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## Dental Erosion and Systemic Diseases: An Overview

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### ABSTRACT

Dental erosion is the irreversible loss of tooth structure due to chemical and mechanical processes, resulting from both intrinsic and extrinsic factors. Several systemic diseases have been reported to contribute to dental erosion. This review summarizes the impact of several systemic diseases on dental erosion development. A literature search was conducted on 21 diseases: eating disorders, depression, gastroesophageal reflux disease, cerebral palsy, asthma, diabetes mellitus, renal failure, cardiovascular diseases, Sjögren's syndrome, celiac disease, inflammatory bowel disease, liver disease, iron deficiency anemia, rheumatoid arthritis, thyroid and parathyroid disorders, systemic lupus erythematosus, obstructive sleep apnea, Parkinson's disease, cystic fibrosis, and rickets. The findings indicate that several systemic diseases may promote dental erosion through various mechanisms, such as direct exposure to gastric acids, use of acidic medication, reduced salivary flow, and enamel defects. Dental practitioners should recognize systemic conditions that predispose patients to dental erosion in order to facilitate timely referrals and minimize further tooth damage.

**Keywords:** Dental erosion, Systemic diseases, Medications, Tooth wear, Acids, Saliva.

### 1. Introduction

Dental erosion is considered a multifactorial disease that involves interaction between chemical, mechanical and behavioral factors for occurrence. It occurs in two stages; in the first stage (chemical), tooth demineralization occurs due to acid dissolution, which weakens the tooth structure. In the second stage (mechanical), the weakened tooth structures are lost due to intraoral friction, eventually leading to alterations in tooth shape (1). Behavioral factors, including immediate tooth brushing after acid exposure can increase tooth structure loss, because the softened tooth surface is more vulnerable to mechanical removal (2).

Dental erosion is caused by two etiologies: intrinsic (resulting from a disorder within the body) and extrinsic (arising from external factors). Extrinsic dental erosion is associated with behavioral factors, such as the high

consumption and frequent intake of acidic drinks by children and adults (3) and people who follow a vegetarian diet that primarily consists of vegetables and acidic fruits (4). Intrinsic dental erosion refers to erosion caused by acids produced within the body. It can result from the regurgitation of gastric hydrochloric acid, as occurs in patients with gastrointestinal disorders (5) or during vomiting episodes associated with eating disorders (6).

Another contributing factor is dry mouth (xerostomia), because reduced salivary flow impairs saliva's buffering capacity. This reduction in buffering ability decreases the saliva's effectiveness in maintaining a normal oral pH, thereby exposing dental tissues to prolonged acid attacks (7). Consequently, systemic diseases or the medications used in their management that alter salivary flow rates may facilitate

the development and progression of dental erosion (8). This article focuses on the role of systemic diseases in the development of dental erosion and aims to summarize their association.

## 2. Materials and Methods

This paper provides an overview of the existing literature. A literature search was conducted across PubMed and Google Scholar. Two main sets of keywords were used in the literature search: the first was “dental erosion” and the second consisted of “the name of a selected systemic disease”. The following systemic diseases were searched: Eating disorders, Bulimia nervosa, Anorexia nervosa, Depression, Gastroesophageal reflux disease, Cerebral palsy, Asthma, Diabetes mellitus, Renal/kidney failure, Cardiovascular diseases, Hypertension, heart diseases, Sjögren’s syndrome, Celiac Disease, Inflammatory bowel disease, Crohn’s disease, ulcerative colitis, liver disease, iron deficiency anemia, Rheumatoid arthritis, thyroid disease, Hyperthyroidism, Hypothyroidism, Hashimoto’s thyroiditis, Graves’ disease, hypoparathyroidism, hyperparathyroidism, Parkinson’s disease, Systemic lupus erythematosus, Obstructive sleep apnea, Cystic fibrosis and Rickets.

The search included all publications up to May 2025. Eligible studies comprised original research articles, reviews, and case reports, published in English. Exclusion criteria were animal studies, studies without full-text availability, and publications in languages other than English. Titles and abstracts were independently reviewed by two reviewers. The search specifically focused on two primary aspects: the prevalence of dental erosion in patients with specific systemic diseases, and the mechanisms by which these diseases contribute to the development of dental erosion.

## 3. Review of Current Literature

### 3.1 Eating disorders (Bulimia nervosa and Anorexia nervosa)

Bulimia nervosa is an eating disorder characterized by eating a large amount of food followed by self-induced vomiting and usually the patient is normal or overweight, while anorexia nervosa is characterized by eating a reduced amount of food with excessive exercises to lose weight and the patient is always underweight (9). Among the common dental complications in those patients are parotid enlargement,

xerostomia, dental caries, periodontal diseases and dental erosion (10). Dental erosion is the most prevalent oral health problem among patients with eating disorders (11). Eating disorder patients are 8.5 times more likely to develop dental erosion compared to healthy individuals (12). Dental erosion prevalence was reported as 26.7% in anorexia nervosa and 54.4% in bulimia nervosa. (13). Dental erosion is directly associated with exposure to gastric acids resulting from forceful self-induced vomiting and is typically localized to the palatal surfaces of the upper anterior teeth and the occlusal surfaces of the lower molars (14).

Additional factors influencing the severity of dental erosion include immediate tooth brushing following vomiting, which may exacerbate enamel loss (15). In contrast, water consumption prior to vomiting and oral rinsing afterward may help reduce acid contact and prevent further progression of dental erosion (14). Additionally, medications used in the management of these conditions, such as antidepressants, tranquilizers, and neuroleptics, may reduce salivary flow and thereby exacerbate dental erosion (16).

### 3.2 Depression

According to the World Health Organization, depression is a serious mental health condition that affects approximately 5.7% of adults worldwide (17). Individuals with depression often exhibit poor oral hygiene, increased consumption of alcohol and tobacco (18), a higher risk of gastroesophageal reflux disease (19), and use antidepressant medications, which may lead to hyposalivation (20,21). Collectively, these factors have been postulated to contribute to the development of dental erosion (18,21,22). However, a systematic review focused specifically on depression and dental erosion (23) reported no significant association between the two.

### 3.3 Gastroesophageal reflux disease

Gastroesophageal reflux disease (GERD) is defined as the involuntary movement of gastric acid from its normal place in the stomach into esophageal, larynx, oral cavity and lungs. This condition can occur due to obesity, pregnancy, caffeine, alcohol consumption, spicy food, gastric distention and smoking (24). GERD completely differs from vomiting although they appear to be similar in term; reflexes are heterogeneous masses of undigested food particles with some gastric enzyme,

like pepsin and trypsin, and it's a passive process which means little or no force carried out by a person, unlike vomiting (25). The association between Dental erosion and GERD is well known in literature (26).

The mean prevalence of dental erosion among patients with GERD is approximately 48.8%, with a markedly higher frequency reported in children compared with adults (27). The most affected surfaces are palatal surfaces of maxillary teeth and the lingual surface of mandibular teeth (28). The development of dental erosion in patients with GERD is associated with the regurgitation of gastric acid, which has a pH of 1.2. However, erosive potential varies and depends on several secondary factors, including the composition and pH of the gastric contents, the frequency of regurgitation and duration of acid exposure in the mouth, salivary flow rate and buffering capacity, as well as toothbrushing practices following regurgitation (29).

### 3.4 Cerebral Palsy

Cerebral palsy is a group of motor muscle disorders caused by abnormal brain development or damage, affecting the person's ability to control his/her muscles (30). Although there is no direct relationship between cerebral palsy and dental erosion, cerebral palsy can affect the muscles of the jaw, cheeks, lips, tongue, palate, and pharynx, thereby impairing eating, drinking, and swallowing (31). Consequently, GERD is a common and well-recognized condition in individuals with cerebral palsy, particularly in children, with a high prevalence of 66% (32). The coexistence of GERD may, in turn, contribute to an increased frequency of dental erosion in patients with cerebral palsy (33,34).

### 3.5 Asthma

The reported association between dental erosion and asthma is inconsistent. One study found no association between dental erosion and asthma in children (35), whereas another study has reported that children with asthma may be at an increased risk of dental erosion. (36), either due to the acidity of asthma medications or xerostomia induced by these medications (37). Additionally, asthmatic patients often experience symptoms of GERD, which contribute intrinsic acid to the oral environment (38). Conversely, dental erosion is more common in GERD individuals who have respiratory symptoms compared to those with no respiratory symptoms (39).

### 3.6 Diabetes Mellitus

Diabetes mellitus is a chronic endocrinal disorder characterized by inability to use or produce insulin from beta cells in the pancreas. Uncontrolled diabetes leads to many oral complications, like periodontitis, xerostomia, halitosis and candidiasis (40). Dental erosion has been reported in diabetic patients with a prevalence of 64.8% (41).

The relationship between diabetes mellitus and dental erosion may be associated with salivary alterations observed in affected patients, such as xerostomia, which is a recognized oral complication of diabetes (40). Additionally, elevated salivary glucose concentrations have been shown to increase the risk of dental erosion (42). Dental erosion may also be related to vomiting episodes experienced by patients with diabetic gastroparesis (43). Furthermore, type-1 diabetes mellitus has been found to negatively affect enamel and dentin microhardness, thereby increasing tooth susceptibility to acid-induced demineralization (44).

### 3.7 Renal Failure

The most common oral findings in renal failure patients are xerostomia, alteration in salivary PH, periodontal diseases, uremic stomatitis and pale mucosa (45). An increased risk for dental erosion has been reported in patients undergoing dialysis therapy and was suggested to be related to regurgitation, xerostomia, and medication side effects (46). However, a study by Imirzalioglu et al. reported no significant relationship between dental erosion and renal failure (47).

### 3.8 Cardiovascular Diseases

The relationship between cardiovascular diseases and dental erosion is primarily associated with the side effects of medications, particularly reduced salivary flow (48) and the acidic nature of certain drugs, especially aspirin (49). A study demonstrated a high prevalence of dental erosion affecting the posterior teeth of children who consumed aspirin in chewable tablet form, which was associated with the direct contact of the medication with the occlusal surfaces of the teeth (49).

### 3.9 Sjögren Syndrome

It is a chronic autoimmune condition that affects elderly people, where T cells attack salivary and lacrimal glands, resulting in dry mouth and dry eyes (50). The resulting xerostomia reduces the protective

functions of saliva, including buffering capacity, oral clearance, and remineralization, thereby increasing the susceptibility of teeth to acids (51). Patients with Sjögren's syndrome also have an increased risk of developing GERD, which may further contribute to the development of dental erosion (52).

### 3.10 Celiac Disease

Celiac disease is a chronic immune-mediated condition affecting the small intestine that is triggered by gluten consumption in genetically susceptible individuals. Several oral manifestations have been reported, including delayed eruption, enamel hypoplasia, molar-incisor hypomineralization, dental caries and periodontitis (53).

Most enamel defects associated with celiac disease occur during the period of enamel formation (54). Regarding post developmental defects, enamel wear is commonly seen in patients with celiac disease (55). This wear is believed to result from a combination of attrition, abrasion, and erosion and may be associated with factors, such as bruxism, sleep disorders, malocclusion, and psychological factors (55,56). However, dental erosion as an isolated condition in association with celiac disease has not been reported in the literature.

### 3.11 Inflammatory Bowel Disease

Inflammatory bowel disease (IBD) comprises a group of recurrent, chronic inflammatory disorders of multifactorial etiology that affect the gastrointestinal tract, primarily including Crohn's disease and ulcerative colitis (57). Only one study has investigated dental erosion in children with IBD, reporting no significant association between the condition and dental erosion. Interestingly, children in the control group demonstrated a higher prevalence of dental erosion, which was attributed to greater consumption of acidic foods compared with patients with IBD, who may be more attentive to dietary choices (58).

Other studies have reported that IBD may adversely affect salivary function, leading to reduced salivary flow, which has been suggested to increase the risk of dental erosion (59,60). However, a direct association between these salivary alterations in IBD patients and dental erosion has not been specifically investigated in literature.

### 3.12 Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a systemic autoimmune, inflammatory disorder that primarily affects the joints, leading to functional impairments. Oral manifestations in patients with RA include periodontal disease, poor oral hygiene, and xerostomia (61). No relevant studies directly examining the association between RA and dental erosion were identified, with the exception of one study conducted in children with juvenile rheumatoid arthritis. The study reported a higher prevalence of dental erosion in children who used chewable aspirin tablets compared with those who swallowed the tablets (62). Although xerostomia is one of the most common oral manifestations of RA (63) and may contribute to an increased risk of dental erosion, no studies have specifically investigated this potential association.

### 3.13 Parkinson's Disease

Parkinson's disease is a degenerative neurological condition associated with a variety of motor and non-motor symptoms, including tremors of the extremities, jaw, tongue, and facial muscles; dysphagia; difficulty initiating voluntary and involuntary movements; as well as depression and dementia (64). In addition, gastroesophageal reflux has been reported to be highly prevalent among patients with Parkinson's disease (65).

Motor symptoms can negatively impact oral health by reducing the ability to perform routine oral hygiene, decreasing chewing efficiency, difficulty swallowing and limited mouth opening (66). Patients also experience facial muscle rigidity, pain, and temporomandibular disorders, which restrict mandibular movements and promote food retention (67). Dental erosion is frequently observed in these patients (68), often resulting from acid reflux due to dysphagia and retained food (66,68).

The most commonly prescribed medications for Parkinson's disease are levodopa and anticholinergic agents, which can cause xerostomia that may further affect the development of dental erosion (68, 69).

### 3.14 Liver Diseases

Dental erosion has been reported in liver disease patients with a prevalence of 5.7% (70), an effect that may be associated with gastroesophageal reflux (a common symptom in those patients) and the consequent acidic regurgitation (71) or the chronic consumption of alcohol

(alcohol cirrhosis) (70,72). Xerostomia is also prevalent among patients with liver disease and may further contribute to the development of dental erosion (73).

### 3.15 Iron Deficiency Anemia

Iron deficiency is one of the most prevalent nutritional deficiencies and represents a major global health concern, with an estimated worldwide prevalence of 16.7%. It usually affects females and children, particularly in developing regions (74). The effects of iron deficiency on the mechanical properties of teeth have been investigated primarily in animal models. The study has demonstrated that iron deficiency leads to reduced enamel thickness and compromised mechanical strength, thereby increasing susceptibility to dental wear (75).

With regard to the pharmacological management of anemia, iron drops are commonly prescribed for pediatric patients. The erosive potential of these formulations has been investigated, revealing that iron drops can lower pH, reduce enamel microhardness, and exert erosive effects on dental tissues (76,77). These effects are likely attributable to additional components in the formulations, such as sucrose and acidic agents. Acids are incorporated as buffering agents to maintain chemical stability, regulate tonicity, ensure compatibility, and enhance flavor (78). Conversely, iron itself may exert a protective effect against enamel dissolution, as demonstrated when tested in the form of mouth rinses *in vivo* (79) or through direct immersion in ferrous sulphate solutions *in vitro* (80).

### 3.16 Thyroid Diseases

Studies examining the association between thyroid diseases and dental erosion are scarce in the literature. Only one early study, published in 1973, reported that 80% of patients with hyperthyroidism in the study sample presented with dental erosion, which was attributed to reduced salivary flow (81).

The relationship between hypothyroidism and dental erosion remains unclear, as no direct studies have been identified. However, from the perspective of known risk factors for dental erosion, hypothyroidism has been reported to impair salivary gland function, resulting in hyposalivation and lower salivary pH (82). Furthermore, autoimmune thyroid disorders have been shown to frequently coexist with Sjögren's syndrome in clinical practice (83).

### 3.17 Parathyroid Diseases

Only one study was identified that examined parathyroid hormone levels in patients with chronic renal failure, given that secondary hyperparathyroidism is a common complication in those patients. However, the study found no significant differences in parathyroid hormone levels between patients with chronic kidney disease who exhibited dental erosion and those without dental erosion. (47). No direct studies have investigated the relationship between hypoparathyroidism and dental erosion. However, hereditary and congenital conditions characterized by hypoparathyroidism, such as velocardiofacial syndrome, DiGeorge syndrome, and autoimmune polyendocrinopathy candidiasis ectodermal dystrophy (APECED), have been associated with the presence of dental hypomineralization and hypoplasia (84).

These enamel defects are believed to be less resistant to acid attacks and more susceptible to dental erosion (85). Moreover, a study on APECED patients revealed a high prevalence of dental erosion among the affected individuals, however; it remained unclear whether this finding was attributable to drugs used or to underlying dental hypoplasia (86).

### 3.18 Systemic Lupus Erythematosus

Systemic lupus erythematosus (SLE) is a multisystem autoimmune disease associated with a wide range of oral manifestations. Of particular relevance to this review is xerostomia, which is frequently observed in patients with SLE and may result either from direct involvement of the salivary glands by the disease or from coexisting Sjögren syndrome (87). SLE may coexist with Sjögren syndrome, with a reported prevalence of 17.8% (88). No clinical studies were identified that directly investigated the association between dental erosion and SLE, except for one case report that described a 13-year-old island girl with SLE who presented with severe dental erosion, which was attributed to xerostomia and lime ingestion (89).

### 3.19 Obstructive Sleep Apnea

Obstructive sleep apnea syndrome (OSAS) is a sleep associated breathing condition characterized by transient upper airway obstruction, causing recurrent episodes of apnea (90). Durán-Cantolla et al. reported a high frequency of tooth wear in patients with OSAS (91). The observed tooth wear was attributed to attrition

associated with sleep bruxism (91, 92), dental erosion resulting from acid exposure due to the coexistence of GERD in these patients (93), or a combination of both factors (94,95).

### 3.20 Cystic Fibrosis

A study conducted in Turkey found no statistically significant differences in dental erosion between children with cystic fibrosis and healthy controls (96). However, factors, such as GERD and the use of inhaled medications in these patients, may influence the development of dental erosion (97,98).

### 3.21 Rickets

Vitamin D deficiency in infancy, whether from malnutrition or genetic conditions, causes rickets. Rickets affects both bone and enamel formation, resulting in several dental abnormalities, including enamel hypoplasia, enamel hypomineralization, enlarged pulp chambers, and shortened roots (99). Teeth with developmental enamel defects are less resistant to acid attacks; consequently, they are more susceptible to demineralization and dental erosion (85). Further studies are needed on the relation between rickets and dental erosion.

## 4. Conclusions

Awareness of the wide range of systemic diseases associated with dental erosion enables dentists to make appropriate referrals to medical specialists and prevent

further dental tissue loss. Systemic diseases may contribute to the development of dental erosion through several mechanisms, including:

1. Direct exposure of teeth to intrinsic acids resulting from regurgitation or vomiting.
2. Reduced salivary flow (xerostomia), either as a side effect of medications, such as anticholinergics, antidepressants, and antihypertensives, or due to direct damage of the salivary glands by the disease.
3. The use of acidic medications, including iron drops and chewable aspirin.
4. The coexistence of gastroesophageal reflux disease with other systemic diseases.
5. Developmental enamel defects that weaken tooth structure.

While there is substantial research on conditions, such as eating disorders and GERD, evidence is limited for other diseases, such as IBD, cardiovascular diseases, thyroid diseases, celiac disease, parathyroid diseases, systemic lupus erythematosus, and rickets. Further studies are needed to clarify the relationship between these systemic conditions and dental erosion.

### Conflict of Interests

The authors have no conflict of interests.

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