Nutrition

Dietary assessment and counseling for dental erosion

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ABSTRACT

Background and Overview. Dental erosion occurs after exposure to intrinsic or extrinsic acids. Exposure to intrinsic gastrointestinal acids is associated with anorexia nervosa, bulimia nervosa, rumination syndrome, or gastroesophageal reflux. Extrinsic dietary acids from foods or beverages also can cause erosion, particularly when exposure is prolonged by holding or swishing behaviors.

Conclusions. Clinicians should screen patients exhibiting dental erosion for anorexia nervosa, bulimia nervosa, rumination syndrome, and gastroesophageal reflux disease. Clinicians should screen patients without a medical explanation for their erosion for exposure to acidic foods and beverages, particularly for habits that prolong exposure.

Practical Implications. Identification of intrinsic and extrinsic acid exposures and recommendations to minimize exposures are important to prevent erosion and maintain oral health.

Key Words. Erosion; diet; anorexia nervosa; bulimia nervosa; gastroesophageal reflux.

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Dental erosion occurs when enamel or dentin tooth structure is lost during exposure to acids. Scientific reports in which the investigators cite increasing prevalence and severity of erosion[1-3] have led to increased media attention regarding dietary risk factors for erosion, as well as marketing of over-the-counter oral health care products designed to reduce the risk of developing erosion. My objectives in this article are to describe the multifactorial causes of erosion, critique the science supporting dietary risk factors for erosion, and provide oral health care practitioners with strategies to screen and counsel patients at risk of developing erosion.

BACKGROUND

Dental erosion is defined as the dissolution with subsequent removal of minerals from enamel or dentin during exposure to acids.[4] Acids can be of either intrinsic or extrinsic origin. Exposure to intrinsic acids of gastrointestinal origin occurs during episodes of vomiting or rumination (that is, regurgitation, rechewing, and reswallowing recently ingested food) or is associated with gastroesophageal reflux (Box 1).[5-9] Although episodes of vomiting associated with bacterial or viral gastrointestinal infections are typically of short duration and, hence, unlikely to contribute to erosion, vomiting associated with anorexia nervosa or bulimia nervosa is associated with erosion.[5-7] Both rumination syndrome and chronic, untreated gastroesophageal reflux also can contribute to overt erosion.[8-10] People with silent (that is, asymptomatic) gastroesophageal reflux may not recognize reflux symptoms and are at increased risk of developing erosion. Pregnancy, obesity, and alcoholism increase the risk of developing gastroesophageal reflux,[4,11] and particular food or beverage items increase reflux episodes in people with gastroesophageal reflux.

Extrinsic acids associated with erosion are typically of dietary origin (Table 1),[11-18] although pool water and environmental exposures also have been associated with erosion.[4] Many fruits, tomatoes, and "spicy" foods are acidic; however, the pH values and buffering capacities of most foods are not readily available.[12,13] Investigators have reported the pH and buffering capacities of fruit juices, carbonated beverages, energy drinks, sports drinks, and teas commonly consumed in the United States.[14-19] Investigators have studied the erosion potentials of many beverages and sour candies

Box 1: Medical conditions associated with erosion.*

MEDICAL CONDITIONS

Anorexia nervosa
Bulimia nervosa
Gastroesophageal reflux
Rumination disorder
Xerostomia

*Sources: Hermont and colleagues,[5] Otsu and colleagues,[6] Johansson and colleagues,[7] Kessing and colleagues,[8] and Holbrook and colleagues.[9]

Table 1. Potentially erosive foods and beverages.*

CATEGORY	FOOD OR BEVERAGE	APPROXIMATE pH
Beverages		
	Energy drinks	2.6-3.6
	Flavored waters	3.0-3.8
	Fruit juices	3.2-4.0
	Herbal teas	2.6-5.7
	Soda or pop	2.4-2.9
	Sports drinks	2.8-3.2
	Wine	3.0-3.9
Fruits		
	Apples	3.3-4.0
	Apricots	3.3-4.8
	Blueberries	3.1-3.3
	Cherries	3.3-4.5
	Grapes	2.8-3.8
	Grapefruit	3.0-3.8
	Limes	2.0-2.8
	Mangoes	3.4-4.8
	Oranges	3.7-4.3
	Peaches	3.3-4.1
	Pears	3.5-4.6
	Pineapples	3.2-4.3
	Plums	2.8-4.3
	Pomegranates	2.9-3.2
	Raspberries	3.2-4.0
	Rhubarb	3.1-4.0
	Strawberries	3.0-3.9
Vegetables		
	Dill pickles	3.2-3.7
	Sauerkraut	3.3-3.6
	Tomatillos	3.8
	Tomatoes	4.3-4.9
Other		
	Ketchup	3.9
	Sour candies	2.5-4.3
	Vinegar	2.4-3.4

*Sources: Quitadamo and colleagues,[11] New York State Agriculture and Markets,[12] Wagoner and colleagues,[13] Davis and colleagues,[14] Ehlen and colleagues,[15] Murrell and colleagues,[16] Hendricks and colleagues,[17] and Willershausen and colleagues.[18]

in vitro; acidic beverages and sour candies are clearly erosive in vitro.[13-18] Thus, the argument that acidic foods and beverages contribute to erosion is biologically plausible.

Although investigators in some studies have reported associations between intakes of carbonated beverages, fruit juices, or sports drinks and erosion in children and adolescents,[1,20-22] others have not.[23-25] However, most of these studies were cross-sectional, and the investigators studied a limited number of erosive candidates or did not consider behavioral (that is, eating behaviors, concurrent food intake) or medical (that is, eating disorders, gastroesophageal reflux) confounding variables of the erosive process. Investigators in a 2015 meta-analysis concluded that carbonated drinks, acidic snacks and sweets, and fruit juices increased erosion in children and adolescents.[26] However, they recognized that the investigators in the included studies measured intake frequency by using a variety of tools, did not assess quantity of intake, and did not consider comorbid conditions. Considerable heterogeneity noted among studies limits the usefulness of their conclusions. Thus, the in vivo literature does not support Hill's criteria for causation; the science lacks consistency, temporality, biological gradient, and strength.[27]

The lack of definitive evidence identifying acidic foods and beverages as causative of erosion should not be interpreted that dietary acids do not cause erosion. Rather, the lack of evidence highlights the inherent difficulties encountered when conducting dietary research and the necessity of considering comorbid conditions during such investigations. Rather than single out individual foods or beverages for investigation, a more comprehensive approach might be to consider food or beverage patterns. As with caries, exposure to the food or beverage item is the mechanistic link. Although many investigators have considered frequency, they have not considered the length of each exposure. Individual eating behaviors, including holding, pocketing, or swishing, also affect the nature of the exposure and the risk of developing erosion (Table 2).[1,4,19-23] The contact time between the offending item and tooth also