I. The problem of Early Childhood Caries

The Center for Disease Control and Prevention reports that dental caries is likely the most prevalent infectious disease in American children, and is five times more prevalent than the second most common chronic disease which is asthma. More than forty percent of kids have tooth decay by age five. The American Academy of Pediatric Dentistry classifies this distinctive disease pattern as Early Childhood Caries (ECC) (Ref: Policy on Early Childhood Caries, adopted 1978, revised 2003, at www.aapd.org). The ECC disease process may start as soon as an infant’s teeth erupt. It is now well understood that dental caries are primarily the result of infection by the oral bacterium known as *Streptococcus mutans*, and that mothers serve as the reservoir for this bacteria, typically passing it to their baby in the first year of life. Depending upon family history of dental caries, environmental-social risk factors, and nutritional factors, such as nighttime feeding practices, ECC can progress rapidly in some children. This disease, which is completely preventable, may have a lasting negative impact on a child’s health and wellness (Ref: Policy Statement, Oral Health Risk Assessment, May 2003, at www.aap.org).

II. How was it discovered that xylitol could prevent cavities?

The Finnish were the first to manufacture xylitol in large amounts from birch tree pulp toward the end of World War II. Due to sugar shortages, xylitol began to be used as a nutritive sweetener on a larger scale in Finland in the 1960’s and 1970’s. Xylitol was particularly attractive as a sweetener because its granular texture, color, and relative sweetness are equal to table sugar (sucrose). Xylitol can be easily substituted for sugar in most food recipes, is forty percent lower in calories, and does not stimulate an elevated blood sugar response like sucrose. It was observed that individuals using xylitol as a sweetener seemed to have fewer cavities. Scientific studies (The Turku Sugar Studies, 1975) were designed to test the safety of xylitol as a nutritive sweetener for the replacement for sugar in the diet. The blood chemistries and the health of the xylitol users were no different than the non users (Ref: Scheinin A., et.al., Acta Odont Scand. 1976). The only side effect described was a laxative effect in some adults consuming more than 70-100 grams per day, but many of these people developed tolerance to increasing amounts over time.

With the safety of xylitol for human consumption established, Finnish scientists concurrently began to study xylitol’s caries-preventative effects in controlled trials. The first study compared the incremental increase in decayed, missing, or filled (DMF) teeth in two groups of college students, one group assigned to chew sucrose sweetened chewing gum, and the other group to chew xylitol sweetened gum four to five times daily for one year. The students’ diets and overall daily sucrose intakes were comparable. At the end of the year long study, the DMF incidence in the sucrose gum group was 2.92 as compared to 1.04 in the xylitol group (Ref: Scheinin A., et.al., Acta Odont Scand 1975). Numerous studies since this initial
report have confirmed xylitol’s efficacy as a caries-preventative ingredient in chewing gums, candies, dentifrices, and mouth rinses.

The most comprehensive xylitol gum study was conducted by researchers at the University of Michigan, and published in 1995. This double blinded randomized controlled trial, conducted in Belize from 1989 to 1993, followed a cohort of 1,277 children (average age 10 years) randomized to a control group (no gum) and nine separate xylitol, sorbitol, and sucrose gum groups. The children’s compliance with the gum chewing was supervised at their schools, and their caries incidence recorded by four calibrated dentists using WHO criteria. The xylitol gum groups (average daily consumption 4.3 to 9.0 grams per day) easily outperformed the sorbitol group, which in turn outperformed the no gum group, which outperformed the sucrose group. The results were statistically validated (Ref: Makinen KK, et.al, J Dent Res., Dec. 1995).

A more recent study looked at the efficacy of 10% xylitol / fluoride toothpaste as compared to fluoride only toothpaste. In this study, conducted in Costa Rica, 3,394 children (ages 7-12) were randomized to one of the two dentifrice groups. The children brushed at school, and at the end of the 30 month study, the xylitol/fluoride group had ten percent fewer cavities as compared with the fluoride only group, which given the size of the groups, was statistically significant, and suggested a synergistic effect of xylitol in combination with fluoride as a caries preventative (Ref: Sintes JL, et.al, Am J Dent, Aug 2002). Xylitol exposure to the dentition can only be estimated in this study. With twice a day tooth brushing, and estimating that approximately 2 grams of 10% xylitol paste was used per brushing, one can calculate that the children were only exposed to 0.4 grams of oral topical xylitol per day with at least a modest beneficial effect. Access www.pubmed.gov and search “xylitol and caries prevention” to review abstracts of scientific studies pertaining to the anti-cavity properties of xylitol.

III. How does xylitol inhibit Streptococcus mutans bacteria?

The cumulative evidence is strong that xylitol inhibits Strep. mutans. The etiology of this inhibition is most probably multifactorial. Substitution of xylitol for the fermentable sugars found in most foods that are cariogenic is one logical explanation, but this does not explain xylitol’s apparent beneficial effect in the context of relatively low consumption levels. Xylitol has also been used as a salivary stimulant in the treatment of dry mouth (xerostoma) which may be an indirect caries protective effect. Most of the biochemical research has focused on xylitol as a metabolic inhibitor to pathogenic strains of Streptococci, in particular Strep. mutans. These pathogenic strains may rely more heavily on the organic acid byproducts of simple sugar fermentation as part of their plaque forming ecology. Xylitol may also inhibit energy utilization, and even alter the composition of the polysaccharide coat of pathogenic strains of certain streptococci, which may affect their adherence to surfaces, and thus their colony forming properties. Current wisdom, based on pathophysiologic rationale, would support the concept that xylitol helps to shift the oral flora toward the predominance of noncariogenic species. Access www.pubmed.gov and search “xylitol and streptococcus mutans” to review scientific studies regarding the inhibition of Strep. mutans bacteria by xylitol.
Particularly intriguing are the studies suggesting that the vertical transmission of *Strep. mutans* from mother to child during infancy is reduced when mothers chew xylitol gum as compared with other maternal interventions (fluoride rinses, etc.), and the long term caries rates in the offspring are similarly reduced (Ref: Isokangas, et.al, J.Dent.Res, Nov.’00).

**IV. Is xylitol safe for consumption by young infants?**

Xylitol is safe for use in infancy. Xylitol occurs naturally in plums (and prunes) which has been a common food for infants for a long time. K.K. Makinen states in “Biochemical Principles of the Use of Xylitol in Medicine and Nutrition with Special Considerations of Dental Aspects” (pub.Birkhauser Velag, 1978, p.7) “Virtually all plant material so far studied seems to contain xylitol. According to the present knowledge the richest sources seem to be plums, strawberries, raspberries, cauliflower and endives, in which the concentration may reach 0.3-1.0 g in 100 g dry material. Considerable amounts of xylitol also occur as an intermediate in human carbohydrate metabolism, viz. 5-15 g daily”. This means that many of us eat naturally occurring xylitol in our food everyday, and we even make xylitol in our bodies as a product of our own metabolism. Xylitol has been added to infant dentifrices for a number of years (Gerber Products and Laclede Inc). These products are recommended for use as early as three months of age.

**V. Why should a parent use Spiffies Baby Tooth Wipes?**

Practicing pediatricians have long recommended that parents clean their baby’s teeth and gums with a wet washcloth or gauze after feeds. Spiffies™ Baby Tooth Wipes with Xylitol takes this recommendation a step further. The dental wipe provides an opportunity to comfortably and efficiently initiate an oral hygiene routine in early infancy. The cleansing and debridement action of the towelette will complement the application of xylitol to the oral cavity and tooth surfaces in the young infant at a time when *Strep. mutans* colonization is beginning, perhaps shifting the microbial population toward the xylitol resistant strains that are less cariogenic. Another concern is the difficulty many parents have in initiating twice daily brushing in their uncooperative one year olds. The dental wipes should facilitate the conditioning of the infant to accept brushing more readily as they grow and develop. We believe Spiffies will serve to augment current oral hygiene practices in infancy, and ultimately improve the oral health of children around the world.