

The Power of Sour Candies

A dental hygienist's battle against dietary dental erosion

Dental erosion from dietary acids found in many sour acid candies is finally no longer being ignored. Described on packages as “sour,” “tart,” “tangy,” “mouth-puckering,” and “extreme,” these candies are coated with or contain acids that can cause a host of oral health problems. Emerging scientific research and review articles link them to erosion of hard tooth surfaces and have raised awareness about the problem. Slowly but surely, recognition, concern, and education about the destructive effects of this popular candy are growing.

This author has seen an increase in erosion, even in patients who have excellent oral hygiene. These irreversible changes are probably caused by an increased frequency of the consumption of sour candy. Some patients accelerate tooth erosion by washing down sour candies with sodas, sports/power drinks, fruit-flavored bottled waters and iced teas – all low pH beverages. This is a powerfully destructive combination.

What is Dental Erosion?

Dental erosion is defined as the “chemical dissolution of the surface of dental hard tissues by acids without the involvement of microorganisms.”¹ It can be *extrinsic*, caused from the consumption of foods and beverages that contain dietary acids, or *intrinsic*, from gastric acids that reach the mouth due to reflux or regurgitation disorders or vomiting. When salivary pH levels drop to 5.5 or below, calcium citrate complexes form and etch the enamel surfaces, and this process results in a loss of calcium. Because of this superficial decalcification, the remaining demineralized enamel or dentin becomes more susceptible to the effects of abrasion or attrition.²

While tooth erosion is hard to spot in the early stages, there are some warning signs. One of the earliest stages of dietary erosion can be seen as a loss of luster of the enamel surface, with a grainy texture that can be felt by a dental explorer. Typically this appears on the facial surfaces of anterior teeth. As erosion

progresses, researchers have demonstrated that the enamel erosion appears smooth, with a shining glazed surface. On anterior teeth, the incisal edge appears thinner and more translucent. Erosion on the facial aspects of teeth appear as a ridge of enamel that



Dental erosion on molars

separates the defect from the marginal gingival while occlusal erosion is characterized by rounded cusps and concavities, sometimes referred to as cupping.³ As the occlusal erosion progresses, a distinct grooving of the cusps are visible and restorations will rise above the level of the adjacent tooth surface.

In children and adolescents, consumption of extrinsic dietary acids is the major cause of erosion as well as tooth loss.⁴⁻⁵ This is most likely due to the destructive combination of low pH and immature tooth enamel and dentin. Primary teeth are more susceptible because of the thinner enamel and dentin layers compared to permanent teeth.³ Despite the significant enamel damage seen with erosion, dental caries is not often seen until the late stages of the condition, when dentin is unable to withstand the acid challenges.⁶

Role of Saliva

Saliva contains several biological properties that protect the hard tissues from the dental erosive process. These include salivary clearance related to flow rates, buffering capacity, and remineralization capacity of stimulated and unstimulated saliva.⁷ Studies have demonstrated that individuals with higher erosion often have low salivary flow rates, high unstimulated salivary urea concentration, & low unstimulated buffering capacity.⁷⁻¹¹

Salivary pellicle is a physical barrier composed of a protein layer that acts as a diffusion barrier. It has been shown to protect the enamel surface greater than the dentin surface against short-time acid exposure.⁷ Therefore, saliva is less protective when dentin has been exposed, such as in older people.

In a recent laboratory study, investigators were able to demonstrate that, although saliva is generally protective against the erosive effects of original flavor candies, it is less likely to protect against the erosive effects of sour candies.¹²

Sour Candies

Sour candies have been available in the United States for over 60 years. Brands such as Lik-M-Aid and Pixy Stix were followed soon after by less messy versions such as Smarties® and SweeTarts®. Citric acid was a common ingredient in these first generation tart candies and continues to be popular today. Citric acid is the most erosive component found in foods and beverages because of its ability to chelate calcium even in the presence of higher pH



Remember sour candies as ACIDD
(Acid Candy Incites Dental Demineralization)

levels.^{6,8,13} Sour candies not only contain a variety of acids, but are coated in acid. Acids in sour candies found alone or in various combinations and unknown concentrations are created by an ingenious process called powder acid blending, dusting or encapsulated acid techniques. The popularity of these sour

candies stems from the more intense or longer lasting tangy flavor compared with original flavor candies.¹²

Manufacturers usually add a combination of different acids to achieve the desired sourness and candies are either filled with the acidic mixture or rolled in an acidic powder. Candy acids commonly used today include ascorbic, acetic, adipic, citric, fumaric, lactic, malic and tartaric.¹² Other labeling ingredients include “acid cover names” such as: natural or artificial flavors, organic fruit juice extracts, pure juice concentrates, juice purees and juice pastes/pulp extracts.

Many of these popular sour candies have been tested to determine their pH and the results are astounding (Table I). Some candies’ pH levels approach the level of battery acid (1.0). For testing, a calibrated electronic pH meter is utilized. The candy is dissolved in tap water (neutral pH of 7.8). The pH of the sour gummy candy (e.g. gummy worms) ranged from a high of 3.5 to a low of 2.4; sour chewy candy (e.g. Sour Skittles®) ranged from 2.5 to 1.9; sour hard candy (e.g. Warheads®) ranged from 3.4 to 1.6; sour powder/crystals/granules (e.g. Pixy Stix powder) ranged from 2.4 to 1.8; and sour spray candy (e.g. Quick Blast™ Sour Spray) ranged from 4.0 to 1.3. Sour flavored chewing gums, some sugar-free, are growing in popularity and preliminary pH testing suggests a pH range of 4.0 – 1.9 depending on the brand. Fruit-flavored cough drops and children’s chewable vitamins are also concerning as they have shown to have a low pH.

Although the harmful effects of acidic beverages such as soft drinks, fruit drinks and sports drinks have been well documented, there is relatively little research on the erosive potential of sour candies.^{12, 14-15} Researchers have hypothesized that since sour candies are held in the mouth for longer periods of time, their erosive potential is much greater than beverages.¹² Patients who are at high risk for dental caries due to low pH are also at high risk for dental erosion. This would especially be true with those patients who have poor saliva buffering capacity because their saliva is not able to overcome the acidic challenge that results from sucking on sour candies.¹⁶

Preventive Strategies

The first line of defense against dietary dental erosion is to eliminate the consumption of acidic candies, foods, and beverages. If this is not possible, here are some additional strategies to suggest to your patients:

- Do not suck, chew, stack or park sour candies for long periods of time.
- Swish or rinse mouth immediately with water after eating sour candies.
- Milk or hard cheese after eating sour candies will help to neutralize the acid.
- Chewing sugar-free natural mint gum (peppermint, spearmint and mint) with xylitol will help to stimulate salivary flow which protects tooth enamel. Try to avoid natural/artificial fruit-flavored gum.
- Wait 30 minutes to one hour after eating sour candies to brush teeth to avoid scratching the acid-softened tooth surface.
- Use a fluoride or an enamel enhancing toothpaste with low abrasiveness to decrease damage to the protective acquired pellicle.

Table I – pH of Popular Sour Candies*

Name	pH
Water	7.8
Orbitz® gum Raspberry Mint	4.0
Tic Tacs® Citrus Twist	3.4
Trident Layers™ with real fruit Green Apple or Golden Pineapple flavor	2.9
Sour Patch® Kids	2.4
Sour SweeTarts®	2.4
Jelly Belly® Sours	2.4
Starburst® Sours	2.4
Blast Pop Super Sour Dippn’ Powder	2.4
Pixy Stix	2.3
Ice Breakers® Sour (sugar-free)	2.2
Sour Skittles®	2.2
Jolly Ranger® Sour Bolt Blast	2.2
Bubble® Yum bubblegum Sour Apple Berry with “sour crystals”	1.9
Mentos® The Chewy Mint (green apple)	2.7
Warheads® Extreme Sours	1.6
Quick Blast™ Sour Candy Spray	1.3
Battery Acid	1.0

*As tested by Erika B. Feltham, RDH

Continued on Page 18

In-office treatments should consist of application of high-concentration fluoride agents such as foams, gels or varnishes. Recent in-vitro and in-situ studies suggest the application of high-concentration fluoride might lead to the reduction of dental erosion in at-risk populations but clinical studies have yet to support this.¹⁶ The use of calcium phosphate products such as casein phosphopeptide amorphous calcium phosphate (CPP-ACP) has been shown to significantly reduce enamel erosion in-vitro.¹⁷ It is important to note that there is a lack of research on these types of calcium rich agents and their effects on enamel erosion in patients.

New research suggests that calcium fortification of acidic candies decreases the erosion potential of sour candies. The study revealed that saliva produced by sucking on fortified candies was significantly less likely to dissolve hydroxyapatite crystals in-vitro.¹⁸

Conclusion

The combination and concentrations of candy acids fall below the Food and Drug Administration radar of evaluation and needs to be revised under the 1958 GRAS (generally recognized as safe) guidelines. At a minimum, pH warnings on sour candy labels should be required to caution consumers about the acid levels and potential harm to the oral hard structures. Currently soft tissue warnings can be found on some sour candy labels. Soft tissue heals itself, whereas hard tissue does not. Tooth enamel is about the thickness of a dime and is intended to last an entire lifetime. Once enamel or dentin is eroded, it is irreversible.

Early diagnosis and prevention of the effects of tooth erosion are fundamental to keeping teeth healthy for life. Increased public awareness is needed for this important erosion prevention and the dental hygienist is in the perfect position to lead the charge against these destructive candies.

About the Author:

Erika B. Feltham, RDH, is dedicated to providing the best possible care for her patients. She has been active in the dental profession for over 27 years, graduating from Pasadena City College. A 2008 ADHA/ Johnson & Johnson Hygiene Hero award recipient, Erika has been passionately educating patients and other dental professionals about the harmful effects of sour candies for over a decade. Along with the San Diego component, she is responsible for presenting the resolution on sour candy labeling at the 2009 CDHA House of Delegates. Erika lectures extensively on dental erosion and can be reached at: erikafeltham@mac.com



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