



Oral manifestations of systemic disease

Edwin T. Parks, DMD, MS*, Henry Lancaster, DMD

*Department of Oral Pathology, Medicine, and Radiology, Indiana University School of Dentistry,
West Michigan Street, Indianapolis, IN 46202, USA*

Most systemic diseases can affect the oral cavity. Some oral changes are nonspecific, whereas others directly lead to the diagnosis of a particular disorder. A systems approach is used here to catalog these oral changes. In some instances it is difficult to separate the oral manifestations of pharmacotherapy for a particular disease from that entity. The oral manifestations of pharmacotherapy are presented for selected disease processes. This article introduces the most common oral manifestations of systemic disease.

Cardiovascular system

There are no specific oral changes that can be attributed to diseases that affect the cardiovascular system. The oral changes associated with disease of the cardiovascular system can be grouped into two distinct areas: risk factors and manifestations of pharmacotherapy.

Risk factors

Numerous articles have chronicled the relationship between periodontal disease and cardiovascular disease in the scientific literature [1]. Although it cannot be said that a direct relationship exists between periodontal disease and cardiovascular disease, several longitudinal studies have indicated that the presence of alveolar bone loss (as a result of periodontal disease) increases the risk of death from cardiovascular disease from 1.9 to 3 times the death rate of the

sample population without periodontal disease [2–4]. Albandar et al [5,6] report that 35% of the adult US population have some form of bony periodontal destruction and over half of the population have some soft tissue component of periodontal disease. The common oral findings associated with periodontal disease are gingival erythema, gingival enlargement, and ultimately loss of attachment (Fig. 1). Research is ongoing to identify the exact relationship between periodontal and cardiovascular disease.

Another recent dental finding related to cardiovascular disease is the presence of calcifications within the carotid arteries. These calcifications can be identified in dental panoramic images (Fig. 2). The presence of these calcifications is indicative of an increased risk for a cerebrovascular accident. Carter et al [7,8] identified carotid calcifications in approximately 5% of the panoramic radiographs of a dental school population. Most of these patients reported additional risk factors for stroke. Doris et al [9] reported a high correlation between the findings of carotid calcifications in plain film imaging and in more sophisticated imaging techniques (eg, angiography or ultrasound). Care must be taken not to confuse hyoid bone calcifications with carotid artery calcifications. The significant morbidity associated with cerebrovascular accidents makes it imperative that patients with radiographic findings of carotid calcifications be referred to their physician for additional work-up.

Oral manifestations of cardiovascular pharmacotherapy

Many of the medications used to treat cardiovascular diseases have effects on the oral cavity. The

* Corresponding author.

E-mail address: edparks@iupui.edu (E.T. Parks).



Fig. 1. Moderate periodontal disease. Heavy deposits of dental plaque and calculus are present at the cervical regions of the teeth. (From Mayo Clin Proc 1999;74: 223–8: with permission.)

most significant adverse effect is xerostomia [10]. Xerostomia is the subjective feeling of dryness of the oral cavity. Xerostomia is very common in patients taking diuretics to control either hypertension or edema. The lack of saliva can have profound effects on the oral health of the patient. Patients with xerostomia usually demonstrate a high caries rate. Additionally, oral candidal infections are seen more frequently in patients with a dry mouth. Although several medications (eg, pilocarpine hydrochloride [Salagen] and civemeline hydrochloride [Evoxac]) exist to treat dry mouth, by and large they are contraindicated for use in patients with a history of cardiovascular disease. Calcium channel blockers can produce significant gingival enlargement in both dentate and edentulous patients [11]. Finally, multiple cardiovascular medications, such as angiotensin-con-



Fig. 3. Abnormal pigmented lesions on the lips of a patient diagnosed with a lung malignancy. (Courtesy of D-J. Summerlin, DMD, MS, Indianapolis, IN.)

verting enzyme inhibitors, β -blockers, and loop diuretics, can produce oral lichenoid reactions [12].

Respiratory system

Because of the oral cavity's proximity to the respiratory tract it often becomes the location of clinical manifestations of illnesses affecting the respiratory system. Merchant [13] showed that nearly 25% of patients with malignant lung disease (eg, bronchogenic carcinoma) presented with abnormal pigmentation of the soft palate. The pigmented lesions are usually on the lateral surface of the soft palate, but can occur anywhere on the oral mucosa. Oral lesions can vary from a unilateral macule 4 mm in size to considerably larger areas (Fig. 3) [14]. One may hypothesize that the pigmentation is a result of the

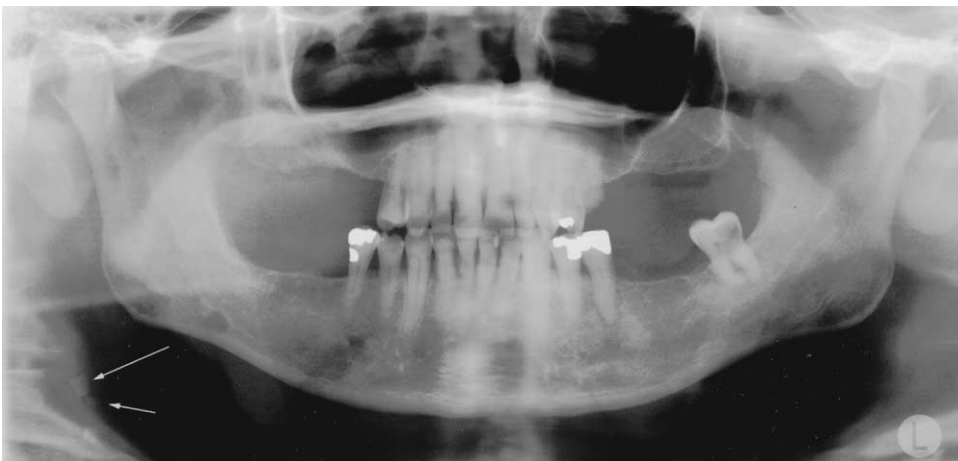


Fig. 2. Panoramic radiograph demonstrating calcifications within the carotid artery. Two calcifications are identified by the white arrows.

high incidence of smoking in this population; however, Merchant showed a much lower incidence of abnormal pigmentation in a population with similar rates of smoking but with no lung malignancies [14].

Although tuberculosis is still rare, it is on the rise. In 1991 there were a total of 26,283 cases in the United States [15]. Tuberculosis is a chronic bacterial infection that usually forms granulomas in the lungs. An untreated patient with significant lung involvement can present with oral lesions. Up to 3.5% of tuberculosis sufferers can have oral ulcers similar in appearance to major aphthous ulcers, or a discrete granular mass [16]. The most common areas affected are the gingiva and the base of the tongue. It is thought that seeding of the oral tissue with tuberculosis bacilli when the patient repeatedly coughs up infected sputum produces the lesions.

Sarcoidosis can occasionally involve the oral cavity with lesions that can affect various oral structures including the lips, tongue, buccal mucosa, floor of mouth, palate, gingiva, and the salivary glands (Fig. 4) [17]. Sarcoidosis affects 10 to 40 per 100,000 people in the United States, and to date there have been 47 documented cases of oral involvement [17]. It can affect people of any age, sex, and race. The typical oral lesions can include firm, asymptomatic, submucosal masses of the tongue or buccal mucosa. Gingival tissue can appear erythematous and enlarged with occasional ulceration. These patients may exhibit Heerfordt's syndrome, which is a triad of bilateral parotid gland enlargement, uveitis, and a low-grade fever. Associated palsy of the facial and mandibular nerves also has been reported [18–20].

A respiratory illness that may escape diagnosis for much of its course is Wegener's granulomatosis. Wegener's is an inflammatory condition of unknown cause that usually manifests as a triad of respiratory, kidney, and vascular inflammation. One must be aware



Fig. 4. Sarcoid lesions affecting the gingival tissues. The erythematous areas indicated by the arrows are granulomas of the gingiva.



Fig. 5. Photograph of a patient with Wegener's granulomatosis. The erythematous, granular appearance of the gingiva is referred to as "strawberry gingivitis." (Courtesy of G.W. Mirowski, DMD, MMSc, MD, Indianapolis, IN.)

that the initial presentation of Wegener's can be one of intraoral lesions [21]. The oral lesions commonly involve the gingiva and appear as red, granular, and sometimes ulcerative lesions (Fig. 5). This is referred to as *strawberry gingivitis* because of its similar appearance in texture and color to a strawberry.

Gastrointestinal system

Because digestion starts in the oral cavity, oral manifestations of gastrointestinal diseases are quite common. At least 15% of the adult US population reports some symptoms of gastroesophageal reflux disease [22]. The pediatric population is not immune to the symptoms of gastroesophageal reflux disease. Although the prevalence of symptoms is lower, reported regurgitation displays a similar prevalence with the adult population [23,24]. Although many of these individuals have mild symptoms, a fair proportion has significant esophageal reflux that can find its way into the oral cavity [25,26]. The pH of stomach contents is low enough to dissolve the enamel of the teeth. Immediate brushing of the teeth after reflux into the oral cavity can accelerate the loss of tooth structure. Patients with persistent gastroesophageal reflux disease should be instructed to rinse the mouth with water or a dilute baking soda solution to neutralize the oral pH before brushing the teeth. The dentin becomes more visible as the enamel dissolves and the teeth exhibit a more yellow color (Fig. 6). The teeth most commonly affected are the upper incisors and the lower molars and premolars. Loss of enamel structure produces many dental problems, such as

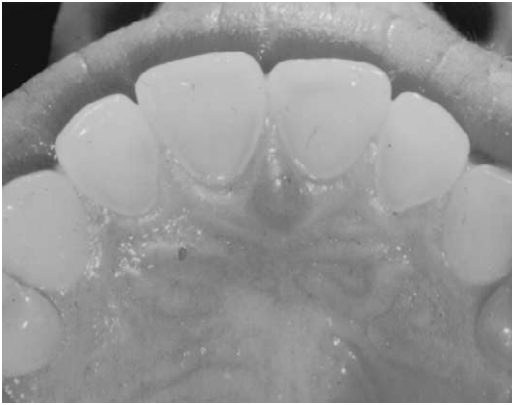


Fig. 6. Enamel erosion in a patient with gastroesophageal reflux disease. The slightly darker line that follows the contour of the dental crowns is the junction between enamel and dentin. This region is not visible in the normal dentition.

restoration failure and dentinal sensitivity. Continued reflux has a significant impact on the methods used to restore teeth that have lost enamel structure. Definitive restoration of the teeth may be deferred until reflux is controlled in patients with severe gastroesophageal reflux disease with attendant reflux into the oral cavity.

Recurrent aphthous ulcerations are very common oral mucosal findings. The prevalence of recurrent aphthous ulcerations ranges from 10% to 50% depending on the study population [27–29]. Aphthous ulcers appear as a shallow, round ulcer with a band of erythema surrounding the ulcer (Fig. 7). Most aphthous ulcers heal without scarring in 10 to 14 days. Many different etiologic agents and conditions have been identified with regard to aphthous ulcers, the most common of which is local trauma. Recurrent aphthous ulceration has been implicated with ulcerative colitis, Crohn's disease, coeliac disease, and numerous vitamin deficiencies that may or may not be associated with a malabsorption disorder [29–31]. Numerous nongastrointestinal disorders have also been implicated in the etiology of recurrent aphthous ulcerations. It is apparent that not all aphthous ulcerations are related to gastrointestinal disorders. Gastrointestinal disorders, however, should be considered as a possible etiologic agent in patients with persistent aphthae or recurrent aphthous ulcerations with a high rate of recurrence.

Pyostomatitis vegetans is a rare oral condition but is presented here because of its association with ulcerative colitis and, to a lesser extent, Crohn's disease [31,32]. A recent review of pyostomatitis vegetans found that 78% of all reported cases had an association

with inflammatory bowel disease [32]. The oral lesions present as numerous punctate pustular eruptions on the labial and buccal mucosa and the palate. Lesions are rarely found on the tongue or on the floor of the mouth. The pustules often coalesce and break leaving superficial erosions. Pyostomatitis vegetans is usually treated with corticosteroids, but also responds to the management of the inflammatory bowel disease.

Endocrine system

A variety of soft tissue lesions have been associated with diabetes. Those most commonly reported include candidal infections, fissured tongue, irritation fibroma, and traumatic ulcers. Additionally there seems to be a higher incidence of periodontal disease and complaints of dry mouth. The complaints of xerostomia may be related to the adverse effects of medications with this group of patients [33]. Candidosis manifesting as angular cheilitis, atrophy of tongue papillae, median rhomboid glossitis, and denture stomatitis were found in greater than 15% of diabetic patients according to Guggenheimer et al [34]. The combined prevalence of the previously mentioned noncandidal lesions was determined to be 44.4% among insulin-dependent diabetics [33]. Oral findings seem to be related to the type of diabetes, history of smoking, and poor glycemic control [34].

Diffuse oral pigmentation may be suggestive of Addison's disease. Addison's, a primary deficiency of adrenocorticotrophic hormone, is characterized by weakness, fatigue, and abnormal bronzing of the skin and pigmentation of the oral mucosa [35]. Although rare, Addison's disease is increasingly being seen in AIDS patients as a result of damage from opportunistic infections of the adrenal glands. Clinically this disease can present as light brown to black pigmented



Fig. 7. Aphthous ulcer. This patient has Crohn's disease.

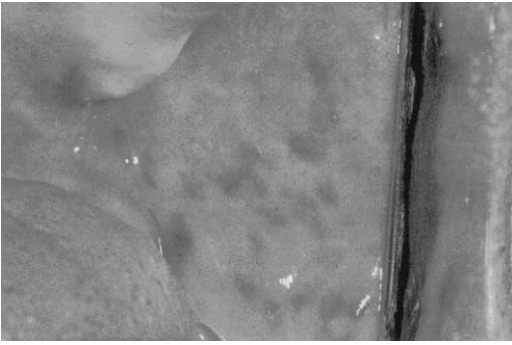


Fig. 8. Addison's disease can present with pigmented lesions of the buccal mucosa as seen in this patient. (Courtesy of D-J. Summerlin, DMD, MS, Indianapolis, IN.)

maculae on the lips, gingival, buccal mucosa, or tongue (Fig. 8) [36].

Skeletal system

Quite often illnesses of the skeletal system result in clinically obvious oral manifestations. One such disturbance is Paget's disease of bone. Paget's disease of bone is seldom found in patients younger than 40. Because of uncontrolled osteoclastic and osteoblastic activity, there is excessive bone formation resulting in increased bone volume with a concurrent decrease in bone strength. Advanced cases of Paget's disease of bone can cause compression of cranial nerves leading to loss of hearing and even sight. The first oral sign may be an increased space between the teeth as the maxillary bone increases in size (Fig. 9). Often edentulous patients may be diagnosed because of complaints about their denture becoming too tight after years of normal wear [16]. A severe complication is



Fig. 9. Photograph of patient suffering from Paget's disease of bone. Note the spaces (diastemas) between the maxillary teeth caused by the large deposition of bone in the maxilla. (Courtesy of D-J. Summerlin, DMD, MS, Indianapolis, IN.)

development of osteosarcomas, which occurs in 60% of patients over 50 years of age [37]. Surgical removal of bone is contraindicated in this population because of the high rate of complicated osteomyelitis [16].

Osteogenesis imperfecta, also known as *brittle bone disease*, is an autosomal-dominant disease of collagen formation that is characterized by blue sclera, hearing loss, growth deficiency, and multiple long bone fractures. Osteogenesis imperfecta is currently classified into four types based on the particular genetic mutation and severity. Among the type III and IV patients one study shows that greater than 80% also exhibit dentinogenesis imperfecta [38]. Dentinogenesis imperfecta is a condition that results in a dentition that may be markedly discolored. The discoloration can be yellow-brown or blue-gray. The involved teeth are very susceptible to chipping of the enamel and excessive wear of the incisal and occlusal surfaces (Fig. 10). Up to 80% of osteogenesis imperfecta patients also exhibit class III malocclusion (prognathic mandible) [38].

Nervous system

The oral cavity is highly innervated. Consequently, many oral components of neurogenous disease processes, such as tic douloureux and medication-induced oral dyskinesias, have been described. Tic douloureux is a form of trigeminal neuralgia that presents with a trigger zone. Light contact with the trigger zone causes an intense lancinating pain that follows the affected branch of the trigeminal nerve. The patient's response to this pain is most likely responsible for the involuntary grimace or movement of the head (tic). The involuntary movements of the facial and oral musculature seen in many of the oral

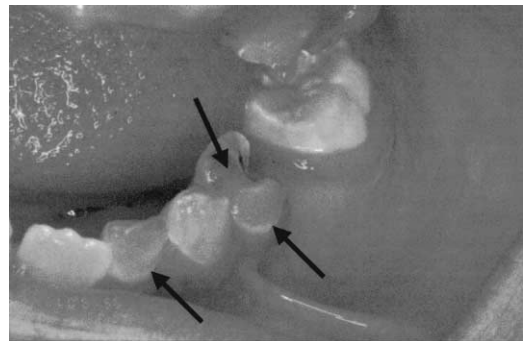


Fig. 10. Dentinogenesis imperfecta in the presence of osteogenesis imperfecta type IV. The arrows indicate dark discoloration of teeth and chipped enamel surfaces.

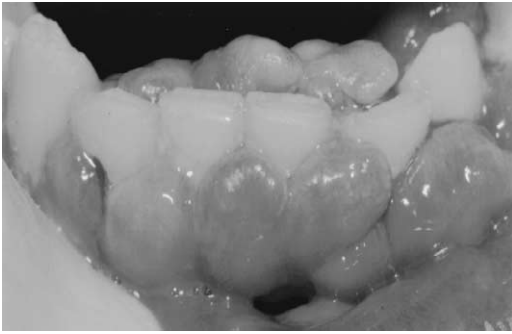


Fig. 11. Gingival hyperplasia. Phenytoin-induced gingival hyperplasia in a black man.

dyskinesias are associated with the chronic use of neuroleptic medications [39,40]. These involuntary movements do not diminish when the medications are diminished. Taste alterations have long been associated with mineral or vitamin deficiencies or the aging process [41]. These alterations usually have an insidious onset and tend to affect the classic taste sensations equally (sweet, sour, salt, and bitter). Rapid onset alteration of taste sensation or alteration of one specific taste sensation may indicate an intracranial space-occupying lesion or central neurologic disorder [42,43]. Phenytoin is commonly used to manage certain forms of epilepsy. Gingival hyperplasia is a very common side effect of the phenytoins (Fig. 11). Good oral hygiene practices can minimize the impact of phenytoin on the gingival tissues.

Neurofibromatosis types I and II are common disorders (approximately 1 in 3000 live births) that often demonstrate oral manifestations [44]. The most common oral manifestation of neurofibromatosis is the presence of mucosal neurofibromas. These intra-oral neurofibromas occur in approximately 25% of patients with neurofibromatosis. The rate of malignant transformation of mucosal neurofibromas is similar to that of cutaneous neurofibromas. Additional oral manifestations include enlarged fungiform papillae and bony erosion adjacent to a soft tissue tumor (eg, widening of the mandibular canal space caused by a neurofibroma involving the inferior alveolar nerve).

Multiple endocrine neoplasia type IIB is an autosomal-dominant disorder that consists of medullary thyroid carcinoma, pheochromocytoma, marfanoid habitus, and mucosal neuromas [45,46]. Mucosal neuromas are commonly found in the oral cavities of individuals with multiple endocrine neoplasia type IIB (Fig. 12). The significance of these oral mucosal neuromas is that their presence may precede the onset of the potentially devastating neoplasms associated

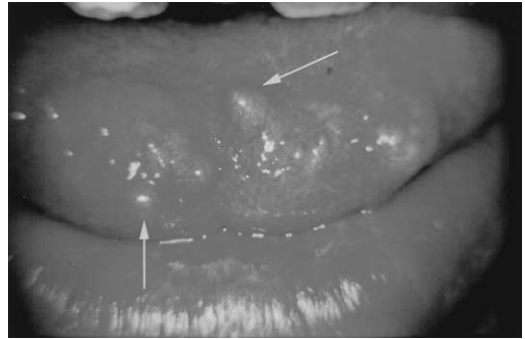


Fig. 12. Multiple oral mucosal neuromas. Multiple neuromas in a 13-year-old white man with multiple endocrine neoplasia type IIB. Two neuromas are identified with white arrows.

with this syndrome and accelerates diagnosis and management of the syndrome. Metastatic thyroid carcinoma has been reported in an infant with multiple endocrine neoplasia type IIB less than 1 year old [47].

Hematologic system

Many clinicians may be unaware that cases of leukemia can first present in the mouth. Leukemia, a cancer of the white blood cells, results from uncontrolled proliferation of an abnormal hematopoietic cell and leads to marrow failure. It is classified according to the primary hematopoietic cell affected and as to the acute or chronic course of the disease [48]. It is estimated that 10% of cases exhibit oral signs of leukemic infiltrate. Oral manifestations may occur as generalized hyperplasia of the gingiva. The gingival tissues are swollen and soft and easily bleed (Fig. 13). As a result of the anemia associated with leukemia, one may also present with mucosal pallor, multiple petechia, and ecchymoses of the oral tissues. Treat-



Fig. 13. Severe, generalized hyperplasia of gingival caused by leukemia infiltrate in a patient with leukemia. (Courtesy of D-J. Summerlin, DMD, MS, Indianapolis, IN.)

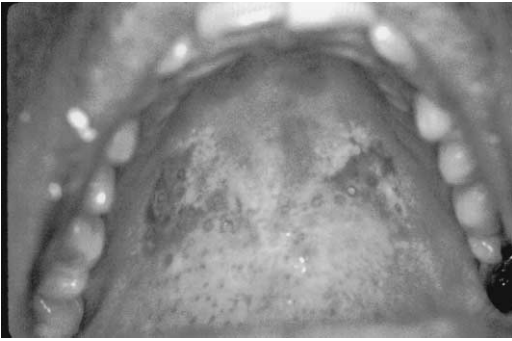


Fig. 14. The lichenoid lesions of chronic graft-versus-host disease present in the palate of a patient 2 years status post-bone marrow transplant.

ment for leukemia can also be responsible for further oral lesions. Chemotherapy can cause mucositis of the oral cavity and bone marrow transplant may lead to graft-versus-host disease. When present in the mouth, graft-versus-host disease is both clinically and histologically identical to oral lichen planus (Fig. 14).

Extranodal lymphomas account for approximately 24% of total lymphomas, and involvement of the oral cavity is relatively rare [49]. Tomich and Shafer [50] reported oral involvement in 0.1% to 0.2% of cases of non-Hodgkin's lymphoma. When the oral region is the site of non-Hodgkin's lymphoma, it can involve several areas including the gingiva, floor of mouth, palate, buccal vestibule, and the bone of the maxilla or mandible. It has also been reported that patients with Sjögren's syndrome are 44 times more likely to develop a primary lymphoma than healthy patients [51]. The parotid gland is the usual location and presents clinically as a unilateral swelling in the parotid region. According to Fukuda et al [52], a painless soft tissue swelling commonly is the initial presentation in cases of intraoral lymphoma (Fig. 15). In the case of bony involvement, numbness, paresthesia, or loose teeth may accompany the swelling [52]. Treatment for oral lymphoma is local radiation in stage I cases and combination chemotherapy in advanced cases [49].

Many cases of aphthous ulceration are of unknown cause or are somehow linked to gastrointestinal disorders or to infectious processes. One type, however, may be attributed to a decrease in circulating neutrophils. Cyclic neutropenia is a condition characterized by an episodic defect in development of neutrophils in the marrow leading to periodic decreases in mature neutrophils in the circulation. In many cases the patient's white cell count falls to approximately 3000 each month for a period of 5 days [16]. It is shortly

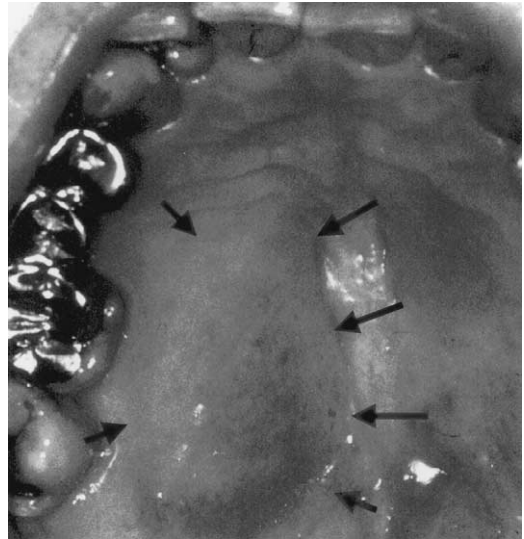


Fig. 15. Oral lymphoma. The lesion presented as a soft swelling in the patient's palate (arrows). (Courtesy of D-J. Summerlin, DMD, MS, Indianapolis, IN.)

after this phase that oral ulcers can arise (Fig. 16). The ulcers may last for 3 to 5 days. In addition to the ulcers, the patient may have fever, malaise, and cervical lymphadenopathy [53]. Serial white cell counts are indicated to make a diagnosis in these cases because of the cyclic nature of the neutropenia.

A deficiency of vitamin B₁₂, also called pernicious anemia, is primarily a disease of the elderly with the average patient presenting at age 60 [54]. Pernicious anemia is caused by the inability to absorb vitamin B₁₂ across the intestinal wall because of the lack of intrinsic factor. This deficiency results in megaloblastic or macrocytic anemia and oral conditions. The classic oral manifestation of pernicious anemia is

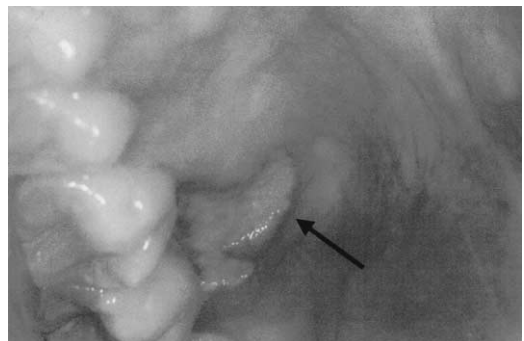


Fig. 16. Cyclic neutropenia. The arrow indicates a large area of ulcerated mucosa on the palate. These ulcers resemble recurrent aphthous ulcers.

“bald tongue.” The tongue appears smooth with an erythematous cast because of the depapillation of the dorsal surface [16]. Commonly these patients complain of pain and burning of the tongue and oral cavity. Monthly parenteral administration of vitamin B₁₂ is curative for these patients.

Immune system

A vast number of disease processes have an immunologic component. Many of these diseases present with oral signs. HIV infection has been extensively studied. A large array of oral manifestations has been reported in the literature [55,56]. The most commonly encountered oral lesions or conditions are oral candidiasis, oral hairy leukoplakia, Kaposi's sarcoma, and ulceration [55,56]. Several different presentations of oral candidiasis can be encountered (Fig. 17).

Pseudomembranous candidiasis presents as a whitish plaque that, when removed, leaves a superficially denuded mucosal surface. Erythematous candidiasis appears as a subtle smooth red patch. This change is often difficult to detect on a mucosal surface that is already somewhat red. Attendant complaints of taste alteration or oral burning are suggestive of candidiasis. Hyperplastic candidiasis presents as a thickened white patch that cannot be removed. The prevalence of oral candidiasis increases as the CD4 count falls. Several other fungal infections have been associated with HIV infection but are not seen with the frequency of candidiasis. Several forms of antifungal therapy are available. The efficacy of systemic antifungal agents can be diminished by lack of compliance, poor absorption, or the interaction of other medications. Topical antifungal agents can also be affected by compliance and, if the patient suffers from xerosto-



Fig. 17. Oral candidiasis. Pseudomembranous candidiasis on the palate of a HIV-positive man.

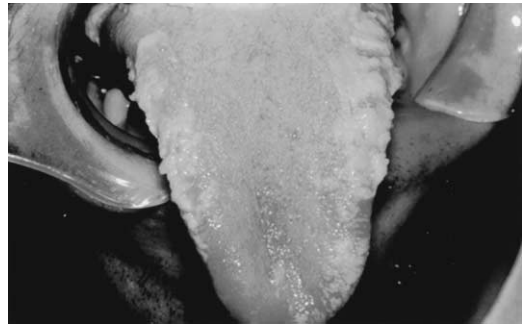


Fig. 18. Oral hairy leukoplakia. Oral hairy leukoplakia on the lateral borders of the tongue of a HIV-positive man. (Courtesy of G.W. Mirowski, DMD, MMSc, MD, Indianapolis, IN.)

mia, they have great difficulty dissolving a troche in their mouth. The sugar content of topical agents can impact the caries experience of the patient. The patient's toothbrush, oral appliances, inhalers, and lipstick should be considered as fungal reservoirs and need to be treated to eliminate the infection and diminish reinfection successfully.

Oral hairy leukoplakia is commonly seen on the lateral border of the tongue but can appear in other parts of the oral cavity. It appears as a corrugated or “hairy” white patch (Fig. 18). Oral hairy leukoplakia has also been reported in kidney transplant patients and other groups of immunosuppressed individuals [55]. Oral hairy leukoplakia is present in approximately 20% of asymptomatic HIV-infected individuals. The prevalence of oral hairy leukoplakia increases with decreasing CD4 cell counts [55].

Kaposi's sarcoma presents as a purple or red plaque that can become papular and ulcerated. The most common intraoral location of Kaposi's sarcoma is the palate followed by the gingiva and tongue (Fig. 19) [57]. Hermans [58] has reported a decrease in incidence of Kaposi's sarcoma with the advent of protease inhibitor therapy.

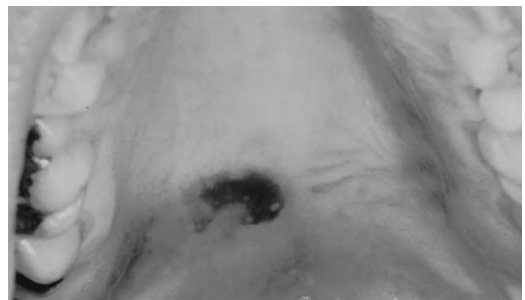


Fig. 19. Kaposi's sarcoma. Kaposi's sarcoma on the palate of a HIV-positive man.

The diagnosis of specific types of oral ulceration can be challenging in the HIV-infected patient. The typical distribution of both herpes simplex lesions and recurrent aphthae is disrupted as the degree of immunosuppression increases. Additionally, the level of immunosuppression diminishes the striking inflammatory response associated with recurrent aphthous ulcerations. Consequently, a herpetic lesion can appear where an aphthous ulcer is anticipated and vice versa. Biopsies should be obtained from any oral ulcer before initiating therapy.

Systemic lupus erythematosus is an autoimmune disease process that can affect virtually every organ system [59]. Oral lesions are frequently encountered in patients with systemic lupus erythematosus with reported prevalence ranging from 9% to 45% [60–62]. Oral ulcerations are the most commonly reported oral lesions [63,64]. The appearance of the ulcer can be confused with erosive lichen planus and should undergo biopsy (Fig. 20). White plaques have also been associated with systemic lupus erythematosus. These white lesions are nonspecific and also should undergo biopsy. Schiødt [62] reported that oral lesions were the first manifestation of systemic lupus erythematosus in 40% of his study group.

Sjögren's syndrome is the second most common autoimmune disease (after rheumatoid arthritis) and is comprised of dry eyes (keratoconjunctivitis sicca) and xerostomia [65,66]. Thomas et al [67] reported a 3% to 4% prevalence of Sjögren's syndrome in the adult population. Because dry eyes and dry mouth are fairly common complaints in the adult population, the diagnosis should be confirmed through laboratory tests or labial salivary gland biopsy. Dry mouth or xerostomia has a serious effect on the health of the oral cavity (Fig. 21). Diminished salivary flow leads to an increased caries rate and potential for candidal



Fig. 20. Oral ulceration in a patient with systemic lupus erythematosus. The lesion has many similarities with erosive lichen planus. These similarities make biopsy a necessity.

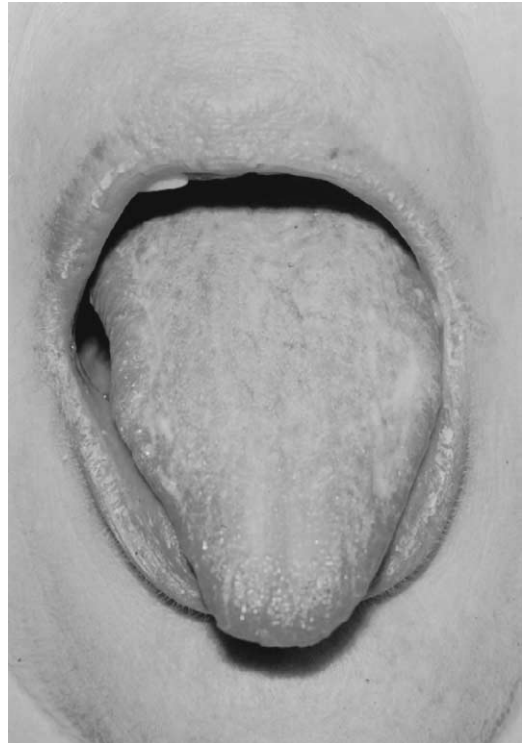


Fig. 21. Xerostomia. Note the dry appearance of the tongue and lips in this Sjögren's syndrome patient.

infections. Additionally, the patient's nutritional intake can be altered significantly because of the difficulty in chewing and swallowing many foods. Parasympathomimetics, such as pilocarpine hydrochloride and civemeline hydrochloride, can increase both salivary and lacrimal output as long as functional glandular parenchyma is still present [68]. Enlargement of major salivary glands is often seen in Sjögren's syndrome patients. Although dry eyes and dry mouth can have a significant impact on the quality of life, they are not life threatening and may not be pursued with much diagnostic rigor. The concern with a diagnosis of Sjögren's syndrome is the association with non-Hodgkin's lymphoma. Voulgarelis et al [69] reported a 4.3% prevalence of non-Hodgkin's lymphoma in a fairly large population of patients with Sjögren's syndrome. These findings are similar to those reported by Jordan and Speight [51]. This high prevalence of non-Hodgkin's lymphoma in Sjögren's syndrome patients necessitates a complete diagnostic work-up for patients who complain of dry mouth and dry eyes.

Many systemic disorders have oral manifestations. The oral component may precede the systemic pre-

sentation of a particular disease. Early diagnosis and management can often diminish the morbidity associated with a systemic disease. Careful examination of the oral cavity is a necessary component of the diagnostic work-up for any patient.

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