

XYLITOL

The Science, Evidence and Clinical Consideration

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Dental caries continues to be the most common chronic disease among children between the ages of five and 17¹ inciting growing concern amongst dental professionals. It is estimated that 59 per cent of children in this age group are affected with tooth decay. Furthermore, research indicates that the prevalence rate of caries increases steadily across the human life span.²

As dental hygienists dedicated to prevention of oral disease, we are often confronted with evidence-based decision making regarding chairside protocols accompanied by the responsibility of complementing with efficacious home care recommendations. It is not often that we can confidently recommend a product that has over 30 years of clinical study, no known toxicity to mankind and is a product found in nature.

The product is Xylitol; one of nature's most powerful weapons against dental caries.

The American Academy of Pediatric Dentistry (AAPD) has recognized the benefits of caries strategies implementing Xylitol. The recommendations were based on the overwhelming clinical data which underline the caries reduction effects of Xylitol. Their goal was to "assist oral health-care professionals make informed decisions about the use of Xylitol-based products in caries prevention." The Canadian Dental Association also encourages the regular use of sugarless gums, especially those containing Xylitol, to stimulate saliva and reduce the acidogenic potential of plaque.³

Before examining the benefits of Xylitol, we must first consider the caries process and the necessary components required to initiate the disease. The three required elements are fermentable carbohydrates such as cooked starch and glucose, which produce acid upon breakdown, susceptible dental enamel and cariogenic oral bacteria. The susceptibility of an individual to the caries process is multi-factorial, including diet, eating patterns, resistance of the tooth surface and the salivary flow rate.

Diet and eating patterns present an opportunity to control risk factors. Seizing this opportunity, food manufacturers have routinely used sugar substitutes to manufacture confectionery and other sweetened products which are deemed "safe for teeth." To date, Xylitol is the only one that is clinically proven to be beneficial to oral health with regular use.⁴

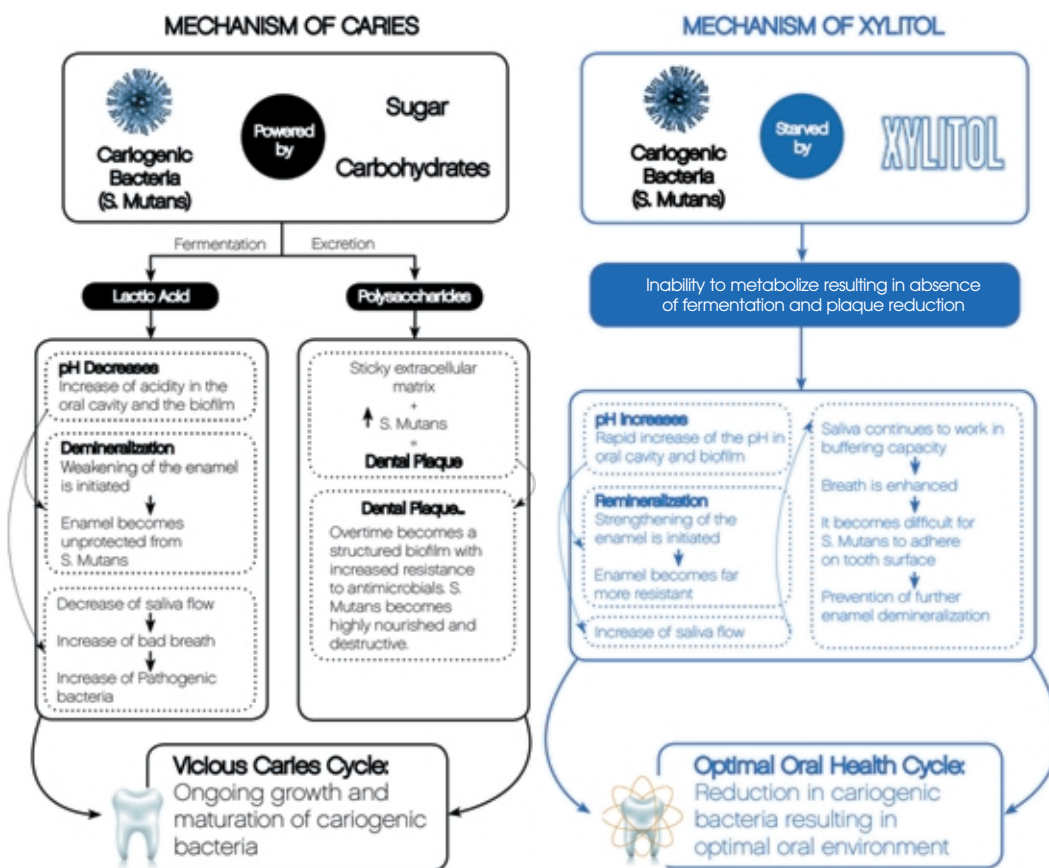
The following are frequently asked questions related to Xylitol, its mechanism of action and clinical consideration.

Xylitol 101

Q. What is the predominant bacterium implicated in the caries process?

A. *Streptococcus mutans* is a gram-positive bacterium and early colonizer playing a major role in the development of dental caries. *S. mutans* has an ability to metabo-

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lize sucrose to lactic acid creating an acidic environment whereby the mineralized surface of tooth enamel becomes more vulnerable to decay.

Q. What does the role of sucrose and other sugars have in the caries process?

A. Sucrose is utilized by *S. mutans* to produce a sticky, extracellular polysaccharide matrix creating an ability for superior adhesion to the tooth surface. Sucrose is the only sugar that *S. mutans* can use to form this sticky polysaccharide. Other sugars such as glucose, fructose and lactose are also digested by *S. mutans* resulting in the production of lactic acid, in turn leading to tooth decay.

Q. What is Xylitol?

A. Xylitol is a five-carbon sugar alcohol naturally present in many fruits and vegetables as well as being produced inside the human body. In contrast, other sugar substitutes such as saccharine or aspartame are synthetic and produced by various chemical pathways.

Q. How does Xylitol work?

A. Xylitol directly interferes with the *S. mutans* halting their growth and preventing them from further adherence and colonization on the tooth surfaces. *S. mutans* are unable to metabolize Xylitol and 'starve' resulting in an absence of fermentation. Therefore the pH of the plaque/biofilm does not lower, preventing further enamel demineralization. Xylitol contributes to a further reduction in plaque on the tooth surface.

Q. Are all Xylitol-containing products of equal therapeutic value?

A. Often an endorsement of a sugar-free chewing gum is based on the finding that the physical action of chewing the gum after eating stimulates salivary flow, increasing the buffering capacity on acids. This property is not unique to Xylitol-sweetened gum. Xylitol provides a far greater therapeutic value and clinically proven reduction in caries susceptibility.

Some of the consumer available advertised Xylitol products also contain other listed sugar substitutes such as sorbitol. There is no clear labelling to identify the amount of actual Xylitol and its ratio to other sugar substitutes listed.

Independent laboratory testing determined that Trident® contained approximately 0.17 grams of Xylitol in each piece, relying on sorbitol to be the predominant sweetener. The ingredients are listed in the following order; Sorbitol, Gum Base, Xylitol, Glycerin, Manitol...

The American Association of Paediatric Dentistry (AAPD) "encourages Xylitol-containing products to be labelled clearly to enable dentists and consumers to evaluate fully their therapeutic value."⁵

Q. Is there strong scientific evidence to support Xylitol?

A. The first clinical trials were conducted in the late 1960s and early 1970s in Finland⁷ showing promising results when sucrose was substituted with Xylitol in the diet of

125 adult volunteers over a study period of two years. During this time, almost no new carious lesions developed among subjects in the Xylitol group, with carious lesions noted in the sucrose and fructose groups.

Extensive clinical trials over a duration of 40-months were conducted in Belize testing the ability of Xylitol to prevent new caries or remineralize existing lesions in comparison with other sugar alcohols. Results demonstrated that the gum that was most effective in preventing caries was a 100 per cent Xylitol-sweetened pellet.⁸

In the *Journal of the American Dental Association*, Vol. 137 February 2006, after conducting a comprehensive literature review through a Medline search, the following conclusion was made.

"The evidence is strong enough to support the regular use of Xylitol-sweetened gum as a way to prevent caries and it can be promoted as a public-health preventive measure."

— *Journal of the American Dental Association*, Vol. 137 February 2006

Q. How does the efficacy of gum sweetened with Xylitol compare to gum sweetened with sorbitol?

A. The most commonly used sugar alcohol or polyol used as a standard sweetener in several sugar-free chewing gums and over-the-counter medicines is sorbitol. Sorbitol is 60 per cent as sweet as sucrose and is much less expensive than Xylitol. Sorbitol is less effective than Xylitol in controlling caries, but its lower cost makes it appealing to food manufacturers.

Sorbitol should be considered a low-cariogenic sweetener rather than a non-cariogenic one because consumption of larger amounts (more than two sticks of chewing gum per day) increases both the acid production in plaque and the number of sorbitol-fermenting micro-organisms. Sorbitol in a solution, such as in a soft drink, can be fermented, though slowly, by *mutans streptococci*. Cariogenic micro-organisms can "learn" to metabolize sorbitol when their sugar supply is restricted.⁶

COMPARATIVE PROPERTIES OF XYLITOL, SORBITOL, SUCROSE & FRUCTOSE				
Sweetener	% Relative Sweetness vs Sucrose	Calories (kcal/g)	Laxation Threshold (g/day)	Cooling Effect Heat of solution (cal/g)
XYLITOL	100	2.4	50-90	-36.6
Sorbitol	60	2.6	50	-26.5
Sucrose	100	4.0	> 100	-4.14
Fructose	117	4.0	50-70	n/a

Q. Can infants become infected with *S. mutans* through oral transmission from their mothers?

A. It is a well-known scientifically studied fact that infants commonly become infected with *S. mutans* through oral transmission from their mothers. Numerous studies have been conducted including a study in Finland involving 195 mother-infant pairs

in which all of the women had high levels of salivary *mutans streptococci*.⁹ A statistically significant reduction in colonization of *mutans streptococci* was observed in the teeth of the children whose mothers regularly chewed Xylitol-sweetened gum compared with those of the children whose mothers received fluoride or chlorhexidine varnish treatment. The children themselves received no preventive treatment and were examined annually for caries until five years of age. In children aged five, the caries rate for those in the Xylitol group was about 70 per cent lower than for those in the fluoride or chlorhexidine group. *Mutans streptococcus* colonization in children aged two years was related significantly to each child's age at the first caries in the primary dentition.

"Collectively, clinical studies provide evidence of the effectiveness of Xylitol-sweetened gum in reducing maternal transmission of cariogenic bacteria."⁶

Q. Is Xylitol safe?

A. Long-term clinical studies have proven the safety of Xylitol. The European Food Safety Authority delivered the following opinion in October of 2008: "Xylitol reduces the risk of caries in children. Chewing gum sweetened with 100 per cent Xylitol can easily be consumed as part of a balanced diet." The use of Xylitol-containing gum or other Xylitol-containing products is recommended for parents, caregivers as well as pregnant women four to five times per day to decrease the cariogenic bacterial load and risk of transmission to children.¹⁰

Q. Is Xylitol recommended for use by diabetics?

A. Xylitol possesses approximately 40 per cent fewer calories making it a low-calorie alternative to table sugar. Absorbed more slowly than sugar and metabolized independently of insulin, it does not contribute to high blood sugar levels or the resulting hyperglycemia caused by insufficient insulin response.

Xylitol has long been used as a sweetener in the diabetic diet; diabetic patients have been found to consume up to 70 g Xylitol per day without any adverse reactions.

These Xylitol levels by far exceed those recommended for dental purposes.¹¹

Q. How much Xylitol is required to be effective?

A. Research shows that we need approximately six to eight grams of Xylitol daily to fight tooth decay. The most beneficial time to use Xylitol is when we are at greatest risk; after meals, snacks and soft drinks. Because Xylitol comes in gum and mints, it can be used conveniently at these critical times.

Studies suggest Xylitol intake that consistently produces positive results ranged

from four to 10 grams per day divided into three to seven consumption periods. Similarly, consumption frequency of less than three times per day at optimal Xylitol amount showed no beneficial effect.⁵

It is clear that an optimal oral health system would contain the therapeutic value of 100 per cent Xylitol.

This would prove beneficial to those in our client population who are seeking a natural alternative and preventive method to proactively reduce their caries risk. RPN

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