Dental health; the relationship between tooth decay and food consumption

Ángel Miguel González Sanz, Blanca Aurora González Nieto and Esther González Nieto

1 Senior Lecturer in Preventative Dentistry and Gerodontology, University Rey Juan Carlos. Madrid.
2 Associate Professor of the University’s ‘Expert in Advanced Dentistry for General Practice Dentists’. University Rey Juan Carlos. Madrid.

Abstract

Although the reduction and prevalence of dental caries in many countries has been largely associated with the use of fluorine and improving dental hygiene, eating habits also play a role in the development of caries. Fermentable carbohydrates characteristics of the food, rate of consumption, food protectors, the quality and quantity of saliva indices that determine the remineralization of teeth are factors to be considered. All these elements are analyzed through the sociodemographic, behavioral, physical and biological environment directly or indirectly with diet and caries.

Key words: Diet. Caries. Risk. Remineralization. Hygiene.

SALUD DENTAL; RELACIÓN ENTRE LA CARIES DENTAL Y EL CONSUMO DE ALIMENTOS

Resumen

A pesar de que la reducción de la incidencia y prevalencia de la caries dental en muchos países se relaciona en gran medida con el uso sistemático del flúor en las pastas dentífricas y la mejora de la higiene dental, se debe tener presente la importancia de los hábitos alimentarios en la prevención primaria y secundaria de la caries dental. En este sentido, destacan los carbohidratos fermentables, determinadas características de los alimentos, la frecuencia de consumo, distintos tipos de alimentos, algunos como factores protectores, la cantidad y la calidad de la saliva, en tanto que ello determina el índice de remineralización de los dientes etc. Todos estos elementos son analizados a través de los factores sociodemográficos, de comportamiento, físico-ambientales y biológicos relacionados directa o indirectamente con dieta y caries.

Key words: Dieta. Caries. Riesgo. Remineralización. Higiene.

Abbreviations

DMFT index: The rate of tooth decay resulting from the calculation of decayed teeth, those missing and filled due to tooth decay, for each permanent tooth.

DMF index: The rate of tooth decay resulting from decayed or filled teeth due to tooth decay, for each deciduous tooth.

CPI of sucrose; the Cariogenic Potential Index. The standard is sucrose with a value of 1.

CH: Carbohydrates.

HLA-DR: The HLA system (human leucocyte antigen, as it was initially only used to ‘classify’ leucocytes) consists of a cluster of genes located in the human chromosome 6. Class II HLA genes: They contain at least three loci, HLA- DR, HLA-DQ and HLA-DP, and all of them have corresponding alleles.

TCL: Total Cariogenic Load. It defines the individual net effects from assessing the risk factors (cariogenic potential, frequency of consumption, etc) together with the protective factors (intrinsic, hygiene, fluoride, sealants, etc).

Introduction

In general, the dietary factors in the aetiology of tooth decay are currently being played down, in favour of promoting hygiene and the adequate use fluoride. Since the widespread use of fluoride, some authors...
have even questioned the relationship between high sugar consumption and the incidence of tooth decay. However, it should be taken into account that in young children dental hygiene and the use of fluoride is often unsatisfactory and/or insufficient, and therefore, it is during this phase of dental development that dietary habits seem to be more important when it comes to preventing the appearance of tooth decay. Something similar occurs in the elderly, where there is a reduction in salivary secretion, which is secondary to the multi-medication and multiple pathologies that are associated with this age group.

Diet is not just important for general health, but also for oral health. If an appropriate diet is not followed, it’s more likely that we will develop tooth decay and gum disease. This applies at any stage in life, for example, acquiring healthy eating habits is essential to prevent the development of tooth decay, amongst other things, in children. Similarly, pregnant women need a suitable diet so that their children develop normal teeth. Socio-economic factors and even obesity are identified as risk factors for developing tooth decay.

In children there is a particular relationship risk between the presence of malnutrition, tooth decay and the timeline of its appearance. Malnutrition adversely influences craniofacial growth and development, and an adverse precedent that can have various consequences, including: changes in the quality and texture of certain tissues (bone, periodontal ligament and teeth). There is a significant connection between oral health and nutritional status (failure to thrive) which could determine higher rates of tooth decay, a higher prevalence of gingivitis in children and an increase in the frequency of malocclusions. There are enamel defects associated with endocrine protein malnutrition, hypocalcaemia, vitamin and mineral deficiencies, in the context of enteropathies (coeliac disease, non-specific diarrhoea). Dental enamel defects have also been reported secondary to an excess of, or poisoning by vitamin D, fluoride or other minerals.

Morbid obesity or its associated conditions or comorbidities (gastro-oesophageal reflux, antidepressants, high blood pressure, etc), cause increased incidences of tooth decay, changes in periodontal indices, the need for dental prostheses and monitoring of salivary flow (quantity and quality).

Tooth decay is one of the most prevalent infectious disease in humans and one of the main public health issues on a global scale. It is a disease where the teeth’s hard tissues are modified and eventually dissolved, a process where localised destruction of these tissues occurs due to the action of bacteria that are involved. Molecular decomposition occurs in the teeth’s hard tissues through a histochemical and bacterial process that ends in the progressive decalcification and dissolution of inorganic materials and the disintegration of its organic matrix. The formation of dental cavities starts in the form of small demineralised areas on the enamel’s sub-surface, which is able to progress through the dentine and reach the dental pulp, producing a chalky lesion on the surface of the enamel. If treatment is not carried out to remineralise the initial lesion, it could progress and turn into a cavity.

Demineralisation is the disorganisation of mineralised dental tissues due to the action of bacterial metabolism products and as a result of biochemical interchanges which take place in three phases: saliva, plaque bacteria and enamel.

The causes of tooth decay are multifactorial, although there are three key factors which will be added to in time: the host, microorganisms and diet. Environmental factors include, among other things, the presence or absence of health services and oral health programmes, socio-economic class, stress, ethnicity, culture, bio-dental engineering factors (biomechanical, biochemical and bioelectrical). The risk of tooth decay is due to socio-demographic, behavioural, physical/environmental and biological risk factors.

Diet plays a pivotal role in the development of tooth decay, particularly in people at risk. Usually, a combination of the high consumption of fermentable carbohydrates and the failure to include fluoride is associated with the increased incidence of tooth decay, however, there is no reason why it should occur in developed societies that have adequate exposure to fluoride and a history of low levels of tooth decay. Although there is no direct relationship between protein-energy malnutrition and tooth decay, vitamin (A, D), calcium and phosphorus deficiencies can cause changes in tooth development and delayed eruption. In protein-energy malnutrition, which is so prevalent in developing countries, a reduction in saliva immunoglobulin A has been detected, which could increase susceptibility to tooth decay (mucosal immunity has an impact via a reduction in secretory IgA).

Nevertheless, there are many epidemiological studies that correlate sugar consumption with the prevalence of tooth decay and which show a clear association between the frequency of consumption, eating between meals and developing tooth decay. Furthermore, there are a variety of food characteristics that may have an influence on their cariogenic potential, such as sucrose concentration, consistency, oral rinsing, the combination of foods, sequence and frequency of ingestion and food pH.

Foods are a chemical mixture of organic and inorganic substances that provide the human body with the nutrients necessary for its maintenance, growth and the development of its functions. Carbohydrates are currently seen as the cornerstone of a healthy balanced diet, followed by fats, whose consumption has decreased to prevent cardiovascular disease, and finally proteins. The current methods for preparing high carbohydrate foods have a great impact on their physical and chemical structure. The carbohydrates found in foods are primarily: monosaccharides
individual characteristics such as chewing, the amount of foods and the solubility of particles, as well as other when saliva flow is greater and enables quick oral to limit sugar consumption during meal times, that most associated with developing tooth decay. The cooking and preparation of foods affects the carbohydrate composition of foods and has an influence on its cariogenic potential.

The frequency of consuming cariogenic foods, particularly between meals, has a strong relationship with the risk of tooth decay, because it favours changes in pH and lengthens the oral rinse time which increases the likelihood of enamel demineralisation. With regard to consistency and oral rinse there are various studies which have observed that certain foods, even those with a high sugar content, may have a greater solubility and are eliminated more quickly from the mouth, whereas foods that are high in starch (bread, cereals, potatoes) may increase acid production and are eliminated more slowly from the mouth.

Epidemiological studies show that breast milk and breast feeding helps physical and nutritional development in children, and has psychological, social, economic and environmental advantages, at the same time as significantly reducing the risk of developing a large number of acute and chronic illnesses. So, breast feeding, and as such, breast milk itself, is not cariogenic. However, various studies have shown that, in combination with other carbohydrates or administered more frequently at night or on demand, it is associated with early tooth decay. Tooth decay that develops as soon as the tooth erupts, on smooth surfaces, and which progresses quickly until it has had an extensive destructive impact on the teeth. For this same reason, the frequent use of bottles of juice or carbohydrates should be avoided. They can be filled with water, for example, using them more for soothing than feeding.

Tooth decay in preschool children is due to a combination of many factors, including the colonisation of cariogenic bacteria on teeth, the type of foods consumed as well as the frequency of the cariogenic bacteria’s exposure to these foods, and sensitive teeth. The risk of developing tooth decay is greater if sugars are consumed very often and are in a form that means the food stays in the mouth for long periods of time. Sucrose is the most cariogenic sugar as it can form glucan, a substance that enables bacteria to adhere better to the teeth and that diffuses plaque acid and buffers. The frequent, elevated consumption of drinks that have been sweetened with sugar and the absence of normal tooth brushing are considered to be the factors that most associated with developing tooth decay.

It is advisable to avoid snacking between meals and to limit sugar consumption during meal times, when saliva flow is greater and enables quick oral rinsing. This rinse period depends on the consistency of foods and the solubility of particles, as well as other individual characteristics such as chewing, the amount and qualities of the saliva, etc. It is very important to limit the frequency of cariogenic carbohydrate consumption outside of meals. So, foods that contain between 15 and 20% of sugars, especially sucrose, are the most cariogenic, particularly if they are eaten between meals. There are other carbohydrates such as fructose, that have greater sweetening properties than complete sucrose, but are less cariogenic. Similarly, Xylitol is not cariogenic as it is not used by bacteria to produce acid, and can even have an anti-caries effect as it increases saliva flow, raises the pH and reduces Streptococcus mutans levels because it interferes with its metabolism.

Furthermore, there are different foods that can have cariostatic effects. In animal studies it was observed that foods that contain high levels of fat, protein, calcium and fluoride can protect against tooth decay. Fats cover the tooth, reducing sugar and plaque retention, and may have toxic effects on bacteria. Proteins increase saliva’s buffering capacity and have a protective effect on enamel. Fats and proteins jointly raise pH following the consumption of carbohydrates. Another type of food that has this protective profile are those that, through chewing, stimulate saliva flow and thereby buffer pH acid and stimulate the remineralisation of enamel.

Sugar free chewing gums use non-caloric sweeteners that can help prevent tooth decay. The sweet taste and chewing stimulates saliva flow, which contributes to the prevention of tooth decay. These chewing gums can contain minerals such as calcium, phosphate and fluoride to improve the teeth’s remineralisation process. Some studies have reported that sugar free chewing gums, that are consumed after a meal, accelerate the cleaning of food debris and reduce the rate of developing tooth decay in children and adolescents.

It is important that adolescents reduce their elevated and frequent consumption of sugary drinks, as they are a factor that is particularly associated with tooth decay. Since diet is a factor that determines the development of tooth decay, adequate information needs to be provided to patients. It’s also worth remembering that an increase in sugar doesn’t just involve an increased risk of tooth decay but also a growing risk of obesity, and therefore a greater disposition for adults to suffer illnesses such as diabetes, cardiovascular (hypertension, cholesterol), respiratory (apnoea, asthma), orthopaedic (fractures) and liver diseases.

Establishing dental care in children, even during pregnancy and afterwards in newborns, is one of the most suitable strategies for preventing tooth decay, including dietary recommendations and instructions on how to practice proper dental hygiene once the first milk teeth have erupted. The predisposition to developing tooth decay varies among individuals and between different teeth in the same mouth. The shape of the jaw and oral cavity, the structure of the teeth and the quantity and quality of saliva are important in deter-
mining whether certain teeth are more predisposed than others.

On the other hand, it’s necessary to put systems in place to promote health using health education and information as the key, with specific dental programmes and programmes or strategies that involve a multidisciplinary team to pass on both dental and general healthy habits. Highlighting, in this sense, the existing education programmes for pregnant women, the oral health guidelines directed towards staff who work in nurseries and educational centres, the prescription of sugar free medications and the appropriate, simple and uniform labelling of foods by food companies.

Weaknesses

The lack of resources and capabilities, the lack of awareness, motivation and resistance to change; in terms of finding primary (avoiding the appearance of new caries) and secondary prevention strategies (avoiding the progression of existing caries and/or eliminating them where possible). The age and history of cavities are the main factors around which the others are centred.

Age affects the structure of teeth, as evidence of changes in tooth eruption and its effects shows, and because from a certain age it makes dental hygiene difficult/poor. There are three major periods in life when the risks of tooth decay reach their peak: between 5 and 8 years old, which affects the milk teeth and the first permanent molars; the period between 11 and 13 years, which affects the permanent teeth and between 55 and 65, when root cavities are more common.

Age affects the structure of teeth, as evidence of changes in tooth eruption and its effects shows, and because from a certain age it makes dental hygiene difficult/poor. There are three major periods in life when the risks of tooth decay reach their peak: between 5 and 8 years old, which affects the milk teeth and the first permanent molars; the period between 11 and 13 years, which affects the permanent teeth and between 55 and 65, when root cavities are more common.

The enamel of a recently erupted teeth is more vulnerable, 5-8 year olds (first molars) and 11-13 year olds (second molars) and susceptibility increases in the pits and fissures due to cleaning difficulties. Cleaning is more difficult until the teeth’s occlusal plane is established and provided that occlusion is correct. Initial lesions may appear in the posterior areas of permanent molars before they have straightened and after they have erupted (vestibular inclination of the upper and lower lingual molars).

There is an increased prevalence of tooth decay in the maxillary central incisors: the incisive papilla is located near the mesiopalatal surface of these teeth and retains more plaque. It is the same for the vestibular fossae of the lower molars and the palatal fossa of the upper molars.

Widespread tooth decay can be found (large, destructive, unrestricted, in uncommon places) in milk teeth during the first year of life due to breastfeeding, medicines and sweetened pacifiers. Mothers with tooth decay contaminate the milk teeth of their children with streptococcus mutans, in particular orally (pacifiers, spoons for trying food, kisses, mouth to mouth contact, etc.).

Table I

<table>
<thead>
<tr>
<th>DMFT</th>
<th>Prevalence levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-1.1</td>
<td>Very low</td>
</tr>
<tr>
<td>1.2-2.6</td>
<td>Low</td>
</tr>
<tr>
<td>2.7-4.4</td>
<td>Moderate</td>
</tr>
<tr>
<td>4.5-8.5</td>
<td>High</td>
</tr>
<tr>
<td>+6.6</td>
<td>Very high</td>
</tr>
</tbody>
</table>

Pit and fissure tooth decay is more frequently associated with tooth decay in mixed dentition. Children whose primary teeth are free from tooth decay tend to have decay-free mixed dentition. Children who have proximal caries in their primary teeth tend to develop new lesions on the smooth surfaces of their mixed dentition.

Occlusal surface tooth decay is more common in permanent teeth and root decay is more common in adults, accompanied by gingival recession.

Tooth decay is usually measured using the DMFT index from 12 years of age (decayed teeth + cavity filling + missing teeth due to decay per tooth) and the DMF index is used for deciduous teeth (Table I).

Threats

High risks and environmental changes are the most serious threats.

Socio-economic status has a negative correlation with the risk of developing tooth decay; the higher the economic status, the lower the incidence and prevalence of tooth decay. Increased immigration and unemployment give rise to an increased risk of developing tooth decay. There is usually a less positive attitude towards dental health and healthy eating, mainly due to the socio-cultural and economic costs involved. A decrease in the use of dental products and the reduced attendance of dental appointments, as well as an increase in dysfunctional families, causes tooth decay.

Culture and religion are also factors that should be considered, as well as cultural levels, longer breastfeeding or increased dietary fat consumption.

Geographical location, in addition to affecting cultural and religious aspects, determines socio-demographic characteristics, such as sugar availability or the concentration of fluoride and other minerals in water and/or soil. For example, it seems that the presence of selenium and cadmium promotes tooth decay. In hot countries, rates of tooth decay are lower, due to the sun and its positive influence on calcium and phosphate metabolism, with the intervention of vitamin D.
Oral hygiene and eating habits are probably the most important.

Plaque bacteria are a prerequisite for the initiation of tooth decay, it’s mechanical and/or chemical removal helps control the risks associated with eating habits, and therefore oral health. A large number of microorganisms in the mouth, particularly in hard-to-reach areas; the production of different acids during bacterial metabolism with the ability to dissolve mineral salts which are part of the tooth’s structure, retaining factors (open cavities, overflowing tooth fillings, fixed or removable prostheses, orthodontic appliances, gingival recession, etc.) are part of a series of threats that healthy teeth are regularly exposed to. The frequency and correct brushing of teeth, the use of additional hygiene devices such as dental floss or interproximal brushes are also determining factors. The frequency of brushing and being an immigrant have a significant association with the incidence and prevalence of tooth decay.

The truth is that diet plays an important role in the development of tooth decay (closely linked to the frequent consumption of carbohydrates and high cariogenic activity) and the fact is that frequency is more important than the amount consumed; there are authors who claim that sugar is not a causal factor in the etiopathogenic process of tooth decay, but it is a risk modifier. We found a statistically significant relationship (P < 0.05) between the colonisation of streptococcus mutans and feeding bottles containing sugary drinks. The stickiness and retention of food, in the hard and soft tissues, depends on the type of foods consumed. Fats in food reduce the oral retention period; liquid foods are eliminated a lot faster than solid foods. The food retention parameters and acid formation are important in the development of tooth decay, but they are not a good epidemiological indicator of tooth decay. Therefore, it is difficult to relate the cariogenicity of foods to an individual physical property, such as its buffering capacity or acid production. The physical form, the consistency and the frequency of consumption, as well as the sugar content (particularly sucrose, which is the standard), are major determinants of the cariogenic potential of foods. Sucrose and starch are found in many products we eat that are not related to their presence (examples are fruit, milk, bread, cereals and even vegetables). The key to eating properly is not to avoid these products, but to know how to eat the right amounts of them and at the right times of day (avoiding snacking between meals). It’s not just what you eat, but when you eat that makes a big difference to dental health.

The characteristics of foods that have an increased potential for causing tooth decay are: texture (the consistency of foods), taste, carbohydrate content and composition (direct, indirect or ‘hidden’, cariogenic potential (CPI of Sucrose = 1), prolonged retention (rinsing or clearance), intake during or between meals, protective factors (cheese, phosphates), consumption frequency (Critical pH: (5.2-5.5) that is expressed graphically by the Stephan curve, which relates the frequency of meals to the exposure time (Fig. 1).

In addition to carbohydrates, there is also a connection with: nutritional deficiencies, protein, vitamin and mineral deficiencies, a diet that reduces saliva secretion and composition, hypoplasia caused by nutritional deficiencies and widespread tooth decay.

Controlling high sucrose diets, the frequency of tooth brushing and social class are predictors for developing tooth decay. Regular brushing (2 times/day) with fluoride toothpaste may have a bigger impact in young people than restricting sugary foods.

Physical and environmental factors such as previous experience of tooth decay (which we have also commented on under weaknesses), the areas at risk and the arch form should also be taken into consideration.

In this section, with regards to tooth decay, we highlighted that: primary teeth, a previous history of treated or untreated tooth decay, numerous unmonitored initial caries lesions, the presence of initial caries lesions or white spots, rare cases of tooth decay in previous groups, more than three new lesions per year, poor or non sealing of specified pits and fissures are good risk indicators for the future development of tooth decay.

We have highlighted areas at risk and the dental arch form: premature dental extractions, multiple restorations, positioning of teeth in the arch (overcrowding, malocclusions,...), the composition of dental tissues and enamel maturation with fluoride uptake and carbonate, magnesium and sodium release, the tooth’s surface texture (cracks and/or flakes, developmental abnormalities, wear on the tooth’s surface (for example, prosthesis retainers).
The locations where tooth decay occurs most often in deciduous teeth are: the pits and fissures, the occlusal surfaces: in molars (primarily occlusal-buccal); buccal in canines and mesial in the incisors. The most affected areas are usually in the lower posterior molars, the upper posterior molars, the upper and lower anterior incisors. In permanent teeth the most common locations are the occlusal surface (buccal and lingual), especially the molars and subsequently the premolars.

Tooth decay in the pits and fissures is relatively easy to prevent with the use of sealants, which once they have been ‘filled’ prevent nutrients from entering and creating a bacterial biofilm. If the fissures are in the shape of a ‘U’, ‘Y’ and ‘YK’ there is an increased risk of tooth decay. Those that are in the shape of a ‘V’ and ‘Y’ pose less of a risk.

A white spot represents the first, clinically visible, stage of enamel demineralisation and is the main warning sign for putting a comprehensive strategy in place to prevent tooth decay, by promoting a healthy, balanced diet as well as monitoring dental hygiene and using topical fluoride treatments, and assistance with monitoring from the dentist (Table II).

One of the most important factors in developing tooth decay, along with diet and time, are microorganisms, as without their presence in the mouth there would be no tooth decay. The most frequently involved microorganisms are: Streptococcus mutans (associated with the onset of tooth decay: occlusal and smooth-surface) and Lactobacillus spp. (it appears once the lesion has been established, particularly in undercut areas and root caries). Other lactobacilli that should be considered are casei and acidophilus. An increase in salivary enzymes has been noted in individuals with poor oral hygiene and is associated with an increase in tooth decay. Once these microorganisms have been counted, we consider S Mutans levels to be high if there are more than 1,000,000,000 colony-forming units per millimetre, and for lactobacillus if it is higher than 100,000 colony-forming units per millimetre in saliva.

Salivary secretion is essential due to the different functions it performs such as mechanical sweeping and oral rinsing, along with the muscles and soft tissues of the mouth, antimicrobial action (children and adults with immunological disorders are more susceptible to tooth decay), its buffering effect, its viscosity and its effect on reducing enamel solubility. Secretion may be spontaneous (primarily from the submandibular and sublingual glands) and/or stimulated by chewing paraffin for five minutes (mainly from the glands previously mentioned plus the parotid gland). We talk about low levels of stimulated saliva when saliva production is lower than 0.7 millilitres per minute, and low levels without stimulation when it is lower than 0.25 millilitres per minute.

The sensation of a dry mouth is called xerostomia, and may or may not be accompanied by hyposalivation (reduced saliva production). Hyposalivation may be caused by systemic, local or medicine-induced disorders so, for example, we have highlighted certain medications: antipsychotics, antihistamines, diuretics, antihypertensives; anorexia, episodes of depression and their treatment, diabetes mellitus, etc.

**Strengths**

Included in the internal analysis are the strength of different capabilities, the natural advantages and the superior resources.

Historically race has been talked about, observing that pure ethnic groups suffer with tooth decay less often. Curiously, Afro-Americans have a higher incidence than Africans. Undoubtedly, an individual’s genetic predisposition has an influence on tooth size, its crystal formation and immunity (natural immunity to tooth decay seems to be connected to HLA-DR locus activity located in chromosome 6 and in individuals that are decay resistant: HLA-DR W6 generates activity in the helper T lymphocytes, increasing the number of antibody-forming cells. Certain HLA class II (DR) alleles are related to oral salivary microorganism populations such as S. Mutans and Lactobacilli.

The genetic factors aren’t fully known yet. It is also due to cultural and socio-economic factors (dietary habits, hygiene and dental education).

Gender, referring to women, is also a protective factor. This is explained by the earlier eruption of permanent teeth in females, by better dental hygiene habits and greater concern about preventing tooth decay. Hormonal changes during the menstrual cycle, breastfeeding and pregnancy can alter saliva composition and encourage bacterial growth, especially if adequate teeth cleaning is forgotten and the consumption of sugary foods is increased, and therefore encourages tooth decay.

The possibility of using public and private resources with professionals that have a high level of
scientific knowledge (awareness campaigns, free or low cost treatment, etc). The existence of collaborative agreements, between the various entities, particularly for the benefit of children, should also be considered\textsuperscript{11-13}.

**Opportunities**

The most significant opportunities are the autonomous communities’ oral health programmes and new technologies. The Universities’ and Vocational Dental Training Centres’ most competitive prices should also be added.

Teacher training programmes for compulsory health education are an alternative that should be considered.

The quality and quantity of dental products available in pharmacies is also a factor that should be considered when it comes to home programmes for protecting against tooth decay.

The most available information via new communication methods is an alternative to misinformation. It is also worth highlighting the information programmes which take place in the professional associations of doctors, dentists, hygienists, nutrition experts and pharmacists, as well as professional scientific societies and bodies\textsuperscript{1,14}. In figure 2 an education feedback loop is displayed.

**Recommendations**

We recommend the following ten guidelines:

1. Watch what you eat: time and frequency.
2. Reduce sucrose consumption to less than 50 mg/day.
3. Reduce the number of exposures to or opportunities for consuming sucrose and sugary products (moments).
4. Avoid snacking between meals and reduce the consumption of sticky or viscous foods. Avoid, as much as possible, acid-producing foods (crisps, chips, chocolate milk, filled biscuits, sweet dried fruits, dates, etc).
5. Substitute sucrose for non cariogenic sweeteners, as required when there is a high risk of tooth decay, particularly between meals. Promote the use of xylitol in chewing gums and sweets.
6. Visit the dentist at least twice a year so that the risks can be assessed and an individual early diagnosis can be made. Avoid dental extractions.
7. Use products that are suitable for dental hygiene. Use toothpaste, mouthwashes and dental gels that contain fluoride.
8. The sealing and remodelling of the tooth profile. Removing barriers to dental hygiene and fermentable carbohydrates retention.

**Fig. 2.** Dietary/tooth decay educational feedback loop (prepared by the author).
9. Improve oral health education at home and in schools. Paediatricians, educators, parents, GPs and nutrition experts should pay more attention to dental health.

10. Dental health is essential for general health: physical and mental.

Conclusions

1. The full cariogenic potential of a food is influenced by:

   - Fermentable carbohydrate content (acid-forming potential).
   - Components in food or the diet that may have cariostatic properties or a food’s ability to remain in the mouth. Oral rinsing times (clearance) may be extended due to retentive factors in the teeth, a low saliva secretion rate, highly viscous saliva or low muscle activity.
   - Eating patterns. An increase in chewing resistance and the presence of fat in foods, an increase in clearance speed.
   - The sequence and frequency of consumption are closely linked to incidences of tooth decay, as the consumption of sugars between meals poses the highest risk of tooth decay and eating patterns are more important than the frequency.

2. The Total Cariogenic Load (TCL) defines individually the net effects from assessing the risk factors (cariogenic potential, frequency of consumption, etc) together with the protective factors (intrinsic, hygiene, fluoride, sealants, etc).

3. Due to the existing relationship between diet and oral health we need to teach our patients and the general population about the importance of proper eating habits and provide nutritional and dental health advice on this subject.

References


