Diet and Dental Erosion

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Dental erosion (erosive tooth wear) is the result of a pathologic, chronic, localized loss of dental hard tissue that is chemically etched away from the tooth surface by acid and/or chelation without bacterial involvement.[1] Acids of intrinsic (gastrointestinal) and extrinsic (dietary and environmental) origin are the main etiologic factors. Tooth wear including dental erosion is not a new phenomenon, but it is receiving increased attention because levels of dental caries have been decreasing in many industrialized societies.

The prevalence of dental erosion changes with age and seems to depend on the society a person lives in, which could explain in part the large between-study variations (for a review, see Nunn[2]). The progression (severity?) of erosion seems to be greater in older (52 to 56 y) than in younger (32 to 36 y) adults and has a skewed distribution in which a small proportion of the population has the most severe levels of erosion and the majority has low levels of erosion.[3]

In the study by Lussi and Schaffner,[3] the group with high progression (severity?) had the following significant differences compared with the group with small progression: intake of dietary acids ($P < 0.01$), the buffering capacity of stimulated saliva ($P < 0.02$), and the bristle stiffness of the toothbrush ($P < 0.01$). The dietary habits of the high-progression group changed very little between the first and second examinations despite discussions with patients about the dangers of erosive foodstuffs. Overall, the high-progression group had four or more acid intakes per day. An intake frequency of the same magnitude has been associated with an increased risk for erosion in children.[4]

It is well known that acidic food and drink can soften dental hard tissues.[5–8] In 2000, the consumption of soft drinks and fruit juices in England amounted to over 120 L per capita per year, representing on average of about 50% of the total individual fluid consumption (A. Rugg-Gunn, personal communication, 2001). The erosive activity of citric, malic, phosphoric, and other acids has been tested and demonstrated in many in vitro, in situ, and in vivo studies.[9–24]

Epidemiologic studies and numerous case reports have found diet to be an important etiologic factor for the development and progression of erosion.[3,17,25–28] In one study, 391 randomly selected individuals were investigated for dental erosion.[29] Data from interviews and multiple regression analyses associated the consumption of citrus fruits and fruit drinks with the presence of erosion of facial tooth surfaces (surfaces adjacent to the cheek and lip) and occlusal erosion (biting surfaces). Chronic vomiting appeared to be most decisive factor for erosion on tooth surfaces adjacent to the palate. A case-control study of 106 cases of erosion showed the same pattern with citrus fruits, soft or sport drinks, apple vinegar, and vomiting associated with dental erosion.[27] Dietary acids most commonly affect the labial surface of the upper incisors (surfaces adjacent to the lips).[29] This could be due to the slow clearance of acids at this site.

Excessive consumption of acidic food and beverages may produce dental hard tissue erosion. However, chemical, biological, and behavioral factors influence the development of dental erosion and are summarized in Table I.

When dental erosion is clinically detected or when there is indication for an increased risk, risk assessment should be undertaken. A very important part is the case history. However, chairside interviews are generally not sufficient to determine dietary habits leading to erosion because patients may be unaware of their acid ingestion. Therefore, it is advisable to have such patients monitor their complete dietary intake for 4 consecutive days, including a weekend day, because dietary habits during weekends can differ considerably from those during weekdays. Patients should record, in writing, the time, quality, and quantity of all ingestions including diet supplements such as vitamin C tablets or solutions, iron tonics, and acidic candies (excessive consumption of the latter combined with a low salivary buffering capacity may aggravate existing erosive lesions).[24,30,31] The dietary record should be sent to the dentist before the next appointment to enable analysis. In addition to estimating the erosive potential of different foodstuffs and drinks and taking into account the various parameters mentioned above, the dentist should analyze the frequency of ingestion of acidic (and of sugar-containing) foodstuffs with main meals and in-between snacks and estimate the duration of the acid challenge. In summary, it is important to know how, how often, how much, and when a particular drink or foodstuff is ingested. If

TABLE I.

FACTORS INFLUENCING DENTAL EROSIVE POTENTIAL WITH RESPECT TO FOOD AND BEVERAGES

Chemical factors
pH and buffering capacity of the product
Type of acid (pKa values)
Adhesion of the product to the dental surface
Chelating properties of the product
Calcium concentration
Phosphate concentration
Fluoride concentration
Biological factors
Saliva: stimulation capacity, flow rate, composition, buffering capacity, pH
Acquired pellicle: diffusion-limiting properties and thickness
Tooth composition and structure (e.g., fluoride content as FHAP or CaF_2-like particles)
Dental anatomy and occlusion
Anatomy of oral soft tissues in relationship to the teeth
Physiologic soft tissue movements
Behavioral factors
Eating habits
Healthier lifestyle: diet high in acidic fruits and vegetables
Excessive consumption of acidic foods and drinks
Nighttime bottle feeding with acidic beverages
Strenuous sporting activities
Dieting
Oral hygiene practices

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there is still doubt as to the etiology, the patient should be asked specifically with the use of a check list. In this context, it should be kept in mind that the buffering capacity and the flow rate of saliva have to be taken into account when estimating a patient's risk for the development or progression of erosive lesions.

Based on such analyses, realistic preventive programs can be suggested. These aim to reduce acid exposure by decreasing the frequency of ingestion of potentially harmful drinks and foodstuffs and reduce contact time by rapid consumption rather than sipping or using a straw. An optimal fluoride regime should be recommended for each patient. It must be emphasized that diet-related erosions cannot be fully explained by the ingestion of acidic foodstuffs and beverages. Additional factors such as salivary parameters and oral hygiene habits may be important.

For individuals at risk for erosive tooth wear, we recommended postponing toothbrushing after consuming erosive foodstuffs or beverages to minimize loss of enamel. For subjects prone to caries, the risk of enhancing carious lesions by postponing their tooth cleaning may be too high because of the rapidly decreasing plaque pH after ingestion of sugar-containing foods or beverages. Possible supplementary measures to minimize the risk of tooth erosion include rinsing with water to dilute acids, rinsing with fluoride solutions to enhance remineralization, and chewing gum to stimulate the secretion of saliva.

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