

Cariogenic potential of bacteria

Virulence of microorganisms

Bacteria must possess certain caries-promoting characteristics to play a role in caries include:

- ✓ The ability rapidly to transport fermentable sugars to acid.
- ✓ The ability to maintain sugar metabolism under extreme environmental conditions, such as at a low pH. Few oral bacteria are able to tolerate acidic conditions for prolonged periods. *Mutans streptococci* and *lactobacilli* not only remain viable at a low pH, but preferentially grow and metabolize, they are both acidogenic and aciduric.
- ✓ The production of extracellular (EPS) and intracellular polysaccharides (IPS). EPS include glucans and fructans, both of which contribute to the biofilm matrix. Fructans are labile and can be metabolized by biofilm bacteria under carbohydrate- restricted conditions. IPS are glycogen-like storage compounds that can be used for energy production and converted to acid when free sugars are not available in the oral cavity. Thus, the metabolism of IPS can prolong periods over which biofilms can generate acids.

Major dental caries-associated bacteria

Mutans streptococci

The *mutans streptococci* (MS) are gram-positive facultative coccus commonly arranged in chains. MS are a group of bacterial species consisting of *S. mutans*, *S. sangius* and others.

S. mutans commonly arranged in chains, subspecies are: *S. Rattus*, *S. Sobrinus*, *S. Cricetus*, *S. Ferus*.

Mutans streptococci are usually found in relatively large numbers in the plaque occurring immediately over developing smooth-surface lesions. Although, they can be isolated from sound tooth surfaces.

Certain physiological characteristics of the MS:

- the ability to adhere to tooth surfaces by either of two mechanisms:

(1) attachment to the acquired pellicle through extracellular proteins (adhesins) located on the fimbriae (fuzzy coat) of these organisms; and (2) sucrose-dependent mechanisms, in which bacteria require the presence of sucrose to produce sticky extracellular polysaccharides (glucans), that allows attachment and accumulation of additional waves of bacterial colonization.

- rapid production of lactic acid from a number of sugar substrates,

- the production of intracellular polysaccharide (energy) stores.

As a general rule, the cariogenic bacteria metabolize sugars to produce the energy required for their growth and reproduction. The by-products of this metabolism are acids, which are released into the plaque fluid. The damage caused by MS is mainly caused by lactic acid, although other acids, such as butyric and propionic, are present within the plaque. A positive correlation is found between the counts of these bacteria in saliva and plaque.

Lactobacilli

Lactobacilli (LB) is a genus of gram-positive facultative anaerobe bacteria. It was thought previously that LB play a major role in the carious process. Later, it was found that LB are more a consequence than a cause of caries initiation. During the initial phases of the developing carious lesions, large numbers of MS are involved, only to decrease later in number as the LB population increases. *Lactobacillus* is acid tolerant (aciduric) and can carry out glycolysis at pH values as low as 3. However, lactobacilli are poor colonizer of smooth tooth surface. Lactobacilli are generally believed to exacerbate the initial enamel lesion to deep dentine lesion. A positive correlation is found between the counts of these bacteria in saliva, plaque and caries activity. Also, these bacteria have ability to produce both extracellular and intracellular polysaccharides.

Actinomyces

Actinomyces is a genus of gram-positive facultative or strict anaerobic pleomorphic rod-shaped bacteria. Has been frequently isolated from both root caries lesions and sound root surface, suggesting their association with root caries. Results of several studies documented that MS and LB were found in root caries lesions. However, the knowledge about the involvement of individual *Actinomyces* species in root caries is still sketchy.

Veillonella

They are gram-negative anaerobic cocci appears as plaque oxygen levels fall, are unable to metabolize dietary carbohydrates but they are able to use lactate that is produced by other microorganisms and convert it to a less cariogenic and weaker acid. This may consider a beneficial effect of these bacteria in relation to dental caries.

Other caries-associated bacteria

The oral cavity is inhabited by hundreds of bacterial species, forming complex ecology system. The “specific pathogen hypothesis” has led to the identification of several other species including *Atopobium*, *Olsenella* and others are also indicated as bacteria associated with the progression of caries. In contrast, the “nonspecific plaque hypothesis” supports the concept that caries is the consequence of the overall acid production activity of the total plaque microflora rather than a few specific bacteria.

Bacterial colonization can be controlled by:

- Antimicrobial approaches (fluoride, chlorhexidine and others).
- Mechanical approaches (teeth brushing and others).
- Dietary assessment (use of non-cariogenic sweeteners as xylitol, avoid frequent consumption of carbohydrates between meals).
- Probiotics are live microorganisms which, when applied in adequate amounts, will benefit the health of the host.
- Salivary antimicrobial substances.