Dental caries

Is an infectious and communicable disease requires multiple factors to influence the initiation and progression of it. The disease is recognized to require a host (tooth in the oral environment), a dietary substrate, and aciduric bacteria.' The saliva (also considered a host component), the substrate, and the bacteria form a biofilm (plaque) that adheres to the tooth surface. Over time the presence of the substrate serves as a nutrient for the bacteria, and the bacteria produce acids that can demineralize the tooth.

Dental caries as a preventable disease, the disease typically begins in enamel and progresses slowly in the early stages of the process. Cavitation of the tooth structure occurs at late stage of the disease. Prior to cavitation, the progress of the disease may be arrested and/or reversed if a favorable oral environment can be achieved. Even after cavitation occurs, if the pulp is not yet involved and if the cavitated area is open enough to be self-cleansing ("plaque-free"), the caries process can halt and become an "arrested lesion.

Arrested lesions

1. Typically exhibit much coronal destruction.
2. Remaining exposed dentin is hard and usually very dark.
3. No evidence of pulpal damage.
4. The patient has no pain.

Treating the oral infection by reducing the number of cariogenic microorganisms and establishing a favorable oral environment to promote remineralization of tooth structure over time will stop the caries process and cure the disease. Curing the disease requires modifications by the patient and/or caretaker and relies on their compliance in making the necessary modifications.

A number of microorganisms can produce enough acid to decalcify tooth structure, particularly aciduric streptococci, lactobacilli, diphtheroids, yeasts, staphylococci, and certain strains of sarcinae. *Streptococcus mutans* has been implicated as one of the major and most virulent of the caries-producing organisms.

The acids that initially decalcify the enamel have a pH of 5.5 to 5.2 or less and are formed in the plaque material, which has been described as an organic nitrogenous mass of microorganisms firmly attached to the tooth structure. This film, which exists primarily in the susceptible areas of the teeth

The acids involved in the initiation of the caries process are normal metabolic by-products of the microorganisms and are

generated by the metabolism of carbohydrates. Because the outer surface of enamel is far more resistant to demineralization by acid than is the deeper portion of enamel, the greatest amount of demineralization occurs 10 to 15 µm beneath the enamel surface.

The continuation of this process results in the formation of an incipient subsurface enamel lesion that is first observed clinically as a so-called white spot. Unless the demineralization is arrested or reversed (remineralization) the subsurface lesion

will continue to enlarge, with the eventual collapse of the thin surface layer and the formation of a cavitated lesion. Remineralization of incipient subsurface lesions may occur as long as the surface layer of the enamel remains intact. Saliva, which is supersaturated with calcium and phosphate and has acid-buffering capability, diffuses into plaque, where it neutralizes the microbial acids and repairs the damaged enamel. The time required for remineralization to replace the hydroxyapatite lost during demineralization is determined by the age of the plaque, the nature of the carbohydrate consumed and the presence or absence of fluoride

RAMPANT DENTAL CARIES

Suddenly appearing, widespread, rapidly burrowing type of caries, resulting in early involvement of the pulp and affecting those teeth usually regarded as immune to ordinary decay.

Etiological factors

1. Emotional disturbances, repressed emotions and fear.
2. Traumatic school experience, continuous general tension and anxiety have been observed in children and adults who have rampant dental caries.
   An emotional disturbance may initiate an unusual craving for sweets or the habit of snacking, which in turn might influence the incidence of dental caries.
3. A noticeable salivary deficiency.
4. Various medications (such as tranquilizers and sedatives) commonly taken to help persons cope with stress, are associated with decreased salivary flow and decreased caries resistance
5. Radiation therapy to the head and neck results in diminished salivary function and may place patients at high risk for severe caries development.

EARLY CHILDHOOD CARIES, SEVERE EARLY CHILDHOOD CARIES, NURSING CARIES, BABY BOTTLE TOOTH DECAY

The American Academy of Pediatric Dentistry (AAPD) defines early childhood caries (ECC) as the presence of one or more decayed (noncavitated or cavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC).

After eruption of the primary teeth begins, excessively frequent bottle feedings and/or prolonged bottle or breast feedings is often associated with early and rampant caries.

The clinical appearance of the teeth in S-ECC in a child 2, 3, or 4 years of age is typical and follows a definite pattern. There is early carious involvement of the maxillary anterior teeth, the maxillary and mandibular first primary molars, and sometimes the mandibular canines. The mandibular incisors are usually unaffected.

A discussion with the parents often reveals an inappropriate feeding pattern: the child has been put to bed at afternoon naptime and/or at night with a nursing bottle holding milk or a sugar-containing beverage. The child falls asleep and the liquid becomes pooled around the teeth (the lower anterior teeth tend to be protected by the tongue). carbohydrate-containing liquid provides an excellent culture medium for acidogenic microorganisms.

Salivary flow is also decreased during sleep, and clearance of the liquid from the oral cavity is slowed.

ADDITIONAL FACTORS KNOWN TO INFLUENCE DENTAL CARIES SALIVA

The flow, dilution, buffering, and remineralizing capacity of saliva are also recognized to be critical factors that affect and regulate the progression and regression of the disease. If the oral environment is balanced and favorable, saliva can contribute to strengthening of the tooth by supplying the components known to help build strong apatite structure. If the oral environment is unfavorable (too much acid is produced), an adequate flow of saliva can help dilute and buffer the acid, and thus slow the rate of damage to the tooth or even repair it.

1. The salivary pH, the acid-neutralizing power, and the calcium, fluoride, and phosphorus content.
2. The rate of flow and the viscosity of saliva may influence the development of caries. The normal salivary flow aids in the solution of food debris on which microorganisms thrive.
3. Salivary antibacterial and other anti infectious properties.

A reduction in the salivary flow may be temporary or permanent. When the quantity is only moderately reduced, the oral structures may appear normal. A pronounced reduction or complete absence of saliva, however, will result in a septic mouth with rampant caries. In addition to the rapid destruction of the teeth, there may be dryness and cracking of the lips, with fissuring at the corners of the mouth, burning and soreness of the mucous membranes, crusting of the tongue and palate, and sometimes paresthesia of the tongue or mucous membrane.

SOCIOECONOMIC STATUS

Children and adolescents living in poverty suffer twice as much tooth decay as their more affluent peers and that their disease is more likely to be untreated.

ANATOMIC CHARACTERISTICS OF THE TEETH

Enamel calcification is incomplete at the time of eruption of the teeth and an additional period of about 2 years is required for the calcification process to be completed by exposure to saliva, the teeth are especially susceptible to caries formation during the first 2 years after eruption. Permanent molars often have incompletely coalesced pits and fissures that allow the dental plaque material to be retained at the base of the defect, sometimes in contact with exposed dentin. These defects or anatomic characteristics can readily be seen if the tooth is dried and the debris and plaque removed. In addition to occlusal surfaces, lingual pits on the maxillary permanent molars, buccal pits on the mandibular permanent molars, and lingual pits on the maxillary permanent lateral incisors are vulnerable areas in which the process of dental caries can proceed rapidly.

ARRANGEMENT OF THE TEETH IN THE ARCH

Crowded and irregular teeth are not readily cleansed during the natural masticatory process. It is difficult for the patient to clean the mouth properly with a toothbrush and floss if the teeth are crowded or overlapped. This condition may contribute to the problem of dental caries.

PRESENCE OF DENTAL APPLIANCES AND RESTORATIONS

Partial dentures, space maintainers and orthodontic appliances often encourage the retention of food debris and plaque material and result in an increase in the bacterial population.

EARLY DETECTION OF DISEASE ACTIVITY

INFRARED LASER FLUORESCENCE (DIAGNOdent)

An instrument designed to facilitate the detection of dental caries, DIAGNOdent, has recently become available in several countries. This instrument was developed for the detection and quantification of dental caries of occlusal and smooth surfaces. It uses a diode laser light source and a fiber-optic cable that transmits the light to a hand-held probe with a fiber-optic eye in the tip. The light is absorbed and induces infrared fluorescence by organic and inorganic materials. The emitted fluorescence is collected at the probe tip, transmitted through ascending fibers, and processed and presented on a display window as an integer between 0 and 99

DIGITAL IMAGING FIBER-OPTIC TRANS-ILLUMINATION (DIFOTI)

Intense light beam that is transmitted through a fiberoptic cable to a specially designed probe to permit the use of transillumination on the proximal surfaces of posterior teeth.

QUANTITATIVE LIGHT FLUORESCENCE

A small portable system* was developed in which the laser source was replaced by a regular light source and filter system. The light illuminating the tooth is transported through a liquid filled light guide. The fluorescent filtered images are captured using a color CCD camera and a frame grabber. Data are collected, stored, and analyzed by custom software.

QLF instrument detected 5 to 10 times more early lesions than conventional detection methods, was particularly useful for examination of occlusal pits and fissures, and gave reproducible results.

QLF for the early detection of
dental caries on occlusal and smooth tooth surfaces as
well as for the quantification of lesion changes related to
treatment procedures and environmental factors such as
oral hygiene. The only significant limitation to this instrument is
its inability to detect or monitor interproximal lesions.