DENTAL CARIES

Dept. of oral pathology

LEARNING OBJECTIVES

- At the end of the lecture student should be able to

- define caries
- Describe all theories regarding the caries
- Enlist drawbacks and positive points of all theories

DENTAL CARIES

- **DEFINITION -**

  The word ‘caries’ is derived from the Latin word, meaning ‘rot’ or ‘decay’.

- In 1880, dental caries came to be “defined as a disintegration of the tooth surface, molecule by molecule and a disease that was caused by fermentation of foods inside the mouth.”

- *STURDEVANT* defined it as; “an infectious microbiological disease that results in localized dissolution and destruction of the calcified tissues of the teeth”.
- *WHO* has said it to be “A localized post eruptive, pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of a cavity”.

THEORIES OF DENTAL CARIES

1. LEGEND OF WORMS
2. ENDOGENOUS THEORIES
   a) HUMORAL THEORY
   b) VITAL THEORY
3. CHEMICAL THEORY
4. PARASITIC / SEPTIC THEORY
5. ACIDOGENIC /CHEMICO-PARASITIC THEORY
6. PROTEOLYTIC THEORY
7. PROTEOLYSIS - CHELATION THEORY
8. SUCROSE CHELATION THEORY

LEGEND OF WORMS

- The writings of Homer evidenced the idea that caries is caused by worms was universal.

- He made a reference to worms as the cause of toothache.

ENDOGENOUS THEORIES

- *Humoral theory* : proposed that dental caries is produced by action of acids and corroding humors.

- *Vital theory* : says that dental caries originated like bone gangrene, from within the tooth itself.

CHEMICAL THEORY

- In 1820 it was noticed that dental decay affect externally.

- It was proposed that an unidentified ‘chemical agent’ was responsible for caries.

PARASITIC THEORY

- Earlier it was related for filamentous microorganisms termed *denticolae* ,which was thought to be a parasite as causative basis for tooth decay.

- Latter on the parasitic concept of dental caries was eliminated.

ACIDOGENIC /CHEMICO-PARASITIC THEORY

- It states that caries is caused by acids produced by microorganisms in mouth.
- W.D.Miller proposed a hypothesis which states that "Dental decay is a chemicoparasitic process consisting of 2stages, the decalcification of enamel, which results in its total destruction and the decalcification of dentin as a preliminary stage followed by dissolution of the softened residue".

Significance *of Miller's observation* :

It stated that there are three factors playing an important role in caries process –

1. The role of microorganisms in acid production and proteolysis.
2. The carbohydrate substrate and
3. The acid which causes dissolution of tooth minerals.

Limitations :

1. Unable to explain predilection for specific site on a tooth to dental caries and the initiation of smooth surface caries.

2. Doesn’t explain reasons for caries free population and phenomenon of arrested caries

The role of carbohydrates :

- The presence of readily fermentable carbohydrates is responsible for loss of caries resistance.

- Cariogenicity of dietary carbohydrate varies with –
  - Frequency of ingestion
  - Physical form
  - Chemical composition
  - Route of administration
  - Presence of other food substituents.

- Polysaccharides are less easily fermented than monosaccaharides.
- Refined carbohydrates are less damaging than pure form.
- Sticky and solid carbohydrates are more caries producing than liquid ones
- Bacteria + Sugars + Teeth

The role of microorganisms :

- Several different microorganisms are found capable of inducing caries. They are – S.mutans, S.salivarius, S.sanguis, S.mitior, S.milleri, A.naeslundi, A.viscosis.

- There is possibility that one or more organisms initiate caries while other different organisms are responsible for progression of caries.

Role of acids :

- The mechanism of carbohydrate breakdown to form acid by bacterial action is not known.
- It probably occurs through enzymatic breakdown of sugar
- The acid formed mainly are lactic acid, also butyric acid is formed.
- The localization of acids upon tooth surface is more important in cariogenic process.

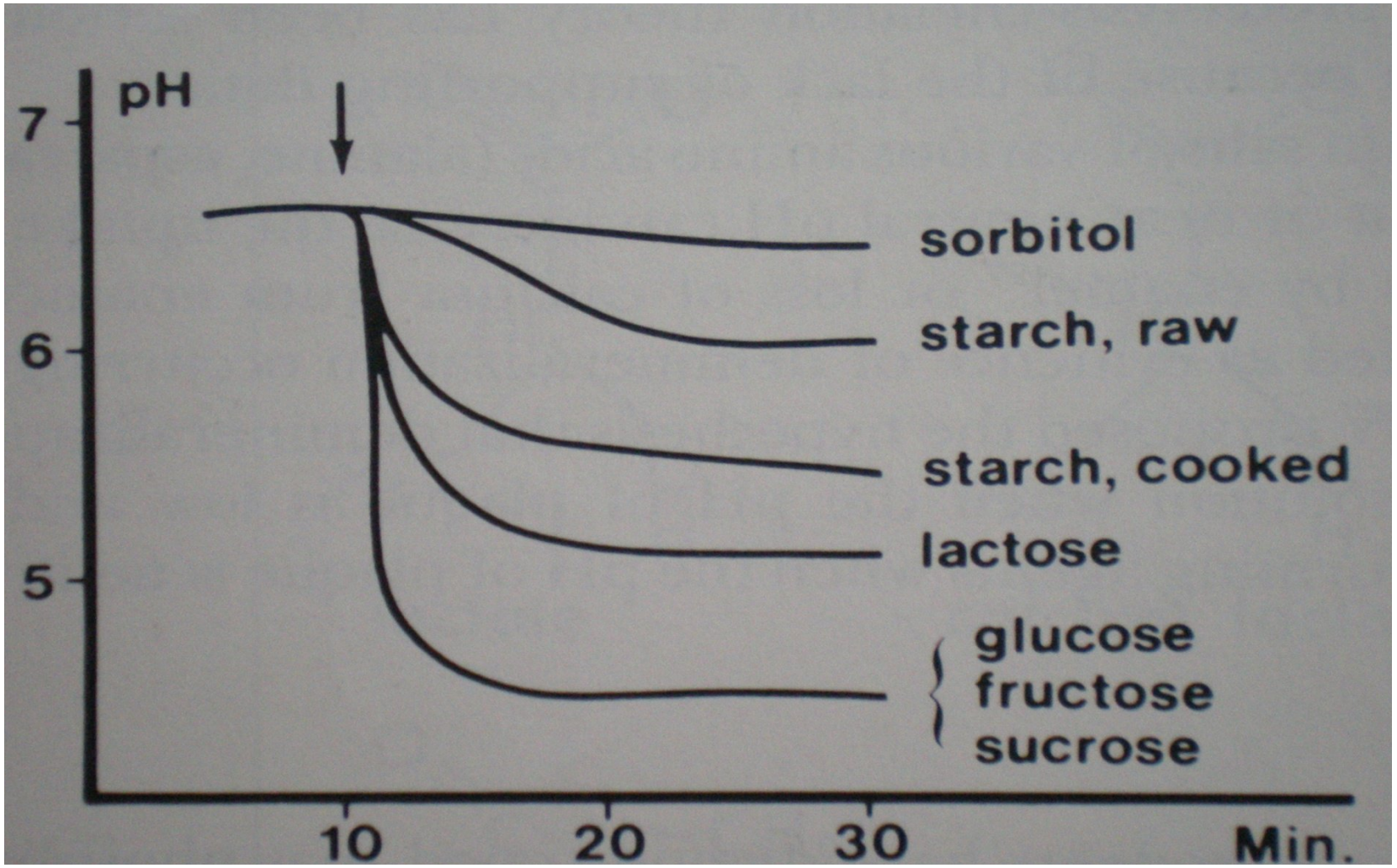
Role of dental plaque :

- The dental plaque is an important contributing factor in initiation of the carious lesion.
- Plaque consists of salivary components such as mucin and desquamated epithelial cells and microorganisms.
- Three basic groups of microorganisms predominate – streptococci, actinomyces, & veilonella.

- The acquired pellicle of plaque may serve as a nutrient for plaque microorganisms.
- The enamel caries forms beneath the plaque, but not necessarily under every plaque film.
- This shows that cariogenic process is attributed to the nature of plaque.

STEFAN CURVE

- Acids are definitely responsible for caries process.
- Within carious lesion and in plaque, the pH decreases following a rinse with suitable substrate for bacterial fermentation.
- Stephan have showed that within 2 to 4 minutes of rinsing with glucose or sucrose the pH fell from about 6.5 to about 5 and gradually returned to original pH within 40minutes.


pH
7
6
5
sorbitol
starch, raw
starch, cooked
lactose
glucose
fructose
sucrose
10
20
30
Min.

THE PROTEOLYTIC THEORY

- The organic portion of tooth play an important role in caries process.

- Enamel structures made up of organic materials such as enamel rods and particularly enamel lamellae may be important in progress of dental caries as they serve as pathway for microorganisms through enamel.

- These microorganisms invading the enamel lamellae produces acid which destroys the inorganic portion of enamel.

- Thus it was postulated that caries is essentially a proteolytic process.

- It is said that the yellow pigmentation of caries is due to proteolytic microorganisms.

- The chief theories regarding the etiology of dental caries states that there may be two types of carious lesion with different cariogenic processes.
- One, in which microorganisms invade enamel lamellae, attacks enamel and invade dentin before there is clinical evidence of caries.
- Two ,in which there is no enamel lamellae present and there is alteration of enamel prior to invasion of microorganisms.

PROTEOLYSIS-CHELATION THEORY

- It was proposed by Schatz ,states that “the bacterial attack on enamel ,initiated by keratinolytic microorganisms ,consists of a breakdown of protein and other organic portions of enamel, chiefly keratin. This results in formation of substances which may form soluble chelates with mineralized component of tooth and thereby calcify enamel at a neutral or even alkaline ph.”

- Other organic components of enamel such as mucopolysaccharides, lipids and citrates are suscepitble to bacterial attack and act as chelators.

- This theory says that both the organic and inorganic matter are attacked simultaneously, thus resolving the issue of site of initial attack of carious lesion.

- The observations of increased caries incidence with increased lactobacillus count is explained by stating that microorganisms being the result than a cause.

- Also it state that proteolysis provides ammonia preventing pH drop which inhibites the growth of lactobacilli.

- And the release of calcium from hydroxyapatite crystals by chelation may encourage growth of lactobacilli, but calcium also have vitamin sparing action on some lactobacilli thus encountering their growth.

- Increased incidence of caries with increased sugar intake occurs through action of carbohydrates stimulating proteolysis, and producing conditions in which keratinous proteins are less stable and complexing calcium.

- Decreased caries incidence with topical fluoride application or systemic fluoride intake is due to formation of fluorapatite which strengthens the linkages between organic and inorganic portions of enamel, preventing their complexing.

SUMMARY

- definition of caries
- various theories regarding the caries
- drawbacks and positive points of various theories

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THANK YOU