Exactly what is "Dental Caries"? Building a Definition from Research

Tooth decay has been part of many people's lives for millennia and is still the single most prevalent disease of US children.[i] But the scientific understanding of the disease process that causes holes in teeth has improved dramatically only over recent decades. With that understanding comes a more reliable approach to cavity prevention in children along with new professional recommendations on risk-assessment, disease management, when to first see a dentist, and the need to establish a "dental home" where each child receives ongoing care tailored to his or her unique needs. The purpose of this document is to provide information to assist you in keeping your child cavity-free by clarifying the multi-factorial nature of dental caries.

Caries is the disease that causes cavities: According to the Centers for Disease Control and Prevention, more than one-in-four US preschoolers (28%) has a visible cavity.[ii] However, long before a child has a first cavity, the caries process has been active in the child's mouth doing damage to the surface of the teeth, particularly along the gum lines. Dentists and parents can now focus treatment on preventing, healing, and reversing this disease.

Caries is an infectious disease: As early as the late 1930's, researchers conjectured that acid production by an "undefined oral bacteria" which "disintegrates the tooth's enamel"[iii] is responsible for cavity formation. Their belief was confirmed in the 1950's when NIH proved that caries could be induced in decay-free rodents by inoculating their mouths with specific bacteria, recovering the bacteria from the affected animals, and then transmitting them to another decay-free animal to again cause cavities.[iv], [v] This finding led in the 1980's to the "specific plaque hypothesis" in humans - i.e., that a plaque containing specific bacteria (the "mutans streptococci") are responsible for cavity formation.[vi] In recent years it has also lead to the belief that any visible, bulky, white plaque along the gum line of the upper front teeth of children under the age of 2 years is a very early sign of high risk for tooth decay.

Caries is transmissible: With these discoveries, researchers began searching for the source and mode of transmission of these bacteria. Unlike most infectious diseases, transmission was found to be vertical (i.e. from parent to child when the child first gets teeth) rather than horizontal (from child to child).[vii], [viii], [ix] A recent review of all available English-language studies[x] reveals 15 showing high correlations between a mother's and child's specific cavity-causing bacterial type but few suggesting a father-to-child linkage. Additional studies show a correlation between the levels of bacteria in mothers' saliva and their children, suggesting that the mother is not just the principal source of bacteria, but that the extent of the disease in a child is also dictated by the level of bacterial in the mother's mouth at the time of transmission. Furthermore, children that acquire the bacteria earlier and/or at high levels, have more cavities early in life than children who acquire it later.[xi]

Caries is diet dependent: The amount and - even more importantly - the frequency of dietary carbohydrates ingestion during a day not only feeds the cavity process but furthers the growth of decay-causing bacteria.[xii] It doesn't matter whether the sugar source is food or drink and, because the bacteria are so small, even small amounts of sugar when given frequently can keep the decay process going at a high rate.

Caries is genetically influenced: The old wives' tale that "soft teeth run in families" is true to an extent since genetics does play some role in cavity susceptibility. This is because genes can influence a variety of factors that impact cavity formation. These include salivary flow and composition, tooth form and position, enamel integrity, taste preference, and even health behaviors.

Fluoride dampens the caries process: Since 1938, fluoride has been known to be an antidote to caries.[xiii] It works in many ways and at many levels - from making teeth less resistant to acid destruction to reducing the metabolic efficiency of decay-causing bacteria. Community water fluoridation – which began in the 1940's –is today considered one of the top 10 most effective public health interventions in history. Small exposures to

fluoride dampen the caries process. Larger amounts do no additional good and induce the risk for permanent discoloration of teeth from "fluorosis." A simple rule of thumb when brushing your child's teeth is to use only a film of toothpaste that is about the size of your child's pinky fingernail.

Combining all of this science into one definition, caries can be understood as an infectious and transmissible, diet dependent, fluoride mediated, genetically influenced, disease of the mouth that typically begins before age two and causes acid destruction of the teeth until cavities develop.

What to do about caries?

Understanding this multi-factorial disease allows dentists and parents to work together to take action that can prevent cavities throughout life. Recommended actions parents can take include:

1. Schedule your child's first dental visit at the time of the first tooth or by the first birthday to learn more about primary caries prevention, to gain an understanding of your child's potential risk for developing cavities, and to learn about other oral concerns ranging from teething and sucking habits to injury prevention.

2. Avoid or limit the transmission of decay-causing bacteria to your child's mouth, particularly if you have had problems with cavities yourself.

3. Carefully manage your child's diet and eating frequency to establish good eating habits that limit the risk for cavity formation.

4. Be sure that your child benefits from daily brushing with a fluoride toothpaste but that you keep the amount of paste appropriate for his or her age and size.

Getting an early start and staying on top of these simple preventive measures are the best ways of preventing common dental problems lifelong.

February 2006 Courtney Chinn, DDS and Burton Edelstein, DDS, MPH
Dr. Chinn is currently a Head Start Fellow in Pediatric Dentistry at Columbia University and Dr. Edelstein is the Founding Director of the Children's Dental Health Project.

[i] Oral Health in America, Report of the US Surgeon General 2000.
[ii] CDC, MMWR August 2005.
[iii] Tanzer JM. Dental Caries is a transmissible infectious disease: The Keyes and Fitzgerald Revolution. J Dent Res 74, 1995.
[iv] Fitzgerald RJ, Keyes PH. Demonstration of the etological role of streptococci in experimental caries in the hamster. J Am Dent Assoc. 1960; 61:9-19.
[v] Fitzgerald RJ, Keyes PH. Ecological factors in dental caries; The fate of antibiotic-resistant cariogenic streptococci in hamsters. Am J Pathol 1963; 42:759-772.
[vi] W Loesch, Role of streptococcus mutans in Human Dental Decay" Microbiol Rev 50:353-80, 1986.
[vii] Berkowitz RJ, Jones P. Mouth-to-mouth transmission of the bacterium Streptococcus mutans between mother and child. Arch Oral Biol. 1985;30(4):377-9.
[viii] Caufield, PW, Cutter GR, Dasanayake AP. Initial Acquisition of Mutans Streptococci by Infants: Evidence for a Discrete Window of Infectivity. J Dent Res 72(1):37-45, January, 1993.
[ix] Kohler B, Bratthall D, Krasse B. Preventive measures in mothers influence the establishment of the bacterium streptococcus mutans in their infants. Archs oral Biol. 28(3):225-231, 1983.
[x] Douglass J, Tinanoff N. personal communication 2-07.
[xi] Kohler B, Andreen I. Influence of caries-preventive measures in mothers on cariogenic bacteria and caries experience in their children. Archs Oral Bio. 39(10):907-911, 1994.
[xii] Van Houte J. Role of Micro-organisms in Caries Etiology. J Dent Res 73(3):672-681, March,1994.
[xiii] Dean HT. Endemic fluorosis and its relation to dental caries, 1938. Public Health Rep. 2006;121 Suppl 1:213-9.