

Episode 145 – Nutrition and Oral Health: Part Two November 21, 2025

Introduction

Nutrition is the study of how food impacts the body. Maintaining nutritional health requires an adequate supply of carbohydrates, proteins, fats, fibre, water, vitamins, and minerals to support life. There is a strong association between nutrition and oral health, with many interrelated factors. Malnutrition can affect oral health, and poor oral health can influence daily dietary intake, ultimately reducing nutritional status. [1]

Nutritional intake of macronutrients and micronutrients impacts the hard and soft tissues of the oral cavity. Malnutrition, which includes undernutrition and overnutrition, influences oral health in various ways.[1] [1]

Dietary factors such as sugar consumption, nutrient deficiencies, and hydration levels have been linked to oral health problems, including dental erosion, dental caries, periodontal diseases, and oral mucosal conditions (e.g., oral cancer, aphthous ulcers, glossitis, angular cheilitis). [2]

Dental erosion

Dental erosion is the chemical loss of mineralized tooth substances caused by exposure to acids not derived from oral bacteria. The etiology of dental erosion is multifactorial, involving intrinsic and extrinsic factors.[2]

Intrinsic erosion is caused by gastric acid refluxing into the oral cavity. Gastric fluid has a pH of ~1.0, so its erosive potential is very high. Intrinsic erosion is related to conditions such as gastroesophageal reflux disease (GERD),[3] alcohol use disorder,[4] eating disorders (e.g., bulimia nervosa),[5] and recurrent vomiting associated with pregnancy (hyperemesis gravidarum).[6] [3] [4] [5]

Intrinsic erosion is most often seen on palatal surfaces of maxillary anterior teeth and occlusal surfaces of posterior teeth. Mandibular anterior teeth are relatively less affected than maxillary anterior teeth. [3]

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[1] Listen to Episode 144 for part one of nutrition and oral health. Topics include macro- and micronutrients, over- and undernutrition, and oral manifestations of nutrient deficiencies and toxicities.
[2] Refer to Episode 82 for additional information on dental erosion and tooth wear.
[3] Refer to Episode 60 for discussion on oral manifestations of gastrointestinal disorders.
[4] Refer to Episodes 104 and 105 for information on alcohol use disorder.
[5] Refer to Episodes 95 and 96 for discussion on eating disorders.
[6] Refer to Episodes 108, 109, and 110 for additional information on pregnancy and oral health.

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Extrinsic acids are related to diet, lifestyle (e.g., competitive swimming due to the low pH of pool water, wine tasting), and environment (e.g., exposure to industrial chemicals), mainly affecting facial and occlusal tooth surfaces. [3] [4] [5]

Extrinsic acids include various dietary substances, especially those containing citric, phosphoric, ascorbic, malic, tartaric, and carbonic acids. These dietary acids are present in many soft drinks, fruits, fruit juices, some herbal teas, vinegars, and wine. [1]

Even light alcohol drinking (e.g., drinking three or less alcoholic beverages a week) is associated with GERD, increasing the risk of dental erosion. Therefore, alcohol consumption can be a cause of both intrinsic and extrinsic dental erosion. [6]

Beyond aesthetic consequences and associated oral health issues, severe erosion can lead to exposed dentin, hypersensitivity, and eventual loss of affected teeth, potentially impacting nutrient intake. [7]

Hyposalivation increases acidity. Thus, individuals with chronic dry mouth are much more susceptible to acid erosion. Saliva normally keeps the oral cavity in the 7.0 pH range (neutral) due to its ability to buffer acids. The critical pH of enamel and dentin is 5.5 and 6.5, respectively. These values represent the pH at which saliva is no longer saturated with calcium and phosphate and tooth substrate can dissolve. [8] [9] [10]

Most soft drinks (regular and diet) have a pH ranging from 2.5-3.5, with an average pH of 3.4 for carbonated drinks and fruit juices. Soft drinks also contain acids with erosive potential, mainly carbonic, phosphoric, malic, and citric acid. [11] [12]

Acids are commonly added to various beverages, contributing to their distinctive taste. These acids provide tartness and a tangy flavour that helps balance the sweetness of sugar present in the drink. Phosphoric acid is added to cola drinks to enhance tartness, inhibit bacterial and fungal growth, and extend shelf life. Malic acid is often added to noncarbonated beverages (e.g. fruit drinks, sports drinks, iced teas) to enhance flavour. In carbonated beverages, malic acid is added to intensify taste and reduce the need for other added flavourings. These additives contribute to the beverage's unique sweet and acidic flavour profile. Citric acid, which occurs naturally in citrus drinks and is added to many others, provides a tangy flavour and acts as a preservative. [13]

Citric acid is the most erosive component in foods and beverages, because it chelates calcium even at higher pH levels, such as those found in buffered saliva. [8] [14]

Chelation is the ability of a molecule to form a complex with an ion. In the oral cavity, chelation is the process by which citric acid can demineralize enamel more significantly than its pH level would suggest. Due to its chelating properties, citric acid effectively removes calcium from the enamel surface, forming a compound that prevents calcium from being released. As a result, the calcium cannot diffuse back into the tooth. Citric acid can chelate calcium in saliva, reducing its ability to remineralize enamel. [15] [16]

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Energy drinks and sport drinks, average pH of 3.1 and 3.3, respectively, have become popular with the general population, especially adolescents and young adults. Energy drinks contain high amounts of sugar and caffeine and are purported to enhance mental and physical performance and improve alertness, concentration, endurance, and mood. Sport drinks aim to prevent dehydration, and enhance athletic physical performance before, during, or after sporting activity. They replace fluids and electrolytes lost by sweating and supply a boost of carbohydrates. The benefits of sport drinks over water alone in reducing the effect of dehydration resulting from exercise on cardiovascular dynamics, temperature regulation, and exercise performance have been questioned. For most individuals engaged in physical activity, no clear evidence was found to support the additional performance benefits of sport drinks over water alone. [12] [13]

Dental erosion is associated with drinking approaches. Frequent consumption of fruit drinks, fruit juice, carbonated beverages, sport and energy drinks increases dental erosion severity. Sipping, holding the drink longer in the mouth, or swishing it around the mouth causes a more pronounced pH drop. Erosive potential is enhanced by higher temperature of the beverage. Conversely, gulping or straw use while drinking reduces the risk of acid erosion. Consuming dairy after an acid challenge will help raise the pH and remineralize the teeth. [11] [12]

In children, dental erosion is most often caused by dietary acids from juice, soft drinks, fresh fruit, and sour candies. The targeted marketing of sour candies to children and youth, particularly through their packaging and labelling, has increased their popularity, which contributes to the growing prevalence of dental erosion.[7] [8]

The pH of sour candies ranges from 1.6 to 3.0. The combination of extremely low pH candies, immature tooth enamel, and a high frequency of ingestion can seriously harm children's teeth. Citric acid, the most erosive dietary acid, is the common sour flavouring agent in sour candies. The low pH of sour candies can also cause localized soft tissue irritation from surface damage to the mucous membranes of the tongue and inner cheek. [8]

Popular types of sour candies include sour chewy candies, powdered candies, sour gels and sprays, and powder-coated gums. Besides having a low pH level, the texture of the candy can also affect its potential to cause dental erosion. For example, gummy candies, thick sticky gels, and citric acid powders can be particularly harmful due to their long clearance times and abrasiveness. [8] [14]

Additionally, acids produced by the metabolization of sugars in beverages and sour candies by microorganisms in dental plaque contribute to demineralization and dental caries. [1]

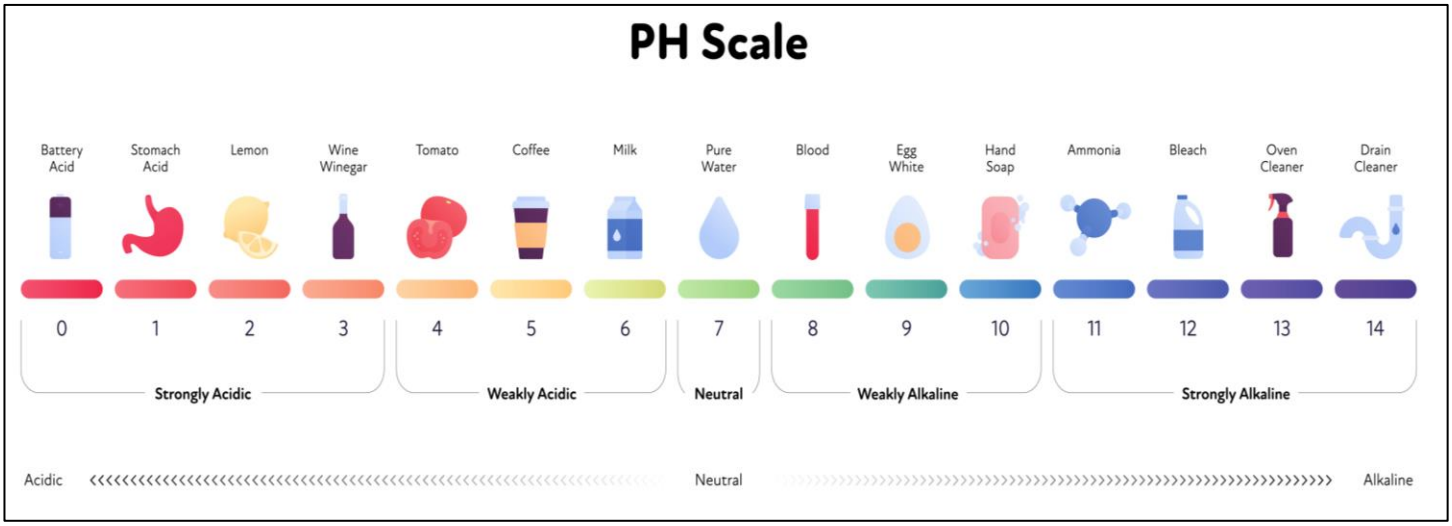
Strategies for managing erosive tooth wear include:

- Avoiding dietary acids between meals and reducing intake of acidic beverages.

[7] Listen to Episodes 115, 116, and 117 for discussion on children and oral health.

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- Avoiding swishing or straining liquid between the teeth, or holding the liquid in the mouth.
- Drinking with a straw positioned behind the front teeth to minimize bathing the teeth.
- Drinking water while eating, and rinsing with water after consuming acidic drinks, candies, or foods.
- Rinsing with water, sodium bicarbonate rinse, or milk after vomiting.
- Chewing sugar free gum to promote salivary flow to help buffer and remove acids.
- Drinking milk with acidic meals or beverages to help neutralize acids and remineralize teeth.
- Rinsing with water rather than brushing teeth immediately after consuming acidic foods or beverages. [7]



Dental caries

Dental caries is the most prevalent noncommunicable disease and a significant global public health issue. It affects both permanent and primary teeth. Approximately 2 billion people with permanent teeth and 510 million children with primary teeth are affected by dental caries. [17]

Dental caries develops when oral bacteria metabolize sugars to produce acid that demineralizes hard tooth structures. Early stages are often asymptomatic. Advanced dental caries can lead to pain, infections, abscesses, sepsis, and tooth loss, which can impair dietary intake and reduce quality of life. [17]

Carbohydrate consumption is a significant nutritional factor in the development of dental caries. Dental hard tissues become demineralized due to acids produced by bacteria in dental plaque biofilm through the fermentation of dietary carbohydrates. After carbohydrates are consumed, there is a rapid decline in the pH of the dental biofilm, dropping to 5.5 or lower. This decrease in pH affects the balance of microbes in the biofilm, leading to a higher proportion of acid-producing bacterial species, which further exacerbates tooth demineralization.[8] [18]

[8] Listen to Episodes 86 and 87 for discussion on dental caries.

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Types of carbohydrates
The relationship between carbohydrates and dental caries is influenced by the type of carbohydrate consumed, whether sugars or starches. The cariogenic potential of a carbohydrate depends on how effectively it can be metabolized by the bacteria that ferment it. [18]

Sugars are the primary drivers of dental caries development. The term free sugar includes all sugars added to food and beverages by manufacturers, cooks, or consumers, as well as the naturally occurring sugars found in fruit juices, fruit juice concentrates, honey, and natural syrups. Together, natural and free sugars, such as sucrose, glucose, and fructose, are considered fundamental factors in the development of dental caries. [17] [18]

Sucrose is a disaccharide composed of glucose and fructose, and is the most cariogenic sugar. It serves as a substrate for the formation of intra- and extracellular polysaccharides in dental plaque. Furthermore, dental plaque formed in the presence of sucrose contains lower levels of essential ions, such as calcium, inorganic phosphate, and fluoride. These ions are vital for the remineralization of enamel and dentin. [18]

Sucrose, along with its constituent monosaccharides, glucose and fructose, is more cariogenic than starches because these sugars enter the glycolytic pathway more quickly, leading to a significant drop in pH. However, the mixture of starch and sucrose exhibit greater cariogenic potential than sugars alone. Lactose, while also a sugar, is less cariogenic than sucrose, fructose, and glucose, as its fermentation results in a lesser decrease in pH. [1] [18] [19]

Amount of sugar
The amount of sugar consumed can also impact the development of dental caries. A systematic review by Moyniham and Kelly (2014) found populations with free sugar intake exceeding 10% of their total energy intake exhibited a higher incidence of dental caries compared to those with free sugar intake below 10%. This systematic review contributed to the World Health Organization (WHO) guidelines on sugar consumption. [18] [20] [21]

The WHO recommends adults and children limit their daily intake of free sugars to less than 10% of their total daily energy intake. Ideally, this should be reduced to less than 5% (approximately 25 grams or six teaspoons of sugar per day) for added health benefits. Research indicates keeping free sugar consumption below 10% of total energy intake helps minimize the risk of dental caries throughout life. [22]

Many sugars consumed today are “hidden” in processed foods. For example, one tablespoon of ketchup contains approximately four grams (~one teaspoon) of free sugars. One can of sugar-sweetened soft drink contains up to 40 grams (~ten teaspoons) of free sugars. [22]

Sugar comes in many forms, such as white sugar, brown sugar, molasses, honey, maple syrup, and corn syrup. Sugars are often added to processed foods to improve

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flavour, colour, texture, and shelf-life and may be listed on food labels under various names, including glucose, fructose, dextrose, maltose, or sucrose. [23]

Alternate names for sugar*			
Agave	Corn sweetener	Golden syrup	Panocha
Agave nectar	Corn syrup	Grape sugar	Powdered sugar
Agave syrup	Corn syrup solids	Granulated sugar	Rapadura
Barbados sugar	Crystalline fructose	High-fructose corn syrup	Raw sugar
Barley malt	Date paste	Honey	Refiner's syrup
Barley malt syrup	Date sugar	Icing sugar	Rice malt syrup
Beet sugar	Dehydrated cane juice	Invert sugar	Rice syrup
Blackstrap molasses	Demerara sugar	Lactose	Saccharose
Brown sugar	Dextrin	Malt	Sugar
Brown rice syrup	Dextrose	Malt syrup	Sorghum syrup
Buttered syrup	Ethyl maltol	Maltodextrin	Sucanat
Cane juice	Evaporated cane sugar	Maltol	Sucrose
Cane juice crystals	Florida crystals	Maltose	Sweet sorghum
Cane sugar	Fructose	Mannose	Syrup
Caramel	Fruit juice	Maple syrup	Table sugar
Carob	Fruit juice concentrate	Molasses	Tapioca syrup
Carob syrup	Fruit nectars	Muscovado	Treacle
Castor sugar	Galactose	Nectar	Turbinado sugar
Coconut palm sugar	Glucose	Palm sugar	White granulated sugar
Coconut sugar	Glucose syrup solids	Pancake syrup	Yellow sugar
Confectioner's sugar	Golden sugar	Panela	*Nonexhaustive list

Frequency of sugar intake

The frequency of free sugar consumption may influence the development of dental caries. Research suggests consuming sugar more often and snacking between meals could be more critical in predicting the risk of dental caries than the total amount of sugar consumed. This concept is based on the observation that it takes approximately 30 minutes for the pH to decrease after sugar intake. Therefore, consuming additional sugar within a period of 30 minutes is considered less harmful than eating more sugar after this window. However, it is challenging to determine the relative impact of the amount of sugar versus the frequency of sugar consumption on the risk of dental caries, as these two factors are closely related. [18]

Advice to limit the frequency of free sugar intake is an essential part of client education. Goal setting in terms of frequency is often more tangible for clients. However, it is also important to educate clients on the quantity of free sugars they consume. [24]

Other nutrients

Studies suggest enamel hypoplasia, salivary gland hypofunction,[9] and changes in saliva composition may explain the association between malnutrition and dental caries. [25]

[9] Refer to Episode 107 for information on Sjögren syndrome.

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Enamel hypoplasia is characterized by grooves and/or pits in the enamel, which are often horizontal or linear in appearance. Enamel hypoplasia is associated with nutritional deficiencies of vitamin A, vitamin D, and protein-energy undernutrition.[10] The structural damage is related to the period during which the nutritional deficiencies occurred. Enamel hypoplasia has been associated with dental caries development as it may provide a mechanical nidus for bacteria and food. [1] [25] [26]

Proper salivary gland function is essential for maintaining the health of the oral cavity. Salivary gland hypofunction has been associated with protein-energy undernutrition, leading to reduced salivary flow rate, buffering capacity, and levels of salivary components, particularly proteins. [1] [25]

Protein-energy undernutrition and vitamin A deficiency can lead to salivary gland atrophy, which subsequently reduces salivary flow, cleansing action, and buffering capacity against plaque acids. [1] [25]

Moderate nutritional deficiencies of protein, vitamins, zinc, and iron can influence the amount and composition of saliva, limiting the protective effects it has on the oral cavity. [1] [25]

Certain dietary factors have been shown to have a protective influence on oral health. For example, consuming dairy products, particularly cheese, has been linked to a reduced risk of dental caries due to their high calcium and phosphorus content. [2]

The micronutrient fluoride plays an important role in dental caries prevention. Fluoride occurs naturally in water, tea, and seafood. Fluoride is added to some municipal water supplies. Water fluoridation is one of the most effective preventive public health measures ever undertaken. Fluoride reduces dental caries by several different mechanisms. The fluoride ion may be integrated into enamel, making it more resistant to acid dissolution and promoting remineralization. In addition, fluoride prevents bacteria from efficiently metabolizing sugars. This not only reduces acid production but also impairs bacterial growth, reproduction, and biofilm formation. [27] [28]

Periodontal diseases

Periodontal diseases are inflammatory conditions and, if left untreated, can lead to tooth loss, which can adversely affect masticatory function, dietary intake, and nutritional status. Periodontal diseases progress more rapidly in individuals who are undernourished.[11] [1]

Vitamins play a crucial role in maintaining periodontal health and preventing periodontal diseases. Deficiencies in vitamins (e.g., A, B, C, D), minerals (e.g., calcium, iron, zinc, potassium, copper, manganese, selenium), and omega-3 fatty acids are associated with periodontal diseases. Additionally, the antioxidant properties of vitamins can positively influence the prevention and treatment of periodontal conditions. [1] [29] [30]

[10] Refer to Episode 144 for information on protein-energy undernutrition.
[11] Listen to Episodes 5, 6, 47, and 138 for discussion on periodontal diseases.

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Vitamin A
Vitamin A is a group of fat-soluble vitamins, which include retinol (found in animal products) and carotenoids (e.g., beta-carotene, a form of vitamin A found in fruits and vegetables). Retinol, the active form of vitamin A, is an antioxidant with anti-inflammatory properties. Retinol helps inhibit inflammatory cytokines such as TNF-α, IL-6, and IL-12. Additionally, vitamin A plays a vital role in maintaining the health of epithelial tissues. [1] [30]

Oral side effects of vitamin A deficiency include dry mouth, increased risk of oral infections, as well as impaired tooth development in infants and children.

Several studies have shown vitamin A deficiency is associated with an increased risk and severity of periodontal disease. Some research suggests an intake of beta-carotene of 7.07 mg per day or more is associated with a reduction in pocket depths greater than 3 mm after scaling and root planing. Considering the antioxidant potential, vitamin A has been used to supplement periodontal treatment. However, there is limited clinical evidence on the effects of vitamin A supplementation on periodontal healing and regeneration. [30] [31]

Vitamin B
Vitamin B is a complex of eight water-soluble vitamins, including vitamins B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine, pyridoxal, pyridoxamine) B7 (biotin), B9 (folic acid), and B12 (cobalamins). B vitamins play a vital role in cell metabolism, repair, and proliferation. [31]

Signs and symptoms of B vitamin deficiency range from dermatitis and paresthesia to oral manifestations, such as angular cheilitis and glossitis. [31]

Vitamin B12 and folic acid (B9) are particularly important for periodontal health. Research has found low serum vitamin B12 and folic acid levels in participants with periodontitis as compared to healthy controls. Low serum B12 levels are associated with increased clinical attachment loss and subsequent tooth loss. Additionally, serum folic acid concentrations among smokers with periodontitis are significantly lower than those in nonsmokers with periodontal disease. [18] [32] [33] [34]

Sources of vitamin B12 include meat, fish, dairy, cheese, eggs, and fortified cereals. Sources of folic acid include broccoli, Brussels sprouts, leafy vegetables (cabbage, kale, spinach), peas, chickpeas, beans, liver, and enriched cereals. [30]

Deficiency in vitamin B complex results in lower resistance to bacterial infections, which may explain the role of vitamin B, particularly B12 and folic acid, in periodontal diseases. In a prospective cohort, Zong et al. (2015) demonstrated an increase in serum vitamin B12 was associated with a decrease in the clinical parameters of periodontal disease (i.e., probing depth, clinical attachment loss, and tooth loss). However, further research is needed to confirm these findings in interventional settings before any conclusion can be drawn. [29] [33]

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A deficiency in folic acid is associated with impaired wound healing. In periodontal health, folic acid is crucial for the proliferation of epithelial cells. A deficiency in folic acid may increase the risk of periodontal disease progression by impairing cell turnover in the junctional epithelium, which serves as a protective barrier. However, it has not yet been proven whether the administration of folic acid supplements helps prevent periodontal disease and improve treatment outcomes. [30] [32]

A clinical trial by Neiva et al. (2005), involving 30 participants, found supplementation with vitamin B complex improved clinical attachment levels following periodontal flap surgery. However, additional research is needed to further evaluate the impact of vitamin B complex supplementation on periodontal health and healing. [35]

Vitamin C

Vitamin C (ascorbic acid) is a water-soluble vitamin found in various fruits and vegetables. Vitamin C plays an essential role in:

- Collagen synthesis
- Maintaining the structural integrity of connective tissue
- Maintaining tissue homeostasis
- Immune function[12]
- Acting as an antioxidant to neutralize free radicals
- Preventing oxidative damage by acting as a reactive oxygen species (ROS) scavenger [30] [31] [36] [37]

Populations at higher risk for vitamin C deficiency include the elderly,[13] infants exclusively fed cow's milk, individuals with alcohol use disorder, and people who do not consume sufficient fruits and vegetables, with smokers[14] being particularly vulnerable. [30] [38] [39] [40]

Vitamin C deficiency is a systemic risk factor among diet-related diseases that can modify the immunoinflammatory response to dental plaque biofilm, leading to an exaggerated or hyperinflammatory response. Vitamin C deficiency has been included in the AAP classification of periodontal diseases and is recognized as a modifying factor that influences the development, severity, and extent of gingivitis. Scurvy is classified as a non-plaque-induced gingival disease under vitamin deficiencies.[15] [37] [41] [42]

The relationship between vitamin C deficiency and periodontal symptoms was described as early as the 18th century, when sailors experienced scurvy, a deficiency of vitamin C associated with gingival inflammation and bleeding and tooth mobility caused by collagen structure changes and impaired connective tissue formation. [30] [31]

Severe vitamin C deficiency (scurvy) results in compromised antioxidant micronutrient defenses to oxidative stress. It also negatively impacts collagen synthesis, resulting in

[12] Listen to Episodes 44 and 45 for discussion on the immune system.
[13] Listen to Episodes 123 and 124 for additional information on aging and longevity.
[14] Refer to Episode 101 for additional information on tobacco use and cessation.
[15] Refer to Episodes 49 and 50 for information on the AAP classification of periodontal diseases.

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weakened capillary blood vessel walls, leading to increased gingival bleeding. Scurvy is treated with vitamin C supplementation and a nutritious diet. [31] [41] [43]

Research has shown a relationship between reduced dietary vitamin C and increased risk for periodontal disease. [29] [30] [31] [44] [45]

Cross-sectional studies have found individuals with gingivitis or periodontitis and smokers have lower serum vitamin C concentrations compared to those who are periodontally healthy or nonsmokers. Research indicates an inverse relationship between serum vitamin C levels and the degree of periodontal inflammation, as well as severity across various populations and age groups. [45]

Total antioxidant capacity is associated with periodontitis, with higher serum antioxidant levels reducing the risk of the disease. Case-control studies indicate individuals with periodontitis have lower serum vitamin C levels and vitamin C intake, more bone loss, and greater periodontal disease progression compared to healthy controls. [46]

Research has shown vitamin C depletion leads to gingival bleeding, regardless of individual oral hygiene practices. Consuming fruits rich in vitamin C and vitamin C supplementation helped reduce sulcular bleeding in nonsmokers with gingivitis and periodontitis. However, the effectiveness of vitamin C intake or supplementation was less effective following nonsurgical periodontal therapy.[16] [39] [47]

Individuals with vitamin C deficiency demonstrate more significant clinical attachment loss than those with normal levels, and there is a negative correlation between serum vitamin C levels and antibodies to the periodontal pathogen *Porphyromonas gingivalis*. [30] [38] [39] [40]

In a multicentre, randomized, parallel-group, controlled clinical trial comprising 300 participants with gingivitis, Shimabukuro et al. (2015) concluded toothpaste with vitamin C and magnesium salt can reduce gingival inflammation. Compared with conventional toothpaste, this toothpaste exhibited a significantly higher activity against ROS, which might be associated with the onset and progression of gingival inflammation. [48]

Research has increased the understanding of the association between vitamin C deficiency to periodontal disease:

- Vitamin C deficiency can result in oxidative stress, which may subsequently cause tissue damage. [49]
- Vitamin C deficiency has been associated with gingival bleeding regardless of oral hygiene levels.[17] [47]
- Vitamin C supplementation and initial nonsurgical periodontal therapy have been shown to reduce gingival bleeding and inflammation in adults with gingivitis and in those with diabetes and periodontitis. However, administration of vitamin C supplements as an adjunct to nonsurgical therapy did not result in a clinically

[16] Refer to Episodes 128 and 129 for additional information on periodontal therapy.
[17] Listen to Episode 89 for discussion on oral self-care.

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significant improvement in pocket probing depths at 3 months in participants with periodontitis. [30] [36] [50]

Vitamin D

Vitamin D is a fat-soluble vitamin primarily produced in the skin in response to sunlight. Small amounts are obtained from dietary sources, such as fatty fish, egg yolks, and fortified dairy products. Vitamin D enhances the absorption of minerals such as calcium, iron, magnesium, phosphate, and zinc. Vitamin D plays an important role in calcium and bone metabolism. It also helps to regulate the immune system and has anti-inflammatory properties. There are two groups of vitamin D, vitamin D2 (cholecalciferol) and vitamin D3 (ergocalciferol).[18] [29] [37] [44]

Research has suggested a deficiency of dietary vitamin D leads to periodontal inflammation and a delay in post-surgical periodontal healing. [31] [51] [52] [53]

However, other studies have found no significant link between serum vitamin D levels and periodontal health. To date, the association between vitamin D deficiency and periodontal health in adults remains unclear and more studies are required to investigate its role. [31] [54] [55]

Vitamin E

Vitamin E is a group of eight fat-soluble compounds, with alpha-tocopherol being the most biologically active form. Vitamin E acts as an antioxidant that protects cells from oxidative damage. [30]

Sources of vitamin E include vegetable oils, nuts, seeds, green leafy vegetables, and wheat germ. [56] [57]

The literature on vitamin E and periodontitis is somewhat limited. A few studies reported favourable effects of vitamin E in maintaining periodontal health and controlling inflammation. A two-year prospective study involving 264 participants found higher vitamin E intake was associated with a lower number of teeth affected by periodontal disease progression. [58] [59]

Individuals with serum alpha-tocopherol levels that were in the low normal range displayed an increased severity of periodontitis. [34] [60]

Dietary or supplements with vitamin E showed a positive impact on clinical measures of periodontitis, potentially through their effect on oxidative stress reactions to chronic inflammation. [34] [61]

A clinical trial by Singh et al. (2014) on the effects of scaling and root planing with vitamin E supplementation appeared to improve periodontal wound healing as well as antioxidant defence against oxidative stress. [62]

[18] Refer to Episode 22 for additional information on vitamin D and oral health.

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Increased dietary intake of alpha-tocopherol with other antioxidants and anti-inflammatory omega-3 fatty acids reduced probing depths in chronic periodontitis in nonsmokers. [34] [63]

A narrative review by Barnawi et al. (2023) found vitamin E has potential benefits in combating oxidative stress in periodontal tissues. [64]

In contrast to these articles, no relationship was found between the two forms of vitamin E (alpha- and gamma-tocopherol) and periodontitis among participants in a cross-sectional study by Linden et al. (2009). [30] [65]

Additionally, research has shown there were no significant differences in the serum level of vitamin E in healthy individuals compared to those with periodontitis. This highlights the need for further investigation to clarify these discrepancies and fully understand the role of vitamin E in periodontal health. [29] [30] [66]

Calcium

Calcium is necessary for healthy bones, teeth, muscle contractions, and other functions. Calcium plays a crucial role in building density in the alveolar bone that supports the teeth. [1]

Dietary sources of calcium include dairy products, eggs, fish, leafy vegetables, nuts, and seeds. [29] [31]

A deficiency of dietary calcium may impact periodontal health. Supplementation with calcium and vitamin D had a positive effect on periodontal therapy outcomes. [31] [67]

A study conducted on older Danish adults[19] by Adegboye et al. (2012) suggests a higher intake of dairy calcium, particularly from milk and fermented products (e.g., yogurt, lactic acid drinks), may protect against periodontitis. [68]

Similarly, a cross-sectional study suggested an inverse relationship between calcium, casein, and whey protein intake and periodontitis among Danish adults. The authors concluded consuming foods rich in calcium, casein, and whey (e.g. dairy products) should be promoted, as they may contribute to the prevention of periodontitis. [31]

A cross-sectional study by Tanaka et al. (2014) involving 1,162 Japanese females (mean age of 31.5 years) found an association between higher calcium intake and lower prevalence of periodontal diseases. This conclusion was drawn after adjusting for factors such as age, smoking status, region of residence, education, household income, tooth brushing frequency, and interdental brush use. The authors suggested calcium intake may have beneficial effects on periodontal health, even at the relatively low levels typically consumed in Japan. However, further studies are needed to confirm these findings and to understand the mechanisms behind the observed relationship between calcium intake and periodontal disease. [69] [70]

[19] Refer to Episode 55 for discussion on seniors and oral health.

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Iron
Iron is essential for synthesizing proteins, including hemoglobin and various enzymes. Good food sources of iron include meat, poultry, spinach, fish, and beans. A deficiency in iron can result in anemia, which is associated with several symptoms (e.g., fatigue, shortness of breath, weakness, dizziness, pallor). Oral signs of anemia can include recurrent aphthous stomatitis, glossitis, pale mucosa, and burning mouth.[20] [31] [70]

Iron is important for maintaining periodontal health, and a deficiency can impair the body's ability to fight periodontal pathogens. For example, individuals with iron deficiency anemia and periodontitis have shown a higher frequency of bleeding upon probing, a greater percentage of sites with clinical attachment loss of 6 mm or greater, and deeper periodontal pockets compared to those with periodontitis alone. The results suggest iron-deficiency anemia can lead to a decrease in antioxidant enzymes, which increases oxidative stress and can worsen periodontal diseases. [30] [31] [71]

Zinc
Dietary sources of zinc include protein-rich foods, spinach, nuts, and fortified cereals. Zinc is a cofactor in enzyme-controlled processes and plays a role in wound healing. it exerts an antioxidative effect by scavenging reactive oxidative species (ROS) in addition to neutralizing bacterial toxins. This makes zinc is an important component of periodontal dressings. [29] [72]

Dietary zinc may also play an important role in maintaining periodontal health. Research has suggested a lack of dietary zinc leads to worsening of periodontal disease in individuals with type 2 diabetes. [29] [31] [73]

A systematic review by Pushparani et al. (2014) further supported the importance of zinc in preventing diabetes-related periodontitis by exerting an anti-oxidant effect. [31] [74]

Potassium
Potassium plays a crucial role in various cellular functions, such as metabolism, growth, enzyme activity, and DNA synthesis.

A cross-sectional study by Yamori et al. (2011) found a significant relationship between potassium intake and the severity of gingival inflammation among middle-aged females. The study demonstrated low potassium intake, often accompanied by a deficiency in dietary fibre, may not only exacerbate periodontal inflammation but also elevate blood pressure.[21] [30] [75]

Copper
Copper is a component of many enzymes, including enzymes that are necessary for energy production, formation of red blood cells, bone, and connective tissue; and antioxidant action to help protect cells against damage by free radicals. [76]

[20] Listen to Episode 106 for discussion on burning mouth syndrome.
[21] Refer to Episodes 135, 136, and 137 for additional information on blood pressure and oral health.

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Research has shown elevated copper levels in individuals with periodontitis, particularly those with diabetes, compared to individuals without periodontitis. [30] [77]

Copper is essential for proper connective tissue development. An elevation in serum copper may reflect the changes in periodontal collagen metabolism. [78]

A study by Sundaram et al. (2017) indicated copper levels in individuals with periodontitis, both with and without diabetes, significantly improved after nonsurgical periodontal therapy. [30] [78]

Manganese
Manganese plays a vital role in metabolic processes, bone formation, and the immune system. It also works in conjunction with vitamin K to facilitate blood clotting. A deficiency in manganese can lead to reduced bone density and impaired bone formation. [30]

A study by Kim et al. (2014) showed an inverse relationship between serum manganese levels and periodontal status (e.g., probing depths, bleeding on probing, calculus deposits), regardless of systemic conditions, oral hygiene, sociodemographic factors, or overall oral health. [30] [79]

Selenium
Selenium has several vital roles, including antioxidant, anti-inflammatory, and antiviral properties. [30]

A study by Thomas et al. (2013) found serum selenium levels were significantly lower in individuals with periodontitis, both with and without type 2 diabetes, but were highest in healthy controls, showing that serum levels of selenium are inversely proportional to inflammation and tissue destruction. [80]

Omega-3 fatty acids
Omega-3 fatty acids, including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are essential polyunsaturated fatty acids that must be obtained from food, such as fatty fish and plant-based sources. [30]

Omega-3 fatty acids are incorporated into cell membranes, where they provide energy and serve as precursors for eicosanoids. Eicosanoids are signaling molecules with various roles in the cardiovascular,[22] respiratory,[23] immune, and endocrine systems. [30]

Omega-3 supplements have been associated with potential anti-inflammatory effects and may contribute to the management of chronic inflammatory conditions, including periodontitis. [30] [81]

[22] Listen to Episodes 79, 80, and 81 for discussion on cardiovascular diseases and oral health.
[23] Refer to Episode 97 for information on respiratory infections.

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In addition to their anti-inflammatory and antioxidant benefits, EPA and DHA have inhibitory effects on bacteria. Inhibiting the action of periodontal pathogens, such as *Aggregatibacter actinomycetemcomitans*, *P. gingivalis*, *Prevotella intermedia*, *Tannerella forsythia*, *Treponema denticola*, and *Fusobacterium nucleatum*, has been demonstrated in several studies. [81]

Research on the potential effects of omega-3 supplementation in periodontal therapy is extensive. Several studies have evaluated the clinical impact of combining omega-3 supplements with nonsurgical periodontal therapy, assessing the effects on periodontal probing depth, clinical attachment level, and inflammation indicators. These studies reported positive outcomes, including a systematic review and meta-analysis that showed in individuals with periodontitis, the use of omega-3 fatty acid dietary supplementation as an adjunct to nonsurgical periodontal therapy can provide additional benefits in clinical attachment level gain and periodontal probing depth reduction, compared with nonsurgical periodontal therapy alone. [30] [82]

The evidence regarding omega-3 fatty acids and their impact on periodontal therapy remains inconclusive. Some studies have reported inconsistent results, attributed to variations in omega-3 dosages, study durations, and the outcomes measured. Despite these limitations, the promising findings underscore the necessity for further randomized clinical trials with clearly defined protocols to better understand the potential benefits of omega-3 fatty acids in periodontal therapy. It is important to recognize that while periodontal disease and tooth loss are associated poor nutritional status, the existing literature is characterized by high heterogeneity, leading to varying levels of confidence in these findings. [30] [83]

Influence of nutrients on periodontal health [30] [31] [59]

Nutrient	Dietary sources	Periodontal health
Vitamin A	Vitamin A (retinol): cheese, milk, yogurt, egg yolks, fish liver oils, liver. Beta-carotene: yellow, red, orange, and dark green vegetables (spinach, carrots, sweet potatoes), yellow and orange fruits (mango, papaya, apricot)	Deficiency linked to increased risk and severity of periodontal disease. Increased beta-carotene linked to improvement in periodontal pocket depths after nonsurgical periodontal therapy.
Vitamin B9 (folic acid)	Broccoli, Brussels sprouts, leafy vegetables (cabbage, kale, spinach), peas, beans, liver, enriched cereals	Insufficiency associated with periodontitis in smokers. Smokers with periodontal disease tend to have lower folic acid levels. Vitamin B complex supplementation may improve clinical attachment levels following periodontal flap surgery.
Vitamin B12	Meats, poultry, fish, dairy, cheese, eggs, fortified cereals	Increased B12 linked to decrease in periodontal disease clinical parameters (e.g., probing depths). Low levels associated with increased clinical attachment loss and subsequent tooth loss.

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Nutrient	Dietary sources	Periodontal health
Vitamin C	Citrus fruits, sweet peppers, strawberries, broccoli, potatoes, tomatoes	Severe deficiency associated with bleeding and gingival inflammation (scurvy). Supplementation may improve nonsurgical periodontal therapy outcomes.
Vitamin D	Primarily from sunlight. Small amounts in fatty fish (salmon, sardines, mackerel), fish liver oils, liver, egg yolks	Deficiency may increase periodontal inflammation and delay post-surgical periodontal healing.
Vitamin E	Vegetable oils, nuts, seeds, wheat germ, green leafy vegetables.	Deficiency may increase periodontitis severity. Supplementation may improve periodontal healing after nonsurgical periodontal therapy.
Calcium	Dairy products (milk, cheese, yogurt), fish, leafy green vegetables (kale, broccoli), almonds, tofu, fortified cereals	Plays a role in maintaining periodontal tissue. Supports jaw bone health.
Iron	Red meat, poultry, fish, poultry, lentils, beans, fortified cereals, spinach	Helps maintain periodontal health. Deficiency increase susceptibility to periodontal pathogens.
Zinc	Meat, seafood, oysters, legumes, seeds, nuts, dairy products, whole grains	Important role in wound healing. Deficiency may increase susceptibility to periodontal disease.
Potassium	Leafy green vegetables, oranges, grapefruits, potatoes, bananas, milk	Low intake may worsen gingival inflammation.
Copper	Liver, shellfish, nuts, mushrooms, whole grains, dried legumes.	High levels found in individuals with both diabetes and periodontitis when compared to individuals with periodontitis and normal blood glucose levels.
Manganese	Whole grains, leafy greens, avocados, nuts, beans	An inverse relationship found between serum manganese levels and periodontal status (e.g., probing depths, bleeding on probing, calculus deposits).
Selenium	Grains, seafood, meat, poultry, eggs, dairy products, Brazil nuts	Low serum manganese levels linked to periodontitis.
Omega-3 fatty acids	Flaxseed, lake trout, certain deep-sea fish (e.g., mackerel, salmon, herring, tuna), green leafy vegetables, walnuts	Inhibitory effects on periodontal pathogens. Omega-3 fatty acid supplementation may improve periodontal healing after nonsurgical periodontal therapy.

Sugar

Several observational and cross-sectional studies have highlighted associations between free sugars and periodontitis. [84]

Research indicates consuming sugar-sweetened carbonated beverages is positively associated with a risk of periodontal disease. The intake of these beverages may

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heighten systemic inflammation, potentially contributing to the development of periodontal disease. [85]

A narrative review by Shanmugasundaram and Karmakar (2024) suggests excessive intake of dietary fructose and sucrose can lead to low-grade systemic inflammation and contribute to dysbiosis in both the gut and oral microbiota. Additionally, consuming too much dietary sugar is high in calories and can result in obesity,[24] metabolic syndrome, and other risk factors that contribute to periodontal inflammation. Therefore, a diet high in added sugars has the potential to initiate and worsen periodontal inflammation. [86]

A small randomized controlled clinical trial by Pappe et al. (2024) showed avoiding free sugar after periodontal therapy had beneficial effects on periodontal and metabolic parameters. The intervention group received a 45-minute dietary consultation and was instructed to avoid free sugars (e.g., sweets, white flour, juice, etc.) for 4 weeks after subgingival instrumentation. To avoid sugar, participants were allowed to replace it with whole fruit, which led to increased levels of micronutrients, such as vitamin C. The control group continued with their regular diet after subgingival instrumentation.

At the six-week follow-up, periodontal bleeding was significantly decreased in both groups (–40% intervention group, –34% control group). Additionally, body weight and visceral fat were significantly reduced only in the intervention group. The authors concluded free sugar avoidance may be of therapeutic benefit in addition to periodontal therapy. Further research is needed to investigate this effect in larger cohorts. [84]

Oral mucosal conditions
Deficiencies of certain nutrients is associated with diseases of the oral mucosa, including oral cancer, aphthous ulcers, glossitis, and angular cheilitis.

Oral cancer
Intake of fruit and vegetables may protect against head and neck cancer incidence. A meta-analysis revealed that higher consumption of fruits and vegetables is associated with a lower risk of oral cancer. A large prospective observational study found higher fruit and vegetable intake was associated with a reduced risk of head and neck cancer. Heavy alcohol consumption is associated with an increased risk of developing oral cancer.[25] [18] [87] [88] [89]

Gomez-Castillo et al. (2025) investigated the association between sugar-sweetened beverages (SSBs) and the risk of oral cavity cancer (OCC) in smoking and nonsmoking adult females. The analyses included 162,602 females (average age of 43 years). The researchers identified 124 invasive OCC cases during 30 years of follow-up. Those consuming one or more SSB daily versus less than one SSB monthly had a 4.87-times increased risk of OCC in multivariable-adjusted models (five versus two people per 100,000 population), increasing the rate of OCC to three more people per 100,000 population. The risk of OCC was 5.46 times higher when restricted to both nonsmokers

[24] Refer to Episodes 120, 121, and 122 for conversations on obesity and oral health.
[25] Refer to Episodes 7, 9, 76, 77, and 78 for additional information on oral cancer.

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or light smokers and nondrinkers or light drinkers, increasing the rate of OCC to three more people per 100,000 population.

The authors concluded a high intake of SSBs was associated with a significantly increased risk of OCC in adult females, regardless of their smoking or drinking habits, yet with a low baseline risk. Additional studies are needed in larger cohorts, including males, to validate these findings. [90]

Aphthous ulcers
There are very few rigorous studies investigating the impact of diet on managing recurrent aphthous stomatitis. Recurrent aphthous stomatitis is characterized by recurring ulcers confined to the oral mucosa in individuals with no other signs of disease. The ulcers may be single or multiple and are very painful. Reported dietary triggers include hard, acidic, and salty foods, as well as alcoholic and carbonated beverages.

Deficiencies in vitamin B12, iron, and folate are associated with recurrent aphthous stomatitis. Preliminary data indicate zinc deficiency is more prevalent among individuals with recurrent aphthous stomatitis compared to those without this condition. Additionally, zinc supplementation may help improve the resolution of recurrent aphthous stomatitis in those with zinc deficiency. [1] [18]

Other oral mucosa conditions
Deficiencies of certain micronutrients results in diseases of the oral mucosa. Vitamin B12, iron, and folate deficiencies are associated with glossitis and angular cheilitis.

Glossitis is characterized by inflammation and loss of papillae of the tongue, and manifests clinically as painful burning sensation of the tongue. Angular cheilitis is an inflammatory condition affecting the corners of the mouth. These oral mucosal conditions can result in difficulty with dietary intake and subsequently lead to poor nutritional status. [1]

Xerostomia
Xerostomia, or dry mouth, can negatively impact oral health and overall quality of life. Xerostomia may be exacerbated by dietary factors, such as dry or acidic foods, caffeine, and alcohol. [18]

Reduced saliva flow can hinder the ability to chew or swallow certain foods, potentially leading to malnutrition. A significant decrease in salivary gland function is associated with dysgeusia (changes in taste sensation) and dysphagia (difficulty swallowing). [91]

Xerostomia can cause the following complications:
- Sticky, dry, or burning feeling in the mouth
- Difficulty chewing, swallowing, tasting, or speaking
- Altered taste
- Intolerance for spicy, salty, or sour foods or drinks
- Dry or sore throat, hoarseness

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- Cracked, peeling, atrophic, or sticky lips
- Dry, rough tongue
- Mouth sores
- Oral fungal infection (e.g., candidiasis)
- Halitosis[26]
- Inability to retain dentures [91]

Xerostomia management
The goals of managing xerostomia include identifying the possible cause(s), relieving discomfort, and preventing complications, e.g., dental caries and periodontal infections.

Management of xerostomia and hyposalivation should emphasize client education, adequate hydration, and lifestyle modifications. Various measures, including pharmacologic treatment with salivary stimulants, topical fluoride, saliva substitutes, and use of sugar-free gum and mints, may alleviate some symptoms of dry mouth and improve quality of life.

Strategies to relieve dry mouth include:
- Sipping water or sugarless, caffeine-free drinks
- Sucking on ice chips
- Using lip lubricants frequently (e.g., every two hours)
- Chewing sugar-free gum or sucking on sugar-free candy (e.g., xylitol-based)
- Avoiding salty or spicy food or dry, hard-to-chew foods
- Avoiding sticky, sugary foods
- Avoiding irritants (e.g., alcohol, alcohol-containing mouthrinses,[27] tobacco, caffeine)
- Drinking fluids while eating
- Using a humidifier at night [91]

Oral health-specific recommendations for dry mouth include:
- Brushing teeth gently at least twice a day with fluoridated toothpaste
- Daily interdental cleaning
- Scheduling regular oral healthcare appointments
- Prompt treatment of oral fungal or bacterial infections
- Professional applications of 0.5% fluoride varnish
- Soft- and hard-tissue relines of poorly fitting prostheses and use of denture adhesives
- Using saliva substitutes and oral moisturizers as required [91]

Water
Water is an essential macronutrient. Adequate water intake is crucial for overall health. Water is one of the most important factors in maintaining oral health. Benefits of drinking plain water include:
- Rinsing away food particles and sugars to help prevent dental caries

[26] Refer to Episode 67 for discussion on halitosis.
[27] Listen to Episode 103 for discussion of the role of mouthrinses in oral care.

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- Neutralizing oral acids to decrease risk of dental erosion
- Preventing dehydration to decrease risk of dry mouth and halitosis
- Maintaining moist oral mucosa
- Drinking fluoridated water to decrease risk of dental caries.
- Higher water intake is associated with a lower incident of periodontitis. [92] [93]

Potential mechanisms that explain the connection between plain water intake and the incidence of periodontitis include:

- Higher water consumption can reduce the intake of sugar-sweetened beverages, such as soft drinks, sweetened coffee, and energy drinks. These beverages contain sugar, acids, and caffeine, all of which negatively affect periodontal health.
- Increased water intake is associated with more favourable metabolic profiles. Metabolic conditions, such as obesity and diabetes,[28] can significantly impact periodontal health.
- Individuals with low water intake often exhibit differences in gut microbiota compared to those with higher water consumption. The gut microbiota has been implicated in influencing alveolar bone metabolism through the gut-bone axis. [93]

Take home messages

- Eating a well-balanced diet is imperative to maintaining good oral health. Good oral health is essential for supporting good nutrition.
- Nutritional imbalances in various vitamins (e.g., B, C, D) and minerals (e.g., calcium, zinc, magnesium) are associated with chronic oral diseases, including gingivitis, periodontitis, and dental caries.
- A low intake of free sugars, appropriate fluoride exposure, daily toothbrushing, and interdental cleaning is crucial to prevent dental caries.
- Encourage clients to make water the drink of choice and drink water throughout the day to help protect their oral health.

References

[1] S. Gondivkar, A. Gadbail, R. Gondivkar, et al., "Nutrition and oral health," *Disease-a-Month,* vol. 65, no. 6, pp. 147-154, June 2019.

[2] I. Tohary, A. Jan, M. Alotaibi, et al., "The impact of diet and nutrition on oral health: A systematic review," *Migration Letters,* vol. 19, no. S5, pp. 338-346, 2022.

[3] M. Rotella, "An Overview on Dental Wear," *Oral Health,* 11 October 2020.

[4] N. Schlueter, B. Amaechi, D. Barlett, et al., "Terminology of Erosive Tooth Wear: Consensus Report of a Workshop Organized by the ORCA and the Cariology Research Group of the IADR," *Caries Research,* vol. 54, pp. 1-6, 2020.

[5] A. Delgado and V. Ólafsson, "Strategies for managing erosive tooth wear," *Dimensions of Dental Hygiene,* 19 November 2019.

[6] V. Meza, J. Arnold, L. Díaz, et al., "Alcohol consumption: Medical implications, the liver and beyond," *Alcohol and Alcoholism,* vol. 57, no. 3, pp. 283-291, May 2022.

[28] Refer to Episodes 91, 93, and 94 for discussion on diabetes and oral health.

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[7] American Dental Association, "Dental Erosion," 22 October 2025. [Online]. Available: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/dental-erosion. [Accessed 11 November 2025].

[8] National Institutes of Health, "Oral health in America: Advances and challenges," 2021. [Online]. Available: https://www.nidcr.nih.gov/sites/default/files/2021-12/Oral-Health-in-America-Advances-and-Challenges.pdf. [Accessed 29 March 2023].

[9] M. Lemaster, "Tooth Wear and Dentin Hypersensitivity," *Dimensions of Dental Hygiene,* 8 June 2009.

[10] S. Eckhart, J. Brewster and D. Curtis, "The erosive potential of sugar-free waters on cervical dentin," *JADA Foundational Science,* vol. 1, pp. 1-6, 2022.

[11] W. Noble, P. Buchanan, B. Surti and R. Lubman, "Noncarious Cervical Lesions," *Dimensions of Dental Hygiene,* 7 October 2014.

[12] J. Tahmassebi and A. BaniHani, "Impact of soft drinks to health and economy: A critical review," *European Archives of Paediatric Dentistry,* vol. 21, pp. 109-117, 2020.

[13] A. Reddy, D. Norris, S. Momeni, B. Waldo and J. Ruby, "The pH of beverages available to the American consumer," *Journal of the American Dental Association,* vol. 147, no. 4, pp. 255-263, April 2016.

[14] R. Loewen, R. Marolt and J. Ruby, "Pucker up: The effects of sour candy on your patients' oral health," *Northwest Dentistry,* Vols. March-April, pp. 20-33, 2008.

[15] B. Amaechi, "Caries Process, Prevention, and Management: Erosion," 15 August 2025. [Online]. Available: https://www.dentalcare.com/en-us/ce-courses/ce716/glossary. [Accessed 12 November 2025].

[16] J. Featherstone and A. Lussi, "Understanding the Chemistry of Dental Erosion," in *Monographs in Oral Science*, Basel, Karger AG, 2006, pp. 66-76.

[17] World Health Organization, "Sugars and dental caries," 14 August 2025. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/sugars-and-dental-caries. [Accessed 11 November 2025].

[18] American Dental Association, "Nutrition and Oral Health," 30 August 2023. [Online]. Available: https://www.ada.org/resources/ada-library/oral-health-topics/nutrition-and-oral-health. [Accessed 20 October 2025].

[19] C. Ribeiro, C. Tabchoury, A. Cury, et al., "Effect of starch on the cariogenic potential of sucrose," *British Journal of Nutrition,* vol. 94, no. 1, pp. 44-50, March 2007.

[20] P. Moynihan and S. Kelly, "Effect on caries of restricting sugars intake: Systematic review to inform WHO guidelines," *Journal of Dental Research,* vol. 93, no. 1, pp. 8-18, 9 December 2013.

[21] World Health Organization, "Guideline: sugars intake for adults and children," 4 March 2015. [Online]. Available: https://www.who.int/publications/i/item/9789241549028. [Accessed 11 November 2025].

[22] World Health Organization, "WHO calls on countries to reduce sugars intake among adults and children," 4 March 2015. [Online]. Available:

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https://www.who.int/news/item/04-03-2015-who-calls-on-countries-to-reduce-sugars-intake-among-adults-and-children. [Accessed 1 June 2023].

[23] Heart and Stroke Foundation of Canada, "Reduce sugar," 2023. [Online]. Available: https://www.heartandstroke.ca/healthy-living/healthy-eating/reduce-sugar. [Accessed 1 June 2023].

[24] P. Moynihan, "Sugars and dental caries: Evidence for setting a recommended threshold for intake," *Advances in Nutrition,* vol. 7, no. 1, pp. 149-156, January 2016.

[25] A. Sheetal, V. Hiremath, A. Patil, et al., "Malnutrition and its oral outcome – A review," *Journal of Clinical & Diagnostic Research,* vol. 7, no. 1, pp. 178-180, 1 January 2013.

[26] H. Alanazi, H. Alenazi, S. Alenazi, et al., "Nutritional status and its effect on dental health among children," *International Journal of Community Medicine and Public Health,* vol. 10, no. 1, pp. 393-397, January 2023.

[27] A. Ehizele, P. Ojehanon and O. Akhionbare, "Nutrition and oral health," *Journal of Postgraduate Medicine,* vol. 11, no. 1, pp. 76-82, 2009.

[28] L. Samaranayake, T. Porntaveetus, J. Tsoi, et al., "Facts and fallacies of the fluoride controversy: A contemporary perspective," *International Dental Journal,* vol. 75, no. 4, pp. 1-12, August 2025.

[29] P. Martinon, L. Fraticelli, A. Giboreau, et al., "Nutrition as a key modifiable factor for periodontitis and main chronic diseases," *Journal of Clinical Medicine,* vol. 10, no. 2, pp. 1-26, 7 January 2021.

[30] Y. Berg, E. Gabay, D. Božić, et al., "The impact of nutritional components on periodontal health: A literature review," *Nutrients,* vol. 16, no. 22, pp. 1-15, 15 November 2024.

[31] S. Najeeb, M. Zafar, Z. Khurshid, et al., "The role of nutrition in periodontal health: An update," *Nutrients,* vol. 8, no. 9, pp. 1-18, 30 August 2016.

[32] M. Hans, P. Malik, V. Hans, et al., "Serum levels of various vitamins in periodontal health and disease- a cross sectional study," *Journal of Oral Biology and Craniofacial Research,* vol. 13, no. 4, pp. 471-475, July-August 2023.

[33] G. Zong, B. Holtfreter, A. Scott, et al., "Serum vitamin B12 is inversely associated with periodontal progression and risk of tooth loss: A prospective cohort study," *Journal of Clinical Periodontology,* vol. 43, no. 1, pp. 2-9, 27 November 2015.

[34] J. Ebersole, J. Lambert, H. Bush, et al., "Serum nutrient levels and aging effects on periodontitis," *Nutrients,* vol. 10, no. 12, pp. 1-19, 15 December 2018.

[35] R. Neiva, K. Al-Shammari, F. Nociti, et al., "Effects of vitamin-B complex supplementation on periodontal wound healing," *Journal of Periodontology,* vol. 76, no. 7, pp. 1084-1091, 1 July 2005.

[36] H. Fageeh, F. H, A. Prabhu, et al., "Efficacy of vitamin C supplementation as an adjunct in the non-surgical management of periodontitis: A systematic review," *Systematic Reviews,* vol. 10, article 5, pp. 1-10, 4 January 2021.

[37] D. Kuzmanova and H. Dommisch, "The role of micronutrients in periodontal disease prevention and therapy," European Federation of Periodontology, 2025.

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[Online]. Available: https://www.efp.org/publications-hub/the-role-of-micronutrients-in-periodontal-disease-prevention-and-therapy/. [Accessed 15 November 2025].

[38] M. Gandhi, O. Elfeky, H. Ertugrul, et al., "Scurvy: Rediscovering a forgotten disease," *Diseases,* vol. 11, no. 2, pp. 1-11, 26 May 2023.

[39] A. Tada and H. Miura, "The relationship between vitamin c and periodontal diseases: A systematic review," *International Journal of Environmental Research and Public Health,* vol. 16, no. 14, pp. 1-15, 11 July 2019.

[40] P. L. T. Pussinen, G. Alfthan, et al., "Periodontitis is associated with a low concentration of vitamin C in plasma," *Clinical and Vaccine Immunology,* vol. 10, no. 5, pp. 897-902, 1 September 2003.

[41] I. Chapple, B. Mealey, T. Van Dyke, P. Bartold, H. Dommisch, P. Eickholz, M. Geisinger, R. Genco, M. Glogauer, M. Goldstein, T. Griffin, P. Holmstrup, G. Johnson, Y. Kapila, N. Lang, J. Meyle, S. Murakami, J. Plemons, G. Romito, L. Shapira, D. Tatakis and et, "Periodontal health and gingival diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions," *Journal of Perodontology,* vol. 89, no. S1, pp. S74-S84, 2018.

[42] P. Holmstrup, J. Plemons and J. Meyle, "Non-plaque-induced gingival diseases," *Journal of Periodontology,* vol. 89, no. S1, pp. S28-S45, 21 June 2018.

[43] L. Johnson, "Vitamin C Deficiency," Merck Manual Consumer Version , August 2024. [Online]. Available: https://www.merckmanuals.com/home/disorders-of-nutrition/vitamins/vitamin-c-deficiency. [Accessed 29 October 2025].

[44] S. Santonocito, G. Polizzi, G. Palazzo, et al., "Dietary factors affecting the prevalence and impact of periodontal disease," *Clinical, Cosmetic and Investigational Dentistry,* vol. 13, pp. 283-292, 9 July 2021.

[45] U. Van der Velden, D. Kuzmanova and I. Chapple, "Micronutritional approaches to periodontal therapy," *Journal of Clinical Periodontology,,* vol. 38, no. s11, pp. 142-158, 16 February 2011.

[46] D. Kuzmanova, I. Ineke Jansen, T. Schoenmaker, et al., "Vitamin C in plasma and leucocytes in relation to periodontitis," *Journal of Clinical Periodontology,* vol. 39, no. 10, pp. 905-912, 24 June 2012.

[47] P. Hujoel and P. Lingström, "Nutrition, dental caries and periodontal disease: A narrative review," *Journal of Clinical Periodontology,* vol. 44, no. S18, pp. S79-S84, 6 March 2017.

[48] Y. Shimabukuro, Y. Nakayama and Y. Ogata, "Effects of an ascorbic acid–derivative dentifrice in patients with gingivitis: A double-masked, randomized, controlled clinical trial," *Journal of Periodontology,* vol. 86, no. 1, pp. 27-35, 1 January 2015.

[49] I. Chapple and J. Matthews, "The role of reactive oxygen and antioxidant species in periodontal tissue destruction," *Periodontology 2000,* vol. 43, no. 1, pp. 160-232, 4 January 2007.

[50] N. Gokhale, A. Acharya, V. Patil and e. al., "A short-term evaluation of the relationship between plasma ascorbic acid levels and periodontal disease in

Disclaimer: This document is educational and not intended to provide clinical advice nor should it be used as a replacement for professional dental or medical advice. Dental hygienists are encouraged to consult with CDHO practice advisors and refer to CDHO guidelines. Dental hygienists are responsible for the decisions they make and for the consequences associated with those decisions. © ODHA

systemically healthy and type 2 diabetes mellitus subjects," *Journal of Dietary Supplements,* vol. 10, no. 2, pp. 93-104, 2013.

[51] G. Antonoglou, M. Knuuttila, O. Niemelä, et al., "Low serum level of 1,25(OH)2D is associated with chronic periodontitis," *Journal of Periodontal Research,* vol. 50, no. 2, pp. 274-280, 7 July 2014.

[52] E. Jagelavičienė, I. Vaitkevičienė, D. Šilingaitė, et al., "The relationship between vitamin D and periodontal pathology," *Medicina,* vol. 54, no. 3, pp. 1-8, 12 June 2018.

[53] J. Bashutski, R. Eber, J. Kinney, et al., "The impact of vitamin D status on periodontal surgery outcomes," *Journal of Dental Research,* vol. 90, no. 8, 9 May 2011.

[54] H. Lee, D. Je, S. Won, et al., "Association between vitamin D deficiency and periodontal status in current smokers," *Community Dentistry and Oral Epidemiology,* vol. 43, no. 5, pp. 471-478, 29 May 2015.

[55] G. Antonoglou, A. Suominen, M. Knuuttila, et al., "Associations between serum 25-hydroxyvitamin D and periodontal pocketing and gingival bleeding: Results of a study in a non-smoking population in Finland," *Journal of Periodontology,* vol. 86, no. 6, pp. 755-765, 1 June 2015.

[56] L. Johnson, "Vitamin E Deficiency," Merck Manual Consumer Version, August 2024. [Online]. Available: https://www.merckmanuals.com/home/disorders-of-nutrition/vitamins/vitamin-e-deficiency. [Accessed 29 October 2025].

[57] L. Johnson, "Vitamin E Excess," Merck Manual Consumer Version, August 2024. [Online]. Available: https://www.merckmanuals.com/home/disorders-of-nutrition/vitamins/vitamin-e-excess. [Accessed 29 October 2025].

[58] M. Iwasaki, P. Moynihan, M. Manz, et al., "Dietary antioxidants and periodontal disease in community-based older Japanese: A 2-year follow-up study," *Public Health Nutrition,* vol. 16, no. 2, pp. 330-338, 22 May 2012.

[59] S. Santonocito, A. Giudice, A. Polizzi, et al., "A cross-talk between diet and the oral microbiome: Balance of nutrition on inflammation and immune system's response during periodontitis," *Nutrients,* vol. 14, no. 12, pp. 1-22, 11 June 2022.

[60] G. Zong, A. Scott, H. Griffiths, et al., "Serum α-tocopherol has a nonlinear inverse association with periodontitis among US adults," *The Journal of Nutrition,,* vol. 145, no. 5, pp. 893-899, May 2015.

[61] F. Muniz, S. Nogueira, F. Medes, et al., "The impact of antioxidant agents complimentary to periodontal therapy on oxidative stress and periodontal outcomes: A systematic review," *Archives of Oral Biology,* vol. 60, no. 9, pp. 1203-1214, September 2015.

[62] N. Singh, S. Narula, R. Sharma, et al., "Vitamin E supplementation, superoxide dismutase status, and outcome of scaling and root planing in patients with chronic periodontitis: A randomized clinical trial," *Journal of Periodontology,* vol. 85, no. 2, pp. 242-249, 1 February 2014.

[63] D. Dodington, P. Fritz, P. Sullivan and W. Ward, "Higher intakes of fruits and vegetables, β-carotene, vitamin C, α-tocopherol, EPA, and DHA are positively associated with periodontal healing after nonsurgical periodontal therapy in

Disclaimer: This document is educational and not intended to provide clinical advice nor should it be used as a replacement for professional dental or medical advice. Dental hygienists are encouraged to consult with CDHO practice advisors and refer to CDHO guidelines. Dental hygienists are responsible for the decisions they make and for the consequences associated with those decisions. © ODHA

nonsmokers but not in smokers,," *The Journal of Nutrition,* vol. 145, no. 11, pp. 2512-2519, November 2015.

[64] B. Barnawi, N. Alrashidi, A. Albalawi, et al., "Nutritional modulation of periodontal diseases: A narrative review of recent evidence," *Cureus,* vol. 15, no. 12, 8 December 2023.

[65] G. Linden, K. McClean, J. Woodside, et al., "Antioxidants and periodontitis in 60–70-year-old men," *Journal of Clinical Periodontology,* vol. 36, no. 10, pp. 843-849, 10 September 2009.

[66] E. Slade, D. Bartuska, L. Rose and D. Cohen, "Vitamin E and periodontal disease," *Journal of Periodontology,* vol. 47, no. 6, pp. 352-354, June 1976.

[67] M. Garcia, C. Hildebolt, D. Miley, et al., "One-year effects of vitamin D and calcium supplementation on chronic periodontitis," *Journal of Periodontology,* vol. 82, no. 1, pp. 25-32, 1 January 2011.

[68] A. Adegboye, L. Christensen, P. Holm-Pedersen, et al., "Intake of dairy products in relation to periodontitis in older Danish adults," *Nutrients,* vol. 4, no. 9, pp. 1219-1229, 4 September 2012.

[69] K. Tanaka, Y. Miyake, H. Okubo, et al., "Calcium intake is associated with decreased prevalence of periodontal disease in young Japanese women," *Nutrition Journal,* vol. 14, article 109, pp. 1-6, 24 November 2014.

[70] G. Gerber, "Iron Deficiency Anemia," Merck Manual Professional Version, April 2025. [Online]. Available: https://www.merckmanuals.com/professional/hematology-and-oncology/anemias-caused-by-deficient-erythropoiesis/iron-deficiency-anemia. [Accessed 15 November 2025].

[71] S. Chakraborty, S. Tewari, R. Sharma, et al., "Impact of iron deficiency anemia on chronic periodontitis and superoxide dismutase activity: A cross-sectional study," *Journal of Periodontal & Implant Science,* vol. 44, no. 2, pp. 57-64, 24 April 2014.

[72] H. Jentsch, G. Knöfler, R. Purschwitz and E. S, "Periodontal dressing as an adjunct after scaling and root planing - A useful preventive tool?," *Oral Health and Preventive Dentistry,* vol. 14, no. 2, pp. 101-109, 2016.

[73] D. Pushparani, "Serum zinc and β D glucuronidase enzyme level in type 2 diabetes mellitus with periodontitis," *Current Diabetes Reviews,* vol. 12, no. 4, pp. 449-453, 2016.

[74] D. Pushparani, "Zinc and type 2 diabetes mellitus with periodontitis- A systematic review," *Current Diabetes Reviews,* vol. 10, no. 6, pp. 1875-6417, 2014.

[75] M. Yamori, M. Njelekela, J. Mtabaji, et al., "Hypertension, periodontal disease, and potassium intake in nonsmoking, nondrinker African women on no medication," *International Journal of Hypertension,* vol. 2011, no. 1, pp. 1-5, 2011.

[76] L. Johnson, "Copper Deficiency," Merck Manual Consumer Version, July 2025. [Online]. Available: https://www.merckmanuals.com/home/disorders-of-nutrition/minerals/copper-deficiency. [Accessed 14 November 2025].

[77] B. Thomas, S. Kumari, K. Ramitha and K. M. Ashwini, "Comparative evaluation of micronutrient status in the serum of diabetes mellitus patients and healthy

Disclaimer: This document is educational and not intended to provide clinical advice nor should it be used as a replacement for professional dental or medical advice. Dental hygienists are encouraged to consult with CDHO practice advisors and refer to CDHO guidelines. Dental hygienists are responsible for the decisions they make and for the consequences associated with those decisions. © ODHA

individuals with periodontitis," *Journal of Indian Society of Periodontology,* vol. 14, no. 1, pp. 46-49, January-March 2010.

[78] G. Sundaram, T. Ramakrishnan, H. Parthasarathy, et al., "Evaluation of micronutrient (zinc, magnesium, and copper) levels in serum and glycemic status after nonsurgical periodontal therapy in type 2 diabetic patients with chronic periodontitis, Contemporary," *Contemporary Clinical Dentistry,* vol. 8, no. 1, pp. 26-32, January-March 2017.

[79] H. Kim, J. Na, K. Lee and K. Bae, "Association Between Plasma levels of manganese and periodontal status: A study based on the fourth Korean National Health and Nutrition Examination Survey," *Journal of Periodontology,* vol. 85, no. 12, pp. 1748-1754, 1 December 2014.

[80] B. Thomas, A. Ramesh, S. Suresh and B. Prasad, "A comparative evaluation of antioxidant enzymes and selenium in the serum of periodontitis patients with diabetes mellitus type 2," *Contemporary Clinical Dentistry,* vol. 4, no. 2, pp. 176-180, 2013.

[81] D. Chatterjee, A. Chatterjee, D. Kalra, et al., "Role of adjunct use of omega 3 fatty acids in periodontal therapy of periodontitis. A systematic review and meta-analysis," *Journal of Oral Biology and Craniofacial Research,* vol. 12, no. 1, January-February 2022.

[82] M. Castro dos Santos, M. Furukawa, I. Oliveira-Cardoso, et al., "Does the use of omega-3 fatty acids as an adjunct to non-surgical periodontal therapy provide additional benefits in the treatment of periodontitis? A systematic review and meta-analysis," *Journal of Periodontal Research,* vol. 57, no. 3, pp. 435-447, 3 March 2022.

[83] A. Kruse, C. Kowalski, S. Leuthold, et al., "What is the impact of the adjunctive use of omega-3 fatty acids in the treatment of periodontitis? A systematic review and meta-analysis," *Lipids in Health and Disease,* vol. 19, article 100, pp. 1-16, 21 May 2020.

[84] C. Pappe, B. Peters, O. Pivovarova-Ramich, et al., "Effects of a 4-week free-sugar avoidance during periodontal therapy: An explorative randomized controlled clinical trial," *Journal of Periodontology,* pp. 1-16, 26 August 2024.

[85] I. Song, K. K. Y. Han, et al., "Associations between the consumption of carbonated beverages and periodontal disease: The 2008–2010 Korea national health and nutrition examination survey," *Medicine,* vol. 95, no. 28, pp. 1-7, July 2016.

[86] S. Shanmugasundaram and S. Karmakar, "Excess dietary sugar and its impact on periodontal inflammation: A narrative review," *BDJ Open,* vol. 10, article 78, pp. 1-8, 9 October 2024.

[87] M. Pavia, C. Pileggi, C. Nobile and I. Angelillo, "Association between fruit and vegetable consumption and oral cancer: A meta-analysis of observational studies," *The American Journal of Clinical Nutrition,* vol. 83, no. 5, pp. 1126-1134, May 2006.

[88] A. Chi and T. Day, "Oral cavity and oropharyngeal squamous cell carcinoma—an update," *CA: A Cancer Journal for Clinicians,* vol. 65, no. 5, pp. 401-421, 27 July 2015.

Disclaimer: This document is educational and not intended to provide clinical advice nor should it be used as a replacement for professional dental or medical advice. Dental hygienists are encouraged to consult with CDHO practice advisors and refer to CDHO guidelines. Dental hygienists are responsible for the decisions they make and for the consequences associated with those decisions. © ODHA

[89] N. Freedman, Y. Park, A. Subar, et al., "Fruit and vegetable intake and head and neck cancer risk in a large United States prospective cohort study," *International Journal of Cancer,* vol. 122, no. 10, pp. 2330-2336, 18 December 2007.

[90] L. Gomez-Castillo, K. Cushing-Haugen, M. Useche, et al., "High sugar-sweetened beverage intake and oral cavity cancer in smoking and nonsmoking women," *JAMA Otolaryngology–Head & Neck Surgery,,* vol. 151, no. 5, pp. 450-457, 13 March 2025.

[91] American Dental Association , "Xerostomia (Dry Mouth)," 24 April 2023. [Online]. Available: https://www.ada.org/resources/research/science-and-research-institute/oral-health-topics/xerostomia. [Accessed 30 June 2023].

[92] Oral Health Foundation, "The role of hydration in oral health," [Online]. Available: https://www.dentalhealth.org/the-role-of-hydration-in-oral-health. [Accessed 14 November 2025].

[93] X. Li, L. Wang, L. Yang and e. al., "The association between plain water intake and periodontitis in the population aged over 45: A cross-sectional study based on NHANES 2009–2014, January 5, 2024, p," *BMC Oral Health,* vol. 24, article 27, pp. 1-10, 5 January 2024.

Client Resources

Nutrition and Oral Health, ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/Nutrition.19.1-copyright.pdf

Enamel Erosion, ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/ODHA-Facts-Enamel-Erosion.VFS21.13.pdf

Acid Reflux and Oral Health, ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/Acid-Reflux.20.2.pdf

Dry Mouth, ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/ODHA-Facts-Dry-Mouth.VFS18-copyright.pdf

Tooth Decay (Caries) ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/Tooth-Decay.23.1.pdf

Periodontal (Gum) Disease, ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/Gum-Disease.14.1-copyright.pdf

Halitosis, ODHA Factsheet
https://odha.on.ca/wp-content/uploads/2016/08/ODHA-Facts-Halitosis-Bad-Breath.VFS24.5.pdf

Canada's Food Guide, Government of Canada
https://food-guide.canada.ca/en/

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Additional Resources

Nutrition and oral health, Gondivkar, S; Gadbail, A; Gondivkar, R; et al. *Disease-a-Month,* Volume 65, Issue 6, June 2019, p 147-154
https://www.sciencedirect.com/science/article/abs/pii/S0011502918301287

The impact of diet and nutrition on oral health: A systematic review, Tohary, I; Jan, A; Alotaibi, M; et al. *Migration Letters*, Volume 19, Issue S5, 2022, p 338-346
https://migrationletters.com/index.php/ml/article/view/9706

Nutrition and Oral Health, American Dental Association, August 30, 2023
https://www.ada.org/resources/ada-library/oral-health-topics/nutrition-and-oral-health

Nutrition and oral health, Ehizele, A; Ojehanon, P; Akhionbare, O. *Journal of Postgraduate Medicine*, Volume 11, Issue 1, 2009, p 76-82
https://www.ajol.info/index.php/bjpm/article/view/48830

The erosive potential of sugar-free waters on cervical dentin, Eckhart, S; Brewster, J; Curtis, D. *JADA Foundational Science*, Volume 1, 2022, p 1-6
https://www.sciencedirect.com/science/article/pii/S2772414X22000056

Impact of soft drinks to health and economy: A critical review, Tahmassebi, J; BaniHani, A. *European Archives of Paediatric Dentistry*, Volume 21, June 8, 2019, p 109-117
https://link.springer.com/article/10.1007/s40368-019-00458-0

The pH of beverages available to the American consumer, Reddy, A; Norris, D; Momeni, S; et al. *Journal of the American Dental Association*, Volume 147, Issue 4, April 2016, p 255-263 https://pmc.ncbi.nlm.nih.gov/articles/PMC4808596/

Pucker up: The effects of sour candy on your patients' oral health, Loewen, R; Marolt, R; Ruby, J. *Northwest Dentistry*, March-April, 2008, p 20-33
https://www.powerofsour.com/userfiles/ckfiles/files/Pucker%20Up%20Power%20of%20Sour%20Article.pdf

Effect of starch on the cariogenic potential of sucrose, Ribeiro, C; Tabchoury, C; Cury, A; et al. *British Journal of Nutrition*, Volume 94, Issue 1, July 2005, p 44-50
https://www.cambridge.org/core/journals/british-journal-of-nutrition/article/effect-of-starch-on-the-cariogenic-potential-of-sucrose/F8074CEF23F218CDB914615AC0765F1D

Effect on caries of restricting sugars intake, Moynihan, P; Kelly, S. *Journal of Dental Research*, Volume 93, Issue 1, December 9, 2013, p 8-18
https://pmc.ncbi.nlm.nih.gov/articles/PMC3872848/

Sugars and dental caries: Evidence for setting a recommended threshold for intake, Moynihan, P. *Advances in Nutrition*, Volume 7, Issue 1, January 2016, p 149-156
https://www.sciencedirect.com/science/article/pii/S2161831323001485

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Malnutrition and its oral outcome – A review, Sheetal, A; Hiremath, V; Patil, A; et al. *Journal of Clinical & Diagnostic Research*, Volume 7, Issue 1, January 1, 2013, p 178-180 https://pmc.ncbi.nlm.nih.gov/articles/PMC3576783/

Nutritional status and its effect on dental health among children, Alanazi, H; Alenazi, H; Alenazi, S; et al. *International Journal of Community Medicine and Public Health*, Volume 10, Issue 1, January 2023, p 393-397 https://www.ijcmph.com/index.php/ijcmph/article/view/10722/6375

Nutrition as a key modifiable factor for periodontitis and main chronic diseases, Martinon, P; Fraticelli, L; Giboreau, A; et al. *Journal of Clinical Medicine*, Volume 10, Issue 2, January 7, 2021, p 1-26 https://www.mdpi.com/2077-0383/10/2/197

The impact of nutritional components on periodontal health: A literature review, Berg, Y; Gabay, E; Božić, D; et al. *Nutrients*, Volume 16, Issue 22, November 15, 2024, p 1-15 https://www.mdpi.com/2072-6643/16/22/3901

The role of nutrition in periodontal health: An update, Najeeb, S; Zafar, M; Khurshid, Z; et al. *Nutrients*, Volume 8, Issue 9, August 30, 2016, p 1-18 https://www.mdpi.com/2072-6643/8/9/530

Serum levels of various vitamins in periodontal health and disease- a cross sectional study, Hans, M; Malik, P; Hans, V; et al. *Journal of Oral Biology and Craniofacial Research*, Volume 13, Issue 4, July-August 2023, p 471-475 https://www.sciencedirect.com/science/article/pii/S2212426823000611

Facts and fallacies of the fluoride controversy: A contemporary perspective, Samaranayake, L; Porntaveetus, T; Tsoi, J; et al. *International Dental Journal*, Volume 75, Issue 4, August 2025, p 1-12 https://www.sciencedirect.com/science/article/pii/S0020653925001224

Serum nutrient levels and aging effects on periodontitis, Ebersole, J; Lambert, J; Bush, H; et al. *Nutrients*, Volume 10, Issue 12, December 15, 2018, p 1-19 https://www.mdpi.com/2072-6643/10/12/1986

Serum vitamin B12 is inversely associated with periodontal progression and risk of tooth loss: A prospective cohort study, Zong, G; Holtfreter, B; Scott, A; et al. *Journal of Clinical Periodontology*, Volume 43, Issue 1, November 27, 2015, p 2-9 https://onlinelibrary.wiley.com/doi/10.1111/jcpe.12483

Effects of vitamin-B complex supplementation on periodontal wound healing, Neiva, R; Al-Shammari, K; Nociti, F; et al. *Journal of Periodontology*, Volume 76, Issue 7, July 1, 2005, p 1084-1091 https://aap.onlinelibrary.wiley.com/doi/10.1902/jop.2005.76.7.1084

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Efficacy of vitamin C supplementation as an adjunct in the non-surgical management of periodontitis: A systematic review, Fageeh, H; Fageeh H; Prabhu, A; et al. *Systematic Reviews*, Volume 10, Article 5, January 4, 2021, p 1-10 https://systematicreviewsjournal.biomedcentral.com/articles/10.1186/s13643-020-01554-9

Scurvy: Rediscovering a forgotten disease, Gandhi, M; Elfeky, O; Ertugrul, H; et al. *Diseases*, Volume 11, Issue 2, May 26, 2023, p 1-11 https://www.mdpi.com/2079-9721/11/2/78

The relationship between vitamin c and periodontal diseases: A systematic review, Tada, A; Miura, H. *International Journal of Environmental Research and Public Health*, Volume 16, Issue 14, July 11, 2019, p 1-15 https://www.mdpi.com/1660-4601/16/14/2472

Periodontitis is associated with a low concentration of vitamin C in plasma, Pussinen, P Laatikainen, T; Alfthan, G; et al. *Clinical and Vaccine Immunology*, Volume 10, Issue 5, September 1, 2003, p 897-902 https://journals.asm.org/doi/10.1128/cdli.10.5.897-902.2003

Non-plaque-induced gingival diseases, Holmstrup, P; Plemons, J; Meyle, J. *Journal of Periodontology*, Volume 89, Issue S1, June 21, 2018, p S28-S45 https://aap.onlinelibrary.wiley.com/doi/10.1002/JPER.17-0163

Periodontal health and gingival diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, Chapple, I; Mealey, B; Van Dyke, T; et al. *Journal of Periodontology*, Volume 89, Issue S1, June 21, 2018, p S74-S84 https://aap.onlinelibrary.wiley.com/doi/10.1002/JPER.17-0719

Vitamin C Deficiency, Johnson, L. *Merck Manual Professional Version*, August 2024 https://www.merckmanuals.com/professional/nutritional-disorders/vitamin-deficiency-dependency-and-toxicity/vitamin-c-deficiency

Dietary factors affecting the prevalence and impact of periodontal disease, Santonocito, S; Polizzi, G; Palazzo, G; et al. *Clinical, Cosmetic and Investigational Dentistry*, Volume 13, July 9, 2021, p 283-292 https://pmc.ncbi.nlm.nih.gov/articles/PMC8276823/

Micronutritional approaches to periodontal therapy, Van der Velden, U; Kuzmanova, D; Chapple, I. *Journal of Clinical Periodontology*, Volume 38, Issue s11, February 16, 2011, p 142-158 https://onlinelibrary.wiley.com/doi/10.1111/j.1600-051X.2010.01663.x

Vitamin C in plasma and leucocytes in relation to periodontitis, Kuzmanova, D; Ineke Jansen, I; Schoenmaker, T; et al. *Journal of Clinical Periodontology*, Volume 39, Issue 10, June 24, 2012, p 905-912 https://onlinelibrary.wiley.com/doi/10.1111/j.1600-051X.2012.01927.x

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Nutrition, dental caries and periodontal disease: A narrative review, Hujoel, P; Lingström, P. *Journal of Clinical Periodontology*, Volume 44, Issue S18, March 6, 2017, p S79-S84 https://onlinelibrary.wiley.com/doi/10.1111/jcpe.12672

Effects of an ascorbic acid–derivative dentifrice in patients with gingivitis: A double-masked, randomized, controlled clinical trial, Shimabukuro, Y; Nakayama, Y; Ogata, Y. *Journal of Periodontology*, Volume 86, Issue 1, January 1, 2015, p 27-35 https://aap.onlinelibrary.wiley.com/doi/10.1902/jop.2014.140138

A short-term evaluation of the relationship between plasma ascorbic acid levels and periodontal disease in systemically healthy and type 2 diabetes mellitus subjects, Gokhale, N; Acharya, A; Patil, V; et al. *Journal of Dietary Supplements*, Volume 10, Issue 2, June 3, 2013, p 93-104 https://www.tandfonline.com/doi/full/10.3109/19390211.2013.790332

The relationship between vitamin D and periodontal pathology, Jagelavičienė, E; Vaitkevičienė, I; Šilingaitė, D; et al. *Medicina*, Volume 54, Issue 3, June 12, 2018, p 1-8 https://www.mdpi.com/1648-9144/54/3/45

The impact of vitamin D status on periodontal surgery outcomes, Bashutski, J; Eber, R; Kinney, J; et al. *Journal of Dental Research*, Volume 90, Issue 8, May 9, 2011 https://journals.sagepub.com/doi/10.1177/0022034511407771

Dietary antioxidants and periodontal disease in community-based older Japanese: a 2-year follow-up study, Iwasaki, M; Moynihan, P; Manz, M; et al. *Public Health Nutrition*, Volume 16, Issue 2, May 22, 2012, p 330-338 https://www.cambridge.org/core/journals/public-health-nutrition/article/dietary-antioxidants-and-periodontal-disease-in-communitybased-older-japanese-a-2year-followup-study/E9C6D137DD54EDD9CD267FD497F41C94

A cross-talk between diet and the oral microbiome: Balance of nutrition on inflammation and immune system's response during periodontitis, Santonocito, S; Giudice, A; Polizzi, A; et al. *Nutrients*, Volume 14, Issue 12, June 11, 2022, p 1-22 https://www.mdpi.com/2072-6643/14/12/2426

Serum α-tocopherol has a nonlinear inverse association with periodontitis among US adults, Zong, G; Scott, A; Griffiths, H; et al. *The Journal of Nutrition*, Volume 145, Issue 5, May 2015, p 893-899 https://www.sciencedirect.com/science/article/pii/S0022316622087065

Higher intakes of fruits and vegetables, β-carotene, vitamin C, α-tocopherol, EPA, and DHA are positively associated with periodontal healing after nonsurgical periodontal therapy in nonsmokers but not in smokers, Dodington, D; Fritz, P; Sullivan, P; Ward, W. *The Journal of Nutrition*, Volume 145, Issue 11, November 2015, p 2512-2519 https://www.sciencedirect.com/science/article/pii/S0022316622089209

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Nutritional modulation of periodontal diseases: A narrative review of recent evidence, Barnawi, B; Alrashidi, N; Albalawi, A; et al. *Cureus*, Volume 15, Issue 12, December 08, 2023 https://www.cureus.com/articles/210250-nutritional-modulation-of-periodontal-diseases-a-narrative-review-of-recent-evidence#!/

Intake of dairy products in relation to periodontitis in older Danish adults, Adegboye, A; Christensen, L; Holm-Pedersen, P; et al. *Nutrients*, Volume 4, Issue 9, September 4, 2012, p 1219-1229 https://www.mdpi.com/2072-6643/4/9/1219

Calcium, vitamin D, casein and whey protein intakes and periodontitis among Danish adults, Adegboye, A; Boucher, B; Kongstad, J; et al. *Public Health Nutrition*, Volume 19, Issue 3, May 4, 2015, p 503-510 https://www.cambridge.org/core/journals/public-health-nutrition/article/calcium-vitamin-d-casein-and-whey-protein-intakes-and-periodontitis-among-danish-adults/79B30EA15AB1A7AD039A4E7BE6322C7A

Calcium intake is associated with decreased prevalence of periodontal disease in young Japanese women, Tanaka, K; Miyake, Y; Okubo, H; et al. *Nutrition Journal*, Volume 13, Article 109, November 24, 2014, p 1-6 https://nutritionj.biomedcentral.com/articles/10.1186/1475-2891-13-109

Impact of iron deficiency anemia on chronic periodontitis and superoxide dismutase activity: A cross-sectional study, Chakraborty, S; Tewari, S; Sharma, R; et al. *Journal of Periodontal & Implant Science*, Volume 44, Issue 2, April 24, 2014, p 57-64 https://jpis.org/DOIx.php?id=10.5051/jpis.2014.44.2.57

Hypertension, periodontal disease, and potassium intake in nonsmoking, nondrinker African women on no medication, Yamori, M; Njelekela, M; Mtabaji, J; et al. *International Journal of Hypertension*, Volume 2011, Issue 1, August 4, 2011, p 1-5 https://onlinelibrary.wiley.com/doi/10.4061/2011/695719

Comparative evaluation of micronutrient status in the serum of diabetes mellitus patients and healthy individuals with periodontitis, Thomas, B; Kumari, S; Ramitha, K; Ashwini, Kumari, M. *Journal of Indian Society of Periodontology*, Volume 14, Issue 1, January-March 2020, p 46-49 https://journals.lww.com/jisp/fulltext/2010/14010/comparative_evaluation_of_micronutrient_status_in.11.aspx

Evaluation of micronutrient (zinc, magnesium, and copper) levels in serum and glycemic status after nonsurgical periodontal therapy in type 2 diabetic patients with chronic periodontitis, Sundaram, G; Ramakrishnan, T; Parthasarathy, H; et al. *Contemporary Clinical Dentistry*, Volume 8, Issue 1, January-March 2017, p 26-32 https://journals.lww.com/cocd/fulltext/2017/08010/evaluation_of_micronutrient__zinc,_magnesium,_and.7.aspx

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Micronutrients and the periodontium: A narrative review, Doshi, D; Kumar, S; Patel, B; et al. *Cureus*, Volume 17, Issue 4, April 04, 2025 https://www.cureus.com/articles/356867-micronutrients-and-the-periodontium-a-narrative-review#!/

A comparative evaluation of antioxidant enzymes and selenium in the serum of periodontitis patients with diabetes mellitus type 2, Thomas, B; Ramesh, A; Suresh, S; Prasad, B, *Contemporary Clinical Dentistry*, Volume 4, Issue 2, 2013, p 176-180 https://journals.lww.com/cocd/fulltext/2013/04020/a_comparative_evaluation_of_antioxidant_enzymes.9.aspx

Role of adjunct use of omega 3 fatty acids in periodontal therapy of periodontitis. A systematic review and meta-analysis, Chatterjee, D; Chatterjee, A; Kalra, D; et al. *Journal of Oral Biology and Craniofacial Research*, Volume 12, Issue 1, January-February 2022, p 55-62 https://pmc.ncbi.nlm.nih.gov/articles/PMC8566999/

What is the impact of the adjunctive use of omega-3 fatty acids in the treatment of periodontitis? A systematic review and meta-analysis, Kruse, A; Kowalski, C; Leuthold, S; et al. *Lipids in Health and Disease*, Volume 19, Article 100, May 21, 2020, p 1-16 https://lipidworld.biomedcentral.com/articles/10.1186/s12944-020-01267-x

Excess dietary sugar and its impact on periodontal inflammation: A narrative review, Shanmugasundaram, S; Karmakar, S. *BDJ Open*, Volume 10, Article 78, October 9, 2024, p 1-8 https://www.nature.com/articles/s41405-024-00265-w

Effects of a 4-week free-sugar avoidance during periodontal therapy: An explorative randomized controlled clinical trial, Pappe, C; Peters, B; Pivovarova-Ramich, et al. *Journal of Periodontology*, August 26, 2024, p 1-6 https://aap.onlinelibrary.wiley.com/doi/10.1002/JPER.24-0208

Association between fruit and vegetable consumption and oral cancer: A meta-analysis of observational studies, Pavia, M; Pileggi, C; Nobile, C; Angelillo, I. *The American Journal of Clinical Nutrition,* Volume 83, Issue 5, May 2006, p 1126-1134 https://www.sciencedirect.com/science/article/pii/S0002916523294228

Oral cavity and oropharyngeal squamous cell carcinoma—an update, Chi, A; Day, T. *CA: A Cancer Journal for Clinicians*, Volume 65, Issue 5, July 27, 2015, p 401-421 https://acsjournals.onlinelibrary.wiley.com/doi/10.3322/caac.21293

Fruit and vegetable intake and head and neck cancer risk in a large United States prospective cohort study, Freedman, N; Park, Y; Subar, A; et al. *International Journal of Cancer*, Volume 122, Issue 10, December 18, 2007, p 2330-2336 https://onlinelibrary.wiley.com/doi/10.1002/ijc.23319

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High sugar-sweetened beverage intake and oral cavity cancer in smoking and nonsmoking women, Gomez-Castillo, L; Cushing-Haugen, K; Useche, M; et al. *JAMA Otolaryngology–Head & Neck Surgery*, Volume 151, Issue 5, March 13, 2025, p 450-457 https://jamanetwork.com/journals/jamaotolaryngology/fullarticle/2831121

The association between plain water intake and periodontitis in the population aged over 45: A cross-sectional study based on NHANES 2009–2014, Li, X; Wang, L; Yang, L; et al. *BMC Oral Health*, Volume 24, Article 27, January 5, 2024, p 1-10 https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-023-03809-y

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