15.16A: Tooth and Gum Infections

The mouth contains a wide variety of oral bacteria, but only a few specific species of bacteria are believed to cause tooth and gum infections.

Learning Objectives

- List the types of bacteria and issues associated with oral bacteria: Streptococci spp and Lactobacillus acidophilus

Key Points

- Dental caries, also known as tooth decay or cavity, is a bacterial infection that causes demineralization and destruction of the hard tissues (enamel, dentin, and cementum).
- Tooth decay results from the production of acid by bacterial fermentation of the food debris accumulated on the tooth surface.
- Bacteria occupy the ecological niche provided by both the tooth surface and gingival epithelium. However, a highly efficient innate host defense system constantly monitors the bacterial colonization and prevents bacterial invasion of local tissues.
- Porphyromonas gingivalis is a Gram-negative oral anaerobe strongly associated with chronic adult periodontitis.
- Dental plaque is the material that adheres to the teeth and consists of bacterial cells (mainly S. mutans and S. sanguis), salivary polymers, and bacterial extracellular products.

Key Terms

- **cavity**: A soft area in a decayed tooth.
Tooth and Gum Infections

Dental caries, also known as tooth decay or cavity, is a bacterial infection that causes demineralization and destruction of the hard tissues (enamel, dentin, and cementum). This usually happens from the production of acid by bacterial fermentation of the food debris accumulated on the tooth surface. If demineralization exceeds saliva and other remineralization factors, such as from calcium and fluoridated toothpastes, these hard tissues progressively break down, producing dental caries (cavities, holes in the teeth). The bacteria most responsible for dental cavities are the mutans streptococci, most prominently Streptococcus mutans and Streptococcus sobrinus, and lactobacilli. If left untreated, the disease can lead to pain, tooth loss, and infection. Today, caries remain one of the most common diseases throughout the world.

The mouth contains a wide variety of oral bacteria, but only a few specific species of bacteria are believed to cause dental caries: Streptococcus mutans and Lactobacilli among them. Lactobacillus acidophilus, Actinomyces viscosus, Nocardia spp., and Streptococcus mutans are most closely associated with caries, in particular root caries. Bacteria collect around the teeth and gums in a sticky, creamy-colored mass called plaque, which serves as a biofilm. Some sites collect plaque more commonly than others. Grooves on the occlusal surfaces of molar and premolar teeth provide microscopic retention sites for plaque bacteria, as do the approximal sites. Plaque may also collect above or below the gingiva where it is referred to as supra- or sub-gingival plaque respectively.

Figure: Gram stain of Streptococcus mutans. Morphology is rod-like with chains when cultured on broth. Can cause subacute bacterial endocarditis and dental caries.

Oral bacteria have evolved mechanisms to sense their environment and evade or modify the host. Bacteria occupy the ecological niche provided by both the tooth surface and gingival epithelium. However, a highly efficient innate host defense system constantly monitors the bacterial colonization and prevents bacterial invasion of local tissues. A dynamic equilibrium exists between dental plaque bacteria and the innate host defense system. The oral cavity of the newborn baby does not contain bacteria but rapidly becomes colonized with bacteria such as Streptococcus salivarius. With the appearance of the teeth during the first year, colonization by Streptococcus mutans and Streptococcus...
sanguinis occurs as these organisms colonize the dental surface and gingiva. Other strains of streptococci adhere strongly to the gums and cheeks but not to the teeth. The gingival crevice area (supporting structures of the teeth) provides a habitat for a variety of anaerobic species. Bacteroides and spirochetes colonize the mouth around puberty.

Figure: **Dental caries**: This image shows destruction of a tooth by cervical decay from dental caries. This type of decay is also known as root decay.

The levels of oral spirochetes are elevated in patients with periodontal diseases. Among this group, Treponema denticola is the most studied and is considered one of the main etiological bacteria of periodontitis. Treponema denticola is a motile and highly proteolytic bacterium.

Spirochetes and fusi-form bacilli live as normal flora in the mouth, but the bacteria can cause infection and diseases to the oral cavity.

Porphyromonas gingivalis is a Gram-negative oral anaerobe strongly associated with chronic adult periodontitis. The bacterium produces a number of well-characterized virulence factors and can be manipulated genetically. The availability of the genome sequence is aiding our understanding of the biology of P. gingivalis and how it interacts with the environment, other bacteria, and the human host.

Aggregatibacter actinomycetemcomitans is considered an oral pathogen due to its virulence factors, its association with localized aggressive periodontitis in young adolescents, and studies indicating that it can cause bone loss.

Dental plaque is the material that adheres to the teeth and consists of bacterial cells (mainly S. mutans and S. sanguis), salivary polymers, and bacterial extracellular products. Plaque is a biofilm on the surfaces of the teeth. This accumulation of microorganisms subject the teeth and gingival tissues to high concentrations of bacterial metabolites which results in dental disease. If not taken care of, via brushing or flossing, the plaque can turn into tartar (its hardened
form) and lead to gingivitis or periodontal disease.