



# Oral Diseases in the Geriatric Population

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## Abstract

**Purpose of Review** This review provides clinical guidance for diagnosing and managing oral disease in the geriatric population. Additionally, we present our clinical observations and personal experiences with these conditions.

**Recent Findings** Recent research has revealed disease associations and provided new insights into the pathophysiology and management of several oral conditions that affect the geriatric population.

**Summary** The oral diseases discussed in this review may greatly impact the overall health and quality of life of geriatric patients. Early diagnosis is critical and is often initially identified by primary care physicians. This review serves as a guide to common oral diseases, aiming to enhance providers' confidence in conducting oral exams, diagnosing oral conditions, and referring for biopsy when warranted.

**Keywords** Oral disease · Oral mucosa · Candida · Xerostomia · Immune-related · Geriatrics

## Introduction

The purpose of this review is to provide clinical guidance for diagnosing and managing oral diseases in the geriatric population. In this article, the geriatric population is defined as people aged 65 and older. According to the 2020 United States Census, this group makes up 16.8% of the total population and is only expected to increase [1]. These patients disproportionately present for office visits to primary care compared to adults younger than 65 [2•]. Among these individuals, there is a high prevalence of oral diseases that have a great impact on individuals' overall health and quality of life [3, 4]. Thus, early diagnosis and proper management of oral mucosal disorders is crucial for improving quality of life. This review serves as a practical guide for recognizing, treating, and managing oral diseases including conditions

related to infection, autoimmunity, and other common oral conditions.

## Infectious Oral Conditions

Oral infections present commonly in the geriatric population as they can be triggered by medications, dental appliances, or immunosuppression.

### Oral Candidiasis

Oral candidiasis is an infection of the oral cavity by a *Candida* species of which *Candida albicans*, a normal component of the oral flora, is the most common causative organism (80%). In immunocompetent adults, 30–60% have commensal *Candida* species in their oral cavity [5•, 6•]. The transformation from the commensal yeast form to the pathologic pseudohyphal form depends on several factors including the fungus, the host, and the oral microenvironment.

### Pseudomembranous Oral Candidiasis

Pseudomembranous candidiasis, commonly known as “thrush,” is the most frequently recognized type of oral candidiasis, accounting for one-third of all cases. It is prevalent among individuals with immune system dysregulation,

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including infants and the elderly, as well as those who are immunosuppressed [5•, 6•, 7•, 8•]. Clinically, soft white papules and plaques can be observed on the tongue, buccal mucosa, hard or soft palate, and oral pharynx (Fig. 1A). A diagnostic clue is the ease with which the white plaque can be wiped off, revealing an erythematous surface. We recommend using a cotton-tipped swab for this purpose. Confirmation of fungal elements (i.e., pseudohyphae and yeast) can be achieved through a potassium hydroxide (KOH) preparation. A non-infectious mimic of pseudomembranous candidiasis includes pseudo-membranes related to trauma or other oral conditions. These lesions appear as a dense, grey fibrinous material that covers ulcerative areas. On a KOH prep of non-infectious pseudomembranes, no pseudohyphae should be identified.

### Erythematous Oral Candidiasis

Erythematous oral candidiasis, also known as acute atrophic candidiasis, may be associated with recent use of broad-spectrum antibiotics or corticosteroids [5•]. This form is the most common clinical presentation in both immunosuppressed and immunocompetent [9]. Clinically, these lesions manifest as erythema of the tongue, palate, and/or buccal mucosa [5•]. The patient may describe burning and tenderness of the mucosa [7•]. KOH is commonly employed for diagnosing oral candidiasis. However, in instances of the erythematous subtype, there is a notable occurrence of false negatives (42%) associated with KOH, believed to stem from insufficient scraping of exfoliated cells by the examiner or a low number of fungal elements, which can lead to misdiagnosis. Some propose that fluorescence staining offers a more precise diagnostic approach for this subtype [10]. It is important to assess the patient's risk factors for developing erythematous oral candidiasis including recent use of antibiotics or corticosteroids [5•]. Non-infectious mimics of this condition include nutritional deficiencies and inflammatory oral conditions.

### Hyperplastic Oral Candidiasis

Hyperplastic oral candidiasis presents clinically as well-circumscribed, slightly elevated, white plaques primarily on the retro-commissures and buccal mucosa and may involve labial commissures and lateral tongue (Fig. 1B). In contrast to pseudomembranous candidiasis, these lesions cannot be easily wiped off by rasping [5•, 6•, 7•]. From our experience, a positive KOH preparation may be observed, but a biopsy specimen for Periodic Acid-Schiff (PAS) staining is often necessary for diagnosis, as it is more sensitive. Patients are often asymptomatic but may describe a burning sensation. Smoking cigarettes or chewing tobacco seems to be linked to the development of these lesions. A biopsy may be necessary to distinguish this condition from non-candidal causes of leukoplakia such as dysplasia [11•].

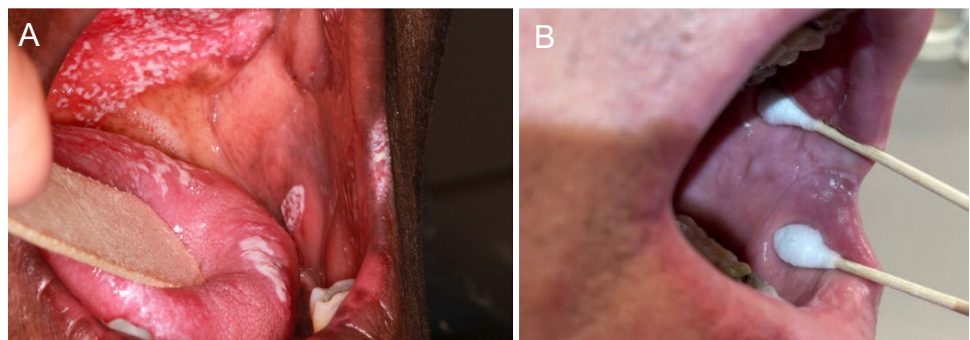
### Candida-Associated Conditions

Unlike the primary clinical forms of oral candidiasis described above, candida-associated conditions are typically multifactorial in nature with candida being a common finding and contributor to the pathophysiology, but not the sole cause.

### Denture Stomatitis

Denture stomatitis is characterized by localized or diffuse erythematous inflammation of the oral mucosal adjacent to sites of dentures. This condition is influenced by multiple factors including inadequate oral or denture hygiene, prolonged denture use (especially during the night), contamination of dentures with biofilms containing *Candida*, and trauma from poor-fitting dentures. The likelihood of this condition increases in smokers, older adults, and individuals with aged dental prostheses [12•]. Patients can be asymptomatic or may describe a burning sensation. Managing denture stomatitis includes treatment of underlying

**Fig. 1** Pseudomembranous oral candidiasis (A) and hyperplastic oral candidiasis (B). **A** White soft papules and plaques with background erythema on the hard palate, buccal mucosa, dorsal tongue and commissure. **B** White plaque of retro-commissure



causes including disinfecting the prosthesis, properly fitting dentures, and addressing fungal overgrowth.

### Angular Cheilitis

Angular cheilitis presents with erythema and inflammation of the oral commissures resulting from pooling of saliva that leads to maceration and colonization by *Candida* and/or bacteria. Classically, angular cheilitis manifests with triangular-shaped, painful, erythematous patches of skin at the oral commissures (Fig. 2). It is essential to examine the oral cavity for signs of oral candidiasis. Diagnosis relies on clinical observations, and empiric treatment is advised. Laboratory investigations are generally conducted in cases of treatment failure. Patients may describe pain exacerbated by opening the mouth leading to difficulty eating [13•].

The underlying etiology is often multifactorial, necessitating a thorough review of risk factors. History-taking should include inquiries about the use of dental appliances, lip licking, facial wrinkling at the commissures, and nutritional deficiencies [6•, 13•]. Systemic diseases such as Sjogren's syndrome and inflammatory bowel disease may present with angular cheilitis [13•]. Managing angular cheilitis involves recommending barrier protection (petrolatum jelly, emollients, lip balm) and addressing contributing behavioral practices, while also offering antifungal and antibacterial treatment [13•]. Details on topical treatments are provided below.

### Treatments for Oral Candidiasis and Associated Conditions

In the management of oral candidiasis and candida-associated conditions, it is imperative to address predisposing risk factors, including poor oral and denture hygiene, xerostomia,



**Fig. 2** Angular cheilitis. Erythema and scaling of bilateral commissures

dietary deficiencies, and medications. Treatment strategies should be tailored to the disease severity and the patient's level of immunosuppression. Topical antifungals, including azoles miconazole, clotrimazole, and ketoconazole, as well as polyenes like nystatin, are first-line therapy for mild cases. The choice of topical antifungal may be guided by the vehicle, with lozenges/troches and oral suspension being more useful in widespread infections versus ointments for angular cheilitis [6•, 13•].

Imidazoles (clotrimazole, miconazole, and ketoconazole) are fungistatic agents that inhibit ergosterol synthesis. These are available as gels, creams, solutions, and lozenges. For pseudomembranous and erythematous candidiasis, clotrimazole 10 mg troches five times a day for 14 days is recommended. The patient should wait 30 min before eating or drinking [7•]. Preventative antifungal regimens, using two clotrimazole troches at bedtime, may be considered when medications predispose patients to oral candidiasis. Miconazole is most effective against *C. albicans* and is a good option for angular cheilitis as it has anti-staphylococcal properties. However, the imidazole group has its shortcomings, including local irritation reported by some patients (<5%) and potential interactions with drugs metabolized by the cytochrome P450 enzyme, such as warfarin, statins, and cyclosporine though less likely with topical formulation [14].

In cases of azole resistance, topical polyenes like nystatin may offer greater efficacy. Polyenes exert their fungicidal and fungistatic effects by binding to ergosterol. Nystatin is available in various forms, including creams, ointments, lozenges, and oral suspensions. It is recommended to use nystatin QID for two weeks. This medication is generally well tolerated; however, like clotrimazole, there is a higher risk for dental cavities and decreased glucose tolerance given the higher sugar content, as well as gastrointestinal distress [6•, 15]. It should be noted that while nystatin solution is often employed as a swish and spit treatment, insufficient contact time of the solution to the oral mucosa due to short swish times limit the efficacy. The recommended contact time for best efficacy is three to five minutes within the oral cavity. Swallowing of nystatin is only recommended if pharyngeal and/or esophageal involvement is suspected for local treatment as there is negligible absorption of nystatin through the gut.

Systemic treatments are necessary in moderate to severe oral candidiasis, cases not responding to topicals, or hyperplastic candidiasis. Triazoles like fluconazole and itraconazole are recommended. Oral fluconazole is first line treatment for moderate-severe *C. albicans* infections at 100-200 mg daily for seven to 14 days [14]. Prophylactic dosing of 200 mg weekly can be helpful for patients with recurrent oral candidiasis due to predisposing factors that are not modifiable. Limitations of fluconazole include drug interactions, side effects such as gastric upset, headache, and rash and poor efficacy against *C.*

**Table 1** Treatment options for oral candidiasis and candida-associated conditions

Drug	Form	Dose	Advantages	Disadvantages
Nystatin	Ointment	TID-QID	Negligible absorbance through GI tract	Local irritation, GI upset, high sugar content
	Suspension	QID		
	Lozenge	QID		
	Tablet	TID		
Clotrimazole	Cream	BID-TID	Anti-staphylococcal properties	Mild irritant
	Troche	5x/d		
Miconazole	Cream/Ointment	BID	Best anti-staphylococcal coverage Lacquer to dentures	Mild irritant, drug interactions
	Gel	TID-QID		
	Lacquer	qweek		
Fluconazole	Capsules 100–200 mg	Daily 1–2 weeks		Drug interactions
Itraconazole	Capsule 100–200 mg	Daily 2 weeks	More effective for <i>C. krusei</i> and <i>C. glabrata</i>	Drug interactions, GI upset, transient transaminitis

*krusei* and *C. glabrata*. In fluconazole-refractory disease, itraconazole, voriconazole, posaconazole, or isavuconazole may be considered. Itraconazole, effective against *C. krusei* and *C. glabrata*, is typically dosed at 100–200 mg daily for two to four weeks. Potential side effects include GI upset, transient transaminase elevations, neuropathy, hallucinations, cerebellar alterations, and hypertriglyceridemia. Additionally, itraconazole is contraindicated in patients with heart failure due to its negative inotropic effects. Isavuconazole, a newer azole, may be considered as it exhibits higher oral absorption and fewer drug interactions and side effects [14, 16].

A comprehensive approach to managing oral candidiasis and associated conditions underscores the importance of identifying and addressing the predisposing risk factors, tailoring treatment according to disease severity and immunosuppression levels, and considering both topical and systemic options for therapy. The summary table serves as a practical guide for healthcare providers, highlighting the nuanced selection of antifungal agents based on clinical context (Table 1).

## Viral Infections

### Primary Herpetic Gingivostomatitis

Primary herpetic gingivostomatitis (PHGS) is a primary (first time) HSV-1 infection. Given the prevalence of the virus PHGS is far more common in children than adults. Patients typically present with a prodrome of systemic symptoms including fever, headache, malaise, nausea, and vomiting [17•]. Classic HSV lesions with punched out erosions may occur on both free (non-keratinized) and attached or keratinized surfaces in primary disease. Elderly people who develop PHGS typically have a milder disease course.

### Recurrent Intraoral Herpes

Recurrent HSV infections are common in immunosuppressed individuals but can also be triggered by stress. Recurrent intraoral herpes is a more common clinical presentation in the adult population compared to PHGS. HSV-1 lesions are characterized by the presence of one-to-two-millimeter vesicles, typically in clusters, which easily rupture, giving rise to painful, punched-out erosions. These lesions may exhibit a yellowish-gray pseudomembrane along with perilesional erythema and gradually heal over 10 to 14 days without scarring. Lesions occur on keratinized or attached mucosal surfaces such as the gingiva, palate, and dorsal tongue and typically occur at the same site with each recurrence. A swab of active lesions for HSV PCR has a high sensitivity and specificity and is the best test for suspected HSV. HSV serologies can be useful to rule out disease if negative. However, positive HSV serologies only indicate previous infection and are not useful in diagnosis of acute infection [18].

### Recurrent Herpes Labialis

Recurrent herpes labialis (often referred to as cold sores) are recurrent HSV infections of the vermilion lip or vermilion border that occur at the same location with each flare due to latent virus reactivation from the trigeminal ganglion. Patients may report a prodrome of tingling or burning sensation prior to flares. Flares can be triggered by factors such as immunosuppression, stress, and sun exposure [19•]. Treatment is most effective when initiated early (see treatment section below and Table 2).

Other oral conditions that may present similarly to HSV include aphthous stomatitis, cytomegalovirus (CMV), infectious mononucleosis, coxsackie-like virus, and erythema multiforme.



**Table 2** Therapies for the treatment of primary and recurrent HSV gingivostomatitis

		Dose	Advantages	Disadvantages
Primary	Acyclovir Ointment	5% Q2h x 7d	Reduction in pain, fever, viral shedding, and duration of lesions	Must be started within first 3 days of signs Some patients have headaches, malaise, and vomiting
	Acyclovir Tablet	400 mg TID x 10d		
	Valacyclovir Capsule	1 g BID x 10d		
	Famciclovir Tablet	500 mg BID x 10d		
Recurrent	Acyclovir Tablet	400 mg TID x 5d	Reduction in duration of lesions if started in the first 48–72 h	
	Valacyclovir Capsule	2 g BID x 1d		
	Famciclovir Tablet	<i>Immunosuppressed:</i> 500 mg BID x 7d		
		750 mg BID x 1 d <i>Immunosuppressed:</i> 500 mg BID x 7d		
Suppressive	Acyclovir Tablet	400 mg BID	> 5 episodes/year, reduction in episodes over 4 months	
	Valacyclovir Capsule	500 mg daily		
		1 g daily (> 10 recurrences/year or immunosuppressed)		

## Treatments for Primary and Recurrent Herpes

Topicals or oral analgesics can be used for pain control. Systemic antivirals, such as acyclovir, valacyclovir, and famciclovir, can be helpful in reducing the duration of flares if started within the first 72 h of symptom onset [20]. The duration of treatment varies based on the type of infection (primary or recurrent) and the immune status of the patient (Table 2). Suppressive treatment should be considered if patients have more than 5 outbreaks in a year. Side effects include headache, malaise, and vomiting. Given the excellent safety profile and easier dosing valacyclovir is often utilized. It should be noted that while topical antivirals are available the dosing schedule of every 2 h is difficult to comply with and the reduction in duration of the flare by < 1 day is minimal.

## Bacterial Infections

Other infections that may manifest with oral lesions can be bacterial in origin such as syphilis and gonorrhea. In cases of syphilis, the primary ulcer is typically a painless lesion with a clear base located on the upper or lower lip or the tongue. Secondary syphilis may appear as mucous patches. Rapid plasma regain (RPR) serologic testing should be performed for confirmation. Oropharyngeal gonorrhea typically presents as a sore throat with small pustules on the oropharynx, tonsils, or uvula while oral gonorrhea manifests as erythematous, erosive ulcerations covered by a pseudomembrane [20, 21•, 22]. While these bacterial infections are considered sexually transmitted and not often considered in the geriatric patients, recent evidence suggests that the incidence is increasing in this population [23•].

## Immune-Related Oral Conditions

Although less common than infectious causes, erosive, and erythematous conditions of the mucosal membranes may be the result of inflammatory oral conditions such as oral lichen planus (OLP), mucous membrane pemphigoid (MMP), pemphigus vulgaris (PV), Behcet's disease, contact stomatitis, and recurrent aphthous stomatitis. Effective management of these conditions typically requires collaboration between primary care physicians and specialists. The following provides summaries of these conditions, along with initial treatment approaches and guidance on referral to a specialist to perform an oral biopsy, such as a dermatologist, oral medicine, or oral pathologist.

Oral conditions, whether infectious or inflammatory, can exhibit similar presentations. If conventional treatments for infectious processes prove ineffective or if the patient presents with genital, eye, and/or skin lesions, an oral biopsy may be necessary. A simple four-question list as suggested by the International Pemphigus and Pemphigoid Foundation may be beneficial when deciding to refer a patient for an oral biopsy. If a patient answers yes to three or more of the following questions, a biopsy should be considered [24].

1. Do you have more than one blister or lesion in your mouth?
2. Have your blisters or lesions lasted for more than a week?
3. Have you continually had blisters or lesions that do not heal?
4. Do you have blisters or lesions in any location outside the mouth?

## Oral Lichen Planus

Oral lichen planus (OLP) is common in the elderly population [25•]. OLP is an immune-mediated chronic inflammatory condition characterized by lesions on the mucosal membranes. This condition is present in approximately 2–5% of the adult population with a tendency for females (2:1) [26]. Clinically, white striated reticular lesions, known as Wickham’s striae (Fig. 3A), are observed, often accompanied by erythematous or erosive lesions, and less frequently by papular, plaque-like, or bullous lesions. These lesions most commonly appear on the buccal mucosa bilaterally, but may be present on the gingivae, labial mucosa and tongue as well [27]. Histopathological confirmation through an oral biopsy is needed for definitive diagnosis and is recommended before starting systemic treatment.

While some patients may be asymptomatic, particularly patients with reticular lesions, individuals with erythematous, erosive, or bullous lesions often report burning and pain [28•]. The etiology of OLP remains unclear, with viral infections (such as Hepatitis C), medications, (including nonsteroidals, antihypertensives, anti-rheumatics, antimalarials, antivirals, and gold salts), and metallic materials being commonly implicated [29]. Screening for risk factors and age-appropriate testing for the Hepatitis C virus are recommended. A thorough review of medications, especially recent initiations, is suggested, along with an assessment for involvement of other mucosa sites.

For symptomatic control, patients should minimize possible triggers including stress, certain foods and beverages, and oral hygiene products such as mint-flavored toothpaste [30]. Corticosteroids, including dexamethasone and clobetasol, are recommended as first-line treatment for symptomatic cases. Ointments and gels may be preferred for patients for small, localized lesions. While topical creams are available, they are generally not recommended for intraoral use. It should be noted that topical steroid ointments and gels will also come with a warning that they are not intended for intraoral use though in clinical practice they are used frequently for oral conditions. It can be helpful to advise patients of this in advance. Those with widespread oral cavity involvement may benefit from liquid suspensions such as dexamethasone elixir, swishing for three to five minutes TID-QID. Other topical agents that are reported to be beneficial in OLP include cyclosporine and tacrolimus [27]. Side effects of topical steroids can include intraoral candidiasis and concurrent anti-candidal treatment should be considered prophylactically. Systemic medications are indicated for patients with severe pain or lesions unresponsive to topical treatments.

OLP is a chronic inflammatory condition that exhibits a wide range of symptoms among patients. While some may need minimal or no therapies, others may require systemic medications to manage disease activity. A higher risk of malignant transformation in patients with erosive/ulcerative OLP has been reported, emphasizing the importance of frequent monitoring by an oral specialist [29].

**Fig. 3** Immune-related oral conditions: oral lichen planus (A), Mucous membrane pemphigoid (B), Pemphigus vulgaris (C & D). **A** White reticular lesions with background erythema of the labial and vermilion lips in a patient with oral lichen planus. **B** Erythema and erosions of the mandibular facial gingiva found to be Mucous Membrane Pemphigoid on DIF. Erythema and erosions of the lower labial mucosa, mandibular facial gingiva (C) and hard palate (D) found to be Pemphigus Vulgaris on DIF



## Mucous Membrane Pemphigoid

Mucous membrane pemphigoid (MMP) is an autoimmune-mediated mucocutaneous disorder characterized by blistering lesions affecting mucosal surfaces, resulting from autoantibodies targeting proteins of the basement membrane zone (these proteins adhere the epithelium to the underlying connective tissue). MMP typically manifests between the ages of 60 to 80. Clinically, erosions, and rarely intact vesicles, are visible in the oral cavity on the gingiva (Fig. 3B), buccal mucosa, and hard and soft palate. The oral vesicles quickly rupture, leading to painful erosions and ulcers that heal slowly. Assessment of other mucosal surfaces is recommended, and histological analysis through immunofluorescence is necessary to confirm the diagnosis [31, 32].

Topical steroids serve as the first-line therapy for mild to moderate MMP. For initial control of moderate to severe disease activity, patients typically require systemic corticosteroids, with a starting dose of prednisone at 1 mg/kg/day. However, prednisone is associated with significant side effects. Notably, the geriatric population faces concerns including osteopenia, osteoporosis, cataracts, and insomnia. As a result, physicians should try to minimize the time patients are on systemic corticosteroids. Systemic medications that are indicated for management of MMP include dapsone, methotrexate, azathioprine, mycophenolate mofetil, and rituximab [31].

## Pemphigus Vulgaris

Pemphigus vulgaris is a rare autoimmune blistering disease that affects skin and mucous membranes. It manifests around the age of 40–60 in both men and women [33]. Clinically, the disease presents with painful erosions within the oral cavity (Fig. 3C, D). In addition to other mucosal surfaces including the eyes, nose, esophagus, vagina, and anus, patients may experience cutaneous involvement which typically presents flaccid bullae and crusted erosions. In addition to history and physical exam, the diagnosis of PV requires histological and immunofluorescence confirmation. Patients with oral ulcers are typically symptomatic and may report pain with eating, poor nutrition, weight loss, and fatigue. Although most instances of PV occur without a clear cause, some studies and case reports indicated that certain medications may trigger the condition [31, 33]. A careful review of the patient's medications is recommended. The recommended initial treatment for patients with PV is prednisone at a dosage of 1 mg/kg/day until an immunomodulatory or immunosuppressive can be initiated [33]. Topicals are less often effective in the treatment of pemphigus. Patients should be referred to a dermatologist for further management.

## Contact Stomatitis

Contact stomatitis is inflammation and pain of the oral mucosa caused by exposure to an irritant or triggering allergen that results in a delayed type of hypersensitivity [34•, 35]. On physical exam, the tongue and buccal mucosa are the most commonly involved sites showing erythema, swelling, and vesicles. Patients may describe a burning or stinging pain. The symptoms will resolve in one to two weeks after removing the allergen [34•].

## Recurrent Aphthous Stomatitis

Recurrent aphthous stomatitis is a common oral ulcerative condition that typically begins in childhood and adolescence. Though frequently considered in patients with intraoral ulcers, it should be noted that the incidence decreases significantly after age 50 and would not be likely to arise as new onset in the geriatric population. The painful lesions present acutely as well defined ulcers with an erythematous halo (Fig. 4) and persist for seven to 14 days. Treatments should be directed to reduce pain through topical analgesics or corticosteroids [36••]. In some instances, systemic medications may be required to alleviate pain and reduce recurrences.

## Behcet's Disease

Behcet's disease should be considered in patients with recurrent oral and genital aphthous ulcers, ocular uveitis, and gastrointestinal involvement. These ulcers are



**Fig. 4** Aphthous ulcer. Well circumscribed ulcer with overlying pseudomembrane and surrounding erythema on the upper labial lip mucosa

indistinguishable from aphthous ulcers and are often small, erythematous painful lesions on the unattached mucosa [34•]. This condition typically presents in early adulthood and would be unlikely to develop with new onset in the geriatric population [37•].

## Other Common Oral Conditions

### Xerostomia

Xerostomia, defined as subjective oral dryness, is a common oral symptom, particularly in older adults, with a reported prevalence of 30% in individuals aged 65 and older [38•]. Clinical manifestations of xerostomia may include difficulty swallowing, chewing, or speaking, a burning sensation, altered taste, halitosis, glossitis, cracked and peeling lips, oral candidiasis, or dental caries [39]. Understanding these symptoms and their potential causes is crucial for healthcare professionals when managing and addressing xerostomia in patients. There are numerous causes of xerostomia, consequential from systemic diseases like endocrine, autoimmune, and infection, as well as local factors such as radiation, medication, lifestyle choices habits such as the use of alcohol and cigarettes [38•, 39]. Given the extent of medications associated with xerostomia, it is essential to thoroughly review the patient's medication list for drugs such as anticholinergics, antihistamines, antihypertensives, diuretics and polypharmacy [41•, 42•, 43•, 44•, 45]. Preliminary treatments should focus on addressing the underlying cause, whether it be dehydration, medications, or lifestyle habits. To alleviate symptoms of xerostomia, tools that improve lubrication, thickening, and moisturizing in the oral cavity should be utilized. This may involve citrus and malic acids to stimulate salivary secretion or hydrocolloids like xanthan gum and cellulose derivatives to thicken saliva [40, 44•]. A meta-analysis of six studies found that chewing sugar-free gum offers relief for dry mouth in the elderly and medically compromised. Additionally, this study found that chewing gum daily over two or more weeks was associated with an increase in the rate of unstimulated salivation [46•]. Pharmaceutical solutions approved by the FDA for xerostomia to restore lost functions include pilocarpine and cevimeline. Pilocarpine (5 mg TID for at least three months) is commonly used for xerostomia caused by Sjogren's syndrome or induced by radiation. Side effects include sweating, gastric distress, headache, and dizziness [47•]. In systemic diseases that are affected by the presence of muscarinic receptors such as COPD, gastric ulcers, uncontrolled asthma, hyperthyroidism, and orthostatic hypotension, pilocarpine is contraindicated [47•, 48•]. Explorations into a topical delivery of

pilocarpine have not shown consistent results and further investigations are needed [47•, 49•]. In conclusion, patients with xerostomia suffer symptoms that affect patients' quality of life and overall health. It is essential to address predisposing factors and offer therapeutic strategies to alleviate symptoms and protect overall oral health.

### Traumatic Ulcers

Traumatic ulcers can result from trauma, chemical agents, or thermal burns contacting the mucosa. Trauma-related ulcers can occur due to brushing vigorously, biting oneself, or direct sustained pressure from dental prostheses. Ulcers associated with chemical or caustic agents may related to exposure to acids or strong alkalis. Thermal burns develop from hot beverages or foods, e-cigarettes, or iatrogenic causes. Clinically, these lesions will appear as vesicles or ulcers. They present acutely and are associated with short, painful episodes of seven to 10 days. Generally, these lesions are self-resolving although topical analgesics and corticosteroids may reduce pain [20].

### Atrophic Glossitis

Atrophic glossitis is identified by the partial or complete lack of filiform papillae on the dorsal tongue and may indicate substantial deficiencies in essential nutrients such as iron, folate, vitamin B12, zinc, vitamin E, and riboflavin. Additionally, the causes of atrophic glossitis include protein-calorie malnutrition, oral candidiasis, or xerostomia. Patients may be symptomatic, or describe a burning sensation, dry mouth, or numbness. Treatments are individualized based on underlying etiology such as supplements for nutritional deficiencies, treat candidiasis, or xerostomia [50, 51].

### Malignant Conditions

Oral squamous cell carcinoma is not discussed in this review but should be considered in any oral lesion that persists and a biopsy should be completed if there is suspicion for malignancy, especially in patients with risk factors such as current or historical tobacco and/or alcohol use.

## Conclusion

This review provided a guide to diagnoses and management of oral conditions that may present in the geriatric population. Oral diseases can have a significant impact on the overall health and well-being of patients. Diagnosis of an oral disease can be challenging as the differential can encompass infections, immune-related, and idiopathic conditions.



Ultimately, management may require collaboration between primary care physicians and oral specialists.

## Key Points

- Oral candidiasis can have several presentations and treatment modality should be based on the symptoms and severity of the infection.
- Primary oral manifestations of HSV, syphilis, gonorrhea, EBV, CMV, and Coxsackie are uncommon in the elderly population but should be considered in patients with risk factors.
- Immune-related oral conditions such as OLP, MMP, and contact stomatitis may present in the geriatric population while PV, Behcet's, and recurrent aphthous stomatitis are less common. A thorough medications review and physical exam should be performed and a biopsy by an oral specialist may be necessary.
- Xerostomia is common in geriatric patients and the etiology may be multifactorial. Management should aim to reduce symptoms and maintain proper oral hygiene.

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**Data Availability** No datasets were generated or analysed during the current study.

## Compliance with Ethical Standards

**Conflicts of Interest** SGM reports no conflict of interests. DAC reports being an investigator for Regeneron, Cabaletta, Incyte, UCB, Pfizer, Lilly, Sanofi, Moberg, BMS, Biogen; consultancy fees from Argenx, Regeneron, iCell and Janssen. Honoraria fees from UpToDate. DAC also reports being a section editor for the Dermatology and Wound Care section of Current Geriatrics Report 2024 volume.

**Human/Animal Studies and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors. Informed consent was not needed for any of the findings presented in this paper.

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Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

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