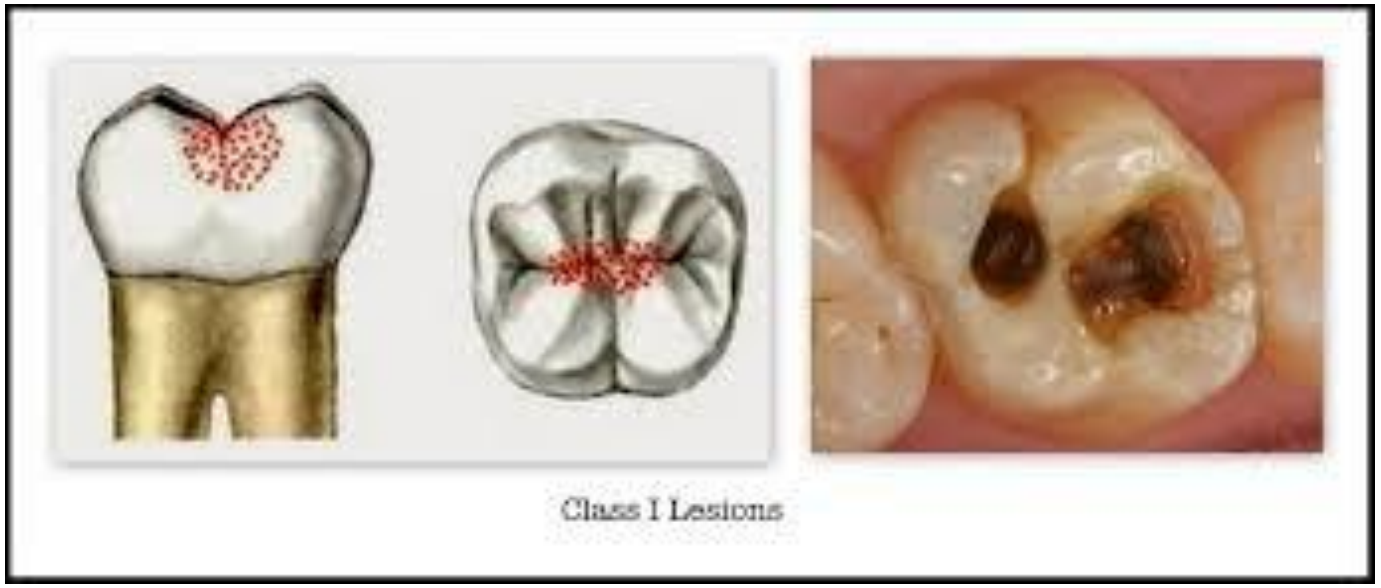
-----Insertion of foreign bodies to the dentition (e.g. fillings with inappropriate margins, dentures, orthodontic bands) may also result in such „protected" sites.

These areas are relatively protected from mechanical influence from the tongue, the cheeks, abrasive foods and, not least, tooth brushing. These are the sites where lesion development is more likely to occur because the biofilm is allowed to stagnate there for prolonged time.

Certain surfaces of a tooth are more prone to caries

. For example, in mandibular 1st molars the caries in descending order is occlusal, buccal, mesial, distal and lingual.

The differences in caries rates of various surfaces on the same tooth are in part due to morphology



2- Position of teeth:

Anterior teeth are less affected by dental caries compared to posterior teeth. The most susceptible **permanent teeth are the mandibular first molars**, followed by the maxillary first molars and the mandibular and maxillary second molars. The second premolars, maxillary incisors and first premolars are the next in sequence. Whereas the mandibular incisors and canines are the least to develop caries

3- Composition of teeth:

The tooth is composed mainly of inorganic elements (96% in enamel and 70% in dentin) and the remaining are organic materials and water.

Composition of teeth is affected by environmental factors (water, diet and nutrition).

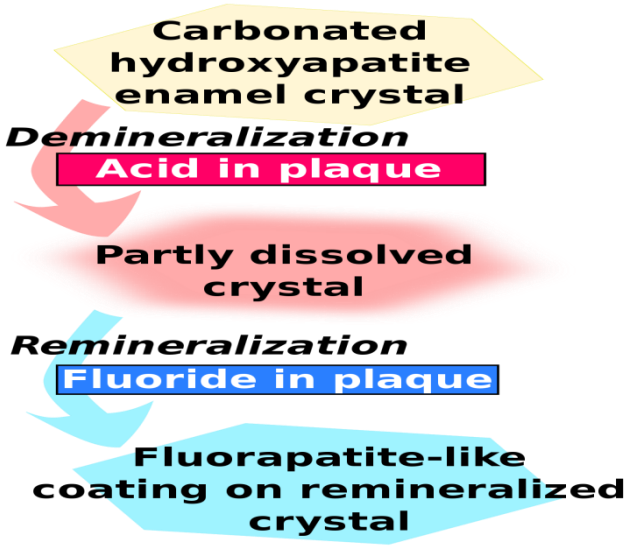
Inorganic components involve:

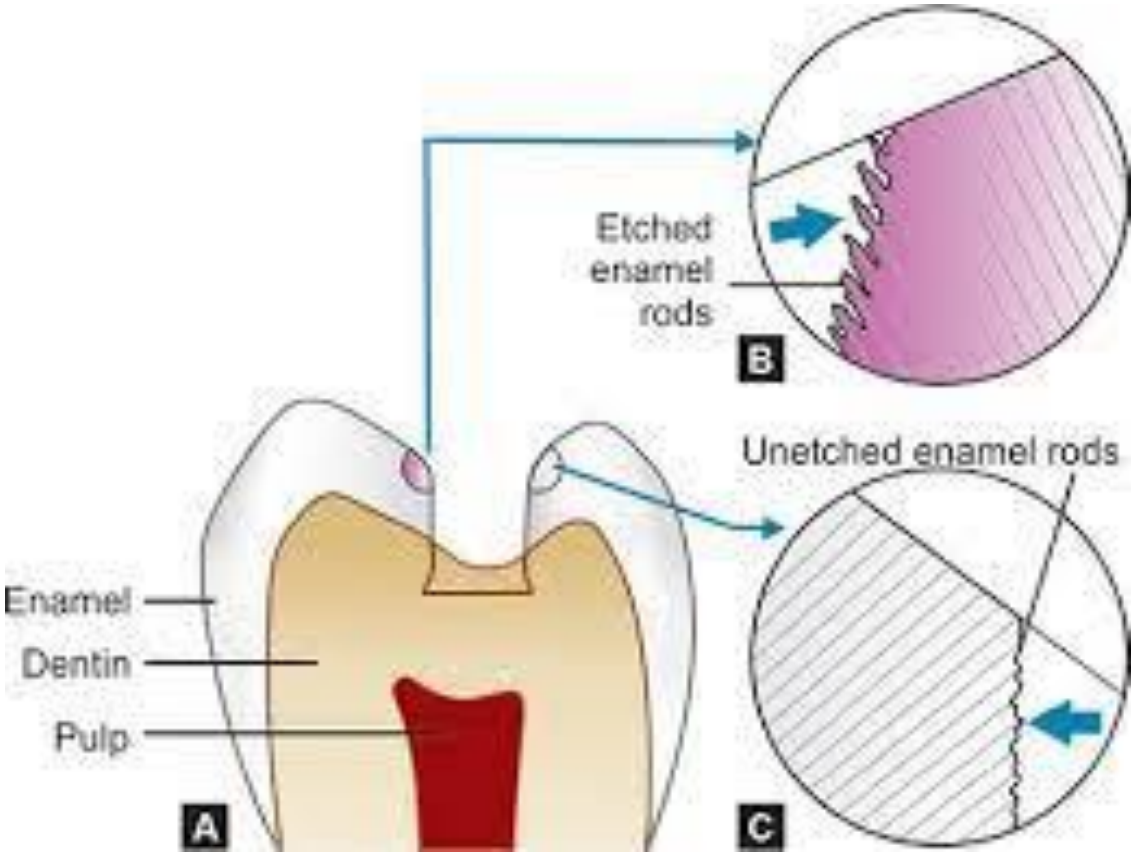
- **Major elements:** calcium, phosphorous, hydroxyl group $Ca_{10}(PO_4)_6(OH)_2$.
- **Minor elements:** Zinc, copper, strontium, magnesium, fluoride, etc. These elements may incorporate the enamel crystal in substitutions with one of its major elements as substitution of hydroxyl group by fluoride ion and formation of $Ca_{10}(PO_4)_6F_2$. Certain elements (fluoride, zinc, iron, chloride) accumulate in the enamel surface, while others are sparse in surface as compared with subsurface enamel. Changes of the enamel (decrease in density and permeability, an increase in fluoride content) occur with age.

Constituent	Human tooth enamel (w/t%)	Stoichiometric HA (w/t%)
Ca	36.40	39.90
P	17.80	18.50
OH	—	3.38
Co_2	2.05	—
H_2O	≤ about 4.00	—
Organic	0.39	—
	(Molar ratio)	**(Molar ratio)**
Ca/P	1.58	1.67

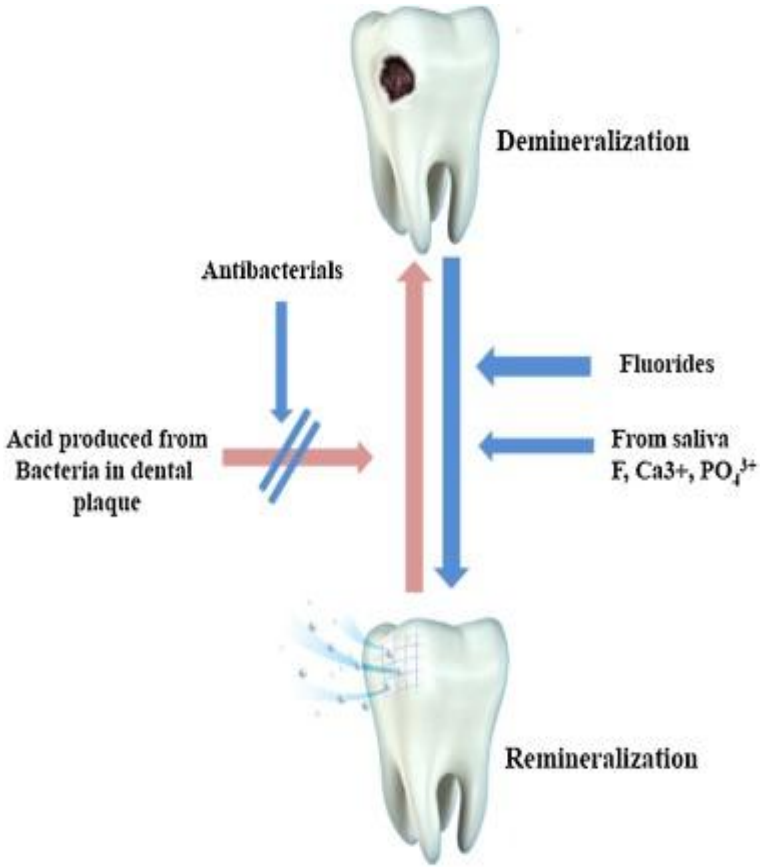
Some of these elements are incorporate the enamel and may increase the resistance to caries like fluoride, zinc and others. While other elements such as magnesium may increase the susceptibility of teeth to caries.

The organic constituents and water of both enamel and dentin may act as a diffusion pathway for bacterial acids increasing the tooth destruction. In other way, they permit the penetration of ions for physiological remineralization - demineralization process. Such voids in enamel as well as proteins act as a caution for intense biting pressure to prevent fracture.



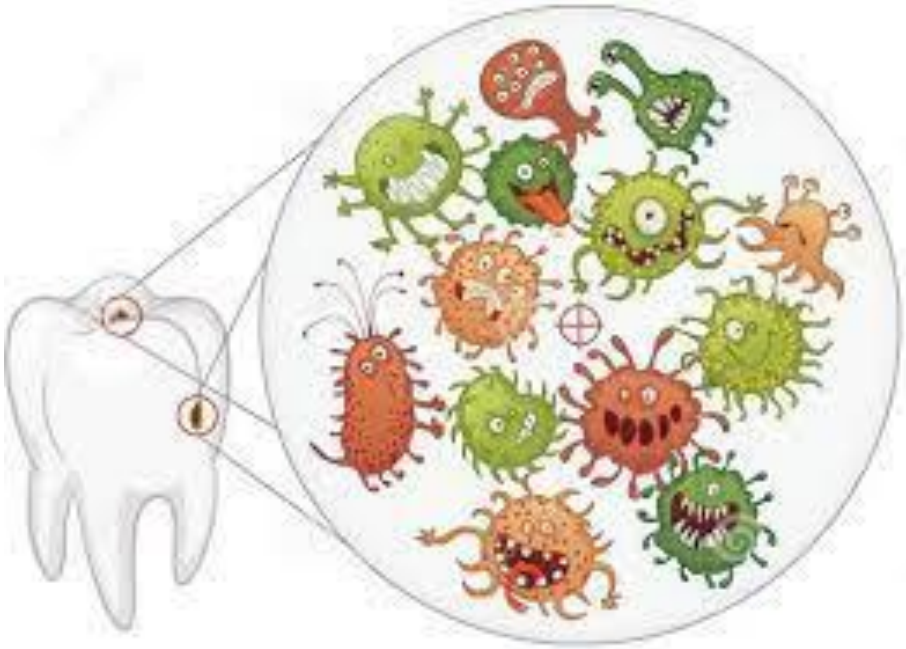


Saliva through its secretion and composition affects dental caries development. It can affect the number of microorganisms through cleansing action (oral clearance), While buffer system in saliva affects the integrity of teeth as well as calcium and phosphate.



Dental plaque:

The cariogenic bacteria in plaque consist of *mutans streptococci, lactobacilli* and other types.

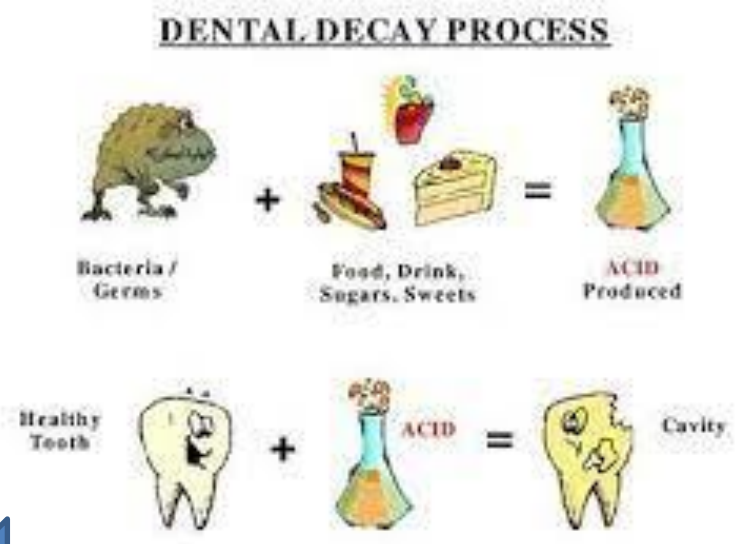


Bacteria ferment carbohydrate causing release of acid lead to demineralization of tooth surface.

Plaque accumulation may show individual variations and affected by many factors such as age and practices of oral hygiene.

Diet:

It may exert an effect on caries locally in the mouth by reacting with the enamel surface and by serving as a substrate for cariogenic microorganisms. Frequent consumption of sweets between meals lead to continuous drop of pH, thus demineralization will occur



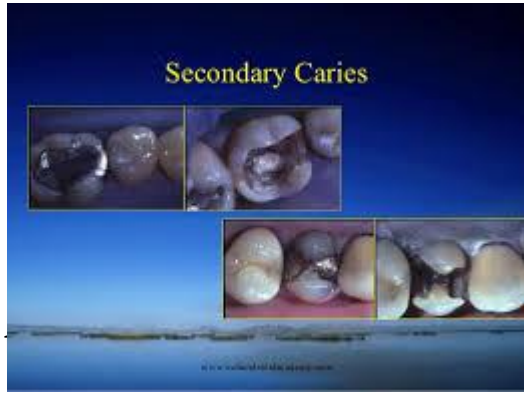
Terminology of caries

Dental caries may be classified in a number of ways, according to their anatomical sites.

- Primary caries **is used to differentiate lesions on natural, intact tooth surfaces from those that develop adjacent to a filling material.**

- **Pits and fissures caries** **is a lesion affected tooth occlusally.**

- **Smooth surfaces caries** **is lesion that may start on enamel or on the exposed root cementum and dentin.**



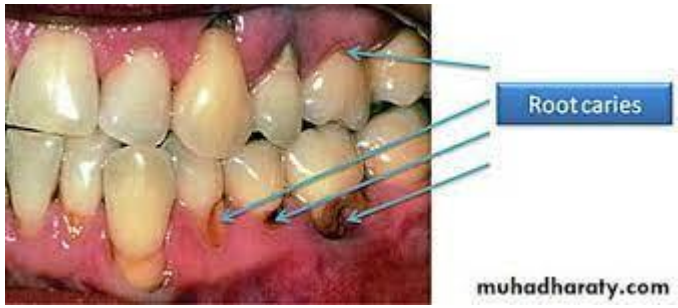
- **Recurrent or secondary caries** **is a lesion developing at a tooth surface adjacent a filling.**

-**Arrested caries** is a lesion that may have formed years previously and then stopped further progression.

- Rampant caries is the name given to multiple active carious lesions occurring in the same patient.

- **Nursing bottle** caries is one type of rampant caries in the primary dentition of infants and young children, result from a sleep sucking bottle.

- **Root caries** is lesion on the exposed root cementum and dentin.



The development of a carious lesion occurs in three distinct stages:

1- The earliest stage is the **incipient lesion**; macroscopically evidenced on the tooth surface by the appearance of an area of opacity (the white spot lesion), which is accompanied by histologic changes of the enamel at the microscopic level and is well established with a number of recognizable zones.

2- The second stage includes the progress of the demineralization front toward the **dentino- enamel junction and/or into the dentin**; the affected dentin displays discoloration from brown to dark brown or black, microscopic changes of dentin showed different zones.

3- The final phase of caries development is the development of the *overt*, or *frank* lesion, which is characterized by actual *cavitation*.

Root caries

Root caries differs from coronal caries (enamel and dentin) in several aspects (mineralization and bacterial invasion).

classified as:

-An active root-surface lesion is a well-defined, softened area on the root surface that shows a yellowish or light- brown discoloration. The lesion is likely to be covered by visible plaque. Some slowly progressing lesions may be brownish or black and reveal a leathery consistency on probing with moderate pressure.

- An **arrested (inactive)** root-surface lesion appears shiny and is relatively smooth and hard on probing with moderate pressure. The color may vary from yellowish to brownish or black. In both active and inactive lesions, cavity formation may be observed, but in the latter, case the margins appear smooth

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Thank You