Tooth Decay (Dental Caries)
by Nghia Nguyen

Etiological agent - *Streptococcus mutans* from the family *Streptococcaceae* [1]

**Transmission:** passed from one person to the next via horizontal or vertical transmission. Main route of Streptococcus mutans is to colonize itself among human hosts. Children and infants are more prone and many receive it from their mothers or caregivers. *S. mutans* favors hard non-shedding surfaces to establish permanent colonies [3]

**Reservoir:** mainly in the mouth oral area, occurs in all ages, but children are more susceptible. [2]

**General Characteristic:** *Streptococcus mutans* are gram+ cocci bacteria. They are facultative anaerobes commonly found in the human oral cavity to cause tooth decay. *S. mutans* are mesophilic, cariogenic microorganism that breaks down sugar for energy and produces an acidic environment. The acid demineralizes the superficial structure of the tooth. After awhile the calcium coating dissolve and there are holes in the tooth as a result. [3]

A normal healthy oral flora will roughly contain 10,000 CFU per ml of *Streptococcus mutans* in their mouth. [3]

**Taxonomy:** Kingdom: Bacteria | Phylum: Firmicutes | Class: Bacilli | Order: Lactobacillales | Family: Streptococcaceae | Genus: Streptococcus | Species: *S. mutans*

**Specific tests for identification:** The dentist can diagnose tooth decay by visually examine the mouth and he will order X-Rays, and sometimes the X-Rays can detect the formation of a cavity before it is fully intact. Dental decay is very obvious later in the stages when black holes appear. [2]

Most cavities are discovered in the early stages during routine dental checkups. A dental exam may show that the surface of the tooth is soft. Dental x-rays may show some cavities before they are visible to the eye. [2]

**Signs and Symptoms:**

The first and most common sign is of decay is toothache. This is typically an infection or irritation of the tooth pulp usually causes the pain. [2] Tooth pain or achy feeling, particularly
after sweet, hot, or cold foods and drinks are first indicator. Visible pits or holes in the teeth are strong positive indicator of tooth decay [2]

**Historical information:**  *S. mutans* have evolved to increase its adaptability to the oral cavity over time. They were able to increased organic acid production, refine the capacity to form biofilms on the hard surfaces of teeth, and survive in very low pH. The ability to increase the amount of carb it could metabolize was thought to be a lateral gene transfer from Lactococcus lactis and *S. galloyticus*, respectively. [1] *S. mutans*’ acquisition of the glucosyltransferase gene allows the bacteria to produce sticky polysaccharides that aggregate with one another and adhere to tooth enamel to form biofilms [3] Co-evolution with humans, beneficial because of agricultural production provided the conditions *S. mutans* needed to evolve into the virulent bacteria it is today. The Industrial Revolution improved manufacturing of food more efficient thus increasing availability and amount of sucrose consumed by humans. This provided *S. mutans* with more energy resources, and thus exacerbated an already rising rate of dental caries [1]

**Virulent Factors:**  *S mutans* possesses water insoluble glycans, acid tolerance, and production of lactic acid. They are the main virulent factors. [8]  

**Treatment:** options for tooth decay can be taken care at the dental office with procedures such as: fillings, crowns and root canals. Daily fluoride flush is recommended [6]

**Prevention/ Vaccine info, new trials?** Normal human flora includes bacteria in their mouth; the only prevention is to lessen the impact of acid fermentation by practicing adequate oral hygiene by brushing your teeth daily, flossing, and fluoride rinse. Avoid eating a lot of sugar food such as sweet candy. [6]  

Good oral hygiene including daily brushing, flossing and the use of appropriate mouthwash can significantly reduce the number of oral bacteria and inhibit their proliferation. Oral bacteria often live in plaque, a kind of biofilm, hence mechanical removal of plaque is the most effective way of getting rid of harmful oral bacteria, as bacterial biofilms are notoriously resistant to antibiotics and antimicrobial rinses. [3] However, there are some remedies used in the treatment of oral bacterial infection, in conjunction with mechanical cleaning.  

Water fluoridation has been a major contributor to the decline of the rate of tooth decay. Studies have shown that water fluoridation can reduce the amount of decay in children’s teeth by 18-40% [5]

**Current outbreaks / cases locally in the US (with prevalence/incidence)**  
Dental caries is the most prevalent chronic disease in both children and adults. However with good education reaching the public it has significantly declined over the past four decades. The trend is reversed for children, probably because the large amount of sugar they are exposed to. [4]  

**Prevalence (age 2 to 11):** 42% of children 2 to 11 have had dental caries in their primary teeth. Overall dental caries in the baby teeth of children 2 to 11 declined from the early 1970s until the mid 1990s. From the mid 1990s until the most recent (1999-2004) it has gone back up. [7]
Prevalence (age 12 to 19): 59% of adolescents 12 to 19 have had dental caries in their permanent teeth. [7]

Prevalence (age 20 to 64): 92% of adults 20 to 64 have had dental caries in their permanent teeth. [7]

Prevalence (age 65 and older): 93% of seniors 65 and older have had dental caries in their permanent teeth. Note: Approximately 5% of senior’s ages 65 and older have no teeth. This survey applies only to those seniors who have teeth. Dental caries, both treated and untreated, in seniors age 65 and older declined from the early 1970s until the most recent (1999-2004) [7]

Current outbreaks/cases globally (with prevalence/incidence)

Worldwide, 60–90% of school children and nearly 100% of adults have dental caries [6]

Here is a link to a world map that shows the prevalence of dental caries worldwide:

MAP

Work Cited:


