The geriatric population is the most rapidly growing segment of the general population, a fact that will have dramatic implications for systemic and oral health in the future. In 1950, only approximately 10% of the US population was aged 65 years or older. This number increased to 13% in 1997 and is expected to reach 20% by the year 2030. The number of adults aged 85 years or older in the United States will rise from 3.3 million in 1994 to 8.6 million in 2030 and will further increase to 19 million by 2050. In 1997, life expectancy was 76.5 years (79.4 years for females, 73.6 years for males), and over one-third of the population survived beyond the age of 85 years. On the basis of mortality experienced in 1997, a person aged 65 years could expect to live an average of 17.7 more years, and a person aged 100 years could expect to live an additional 2.5 years on average. In comparison to statistics from 1900, the population has changed dramatically. The median age of death has reached 80 years (in 1900, it was 58 years), and 1.5% of the population survives to age 100 years (in 1900, the proportion was 0.03%).

As more people live longer and become elderly, there will be an increase in chronic conditions and illnesses that will influence both oral and systemic health. The most common causes of death in adults aged > 65 years in the United States are diseases of the heart, cancers, and cerebrovascular and pulmonary diseases (Table 24-1). The most common chronic diseases in elderly people are arthritis, hypertension, heart disease, sinus diseases, and diabetes mellitus (Table 24-2). All of these acute and chronic conditions have potential oral sequelae, particularly in an older and more medically compromised adult. Furthermore, the treatment of these diseases with medications, chemotherapy, and radiotherapy has implications for the maintenance of oral health (Table 24-3). Chronic impairments are also prevalent among elderly persons; hearing, visual, and orthopedic impairments and speech disorders are the most common of these (Table 24-4). Older adults experience other sensory impairments...
such as olfactory and gustatory dysfunction, as well as oral motor problems including difficulty with mastication, speech, and swallowing.5–7 These chronic impairments can directly affect oral health and impair dental treatment, and simple steps taken by dental professionals will help improve communication with these patients (Table 24-5).

Many of the systemic conditions that are common among elderly people (see Tables 24-1, 24-2, and 24-4) and that directly or indirectly affect oral health are discussed elsewhere in this book, with the exception of dementias. Dementias are a considerable problem among the elderly population. There are some estimates that the prevalence is ~1% at the age of 60 years and doubles every 5 years to reach more than 50% by the age of 85 years.8–10 Dementia is characterized by both mental and physical decline. With increased severity of dementia, there is progressive cognitive and memory loss, development of social and behavioral problems, and inability to perform daily activities.8,11 Dementias comprise more than 55 illnesses, with the most common being Alzheimer’s disease and Parkinson’s disease.8 Estimates for the prevalence of Alzheimer’s disease approach 50% in adults aged > 85 years in the community population.9 Furthermore, US Census Bureau projections estimate 10.3 million persons with the disease by the year 2050.12 The incidence of Parkinson’s disease also increases steeply with advancing age,13 reaching a prevalence of 5% in community-dwelling adults aged 85 to 89 years,14 with a similar prevalence in nursing homes.15 More than two-thirds of these patients have moderate to severe functional disability,15 which will dramatically affect their oral health and the ability of dental professionals to deliver dental services to these patients. With the rapid growth of the elderly population and the retention of the natural dentition, there will be an increased need for dental care services for older adults with dementia.16

The progression of dementia is accompanied by a gradual inability to perform self-care, including adequate oral hygiene, due to self-neglect and loss of cognitive and motor skills.17 Persons with dementia, even those living in the community and experiencing few medical problems, have impaired oral health as a result of poor oral hygiene.18 For example, patients with Alzheimer’s disease have more gingival plaque, bleeding, and calculus compared to age- and gender-matched adults,19 and submandibular saliva output is impaired in nonmedicated persons with Alzheimer’s disease.20 Poor gingival health and oral hygiene have been found to increase with the severity of dementia.21 The neuronal degeneration that accompanies Parkinson’s disease also impacts negatively on oral health.22 Insufficient and inadequate oral hygiene, impaired access to professional oral examination and treatment, and frequent medical management with psychotropic medications that cause salivary dysfunction all combine to negatively affect oral health and function.

Oral care, treatment planning, and behavioral management for persons with dementia must be designed with consideration of the severity of disease and must involve family members or caregivers.17,23 Early in the disease process, aggressive preventive and interceptive steps need to be formulated to preserve existing stomatologic health. As dementia progresses, treatment becomes problem based, and short-acting benzodiazepines may be helpful for managing patients’ behavior.16 Frequent recall and preventive measures must be continued. The role of the caregiver becomes more critical in providing symptomatic and objective information as well as in performing daily oral hygiene. Complex and time-consuming dental treatment should be avoided in persons with severe dementia. The emphasis should be on keeping the patient free of pain and able to maintain adequate nutritional intake, particularly if the patient is no longer able or willing to wear removable prostheses. Intravenous sedation or general anesthesia can be considered for necessary dental care.24 In summary, oral health care providers will be increasingly challenged with preserving the oral and nutritional health of these patients, to diminish pain and pathology, and to maintain their dignity and quality of life.

---

**TABLE 24-1  Leading Causes of Death in Adults Aged 65 Years and Older in the United States, 1996**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause of Death</th>
<th>Rate/100,000 Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diseases of the heart</td>
<td>1,808</td>
</tr>
<tr>
<td>2</td>
<td>Malignant neoplasms</td>
<td>1,131</td>
</tr>
<tr>
<td>3</td>
<td>Cerebrovascular diseases</td>
<td>415</td>
</tr>
<tr>
<td>4</td>
<td>COPD</td>
<td>270</td>
</tr>
<tr>
<td>5</td>
<td>Pneumonia and influenza</td>
<td>221</td>
</tr>
<tr>
<td>6</td>
<td>Diabetes mellitus</td>
<td>137</td>
</tr>
<tr>
<td>7</td>
<td>Accidents and adverse effects</td>
<td>91</td>
</tr>
<tr>
<td>8</td>
<td>Alzheimer’s disease</td>
<td>62</td>
</tr>
<tr>
<td>9</td>
<td>Renal diseases</td>
<td>62</td>
</tr>
<tr>
<td>10</td>
<td>Septicemia</td>
<td>51</td>
</tr>
</tbody>
</table>


COPD = chronic obstructive pulmonary disease.

**TABLE 24-2  Leading Chronic Conditions in Adults Aged 65 Years and Older in the United States, 1994**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Chronic Conditions</th>
<th>Rate/1,000 Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arthritis</td>
<td>502</td>
</tr>
<tr>
<td>2</td>
<td>Hypertension</td>
<td>364</td>
</tr>
<tr>
<td>3</td>
<td>Heart disease</td>
<td>324</td>
</tr>
<tr>
<td>4</td>
<td>Chronic sinusitis</td>
<td>151</td>
</tr>
<tr>
<td>5</td>
<td>Diabetes mellitus</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>Allergic rhinitis</td>
<td>80</td>
</tr>
<tr>
<td>7</td>
<td>Varicocities</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>Hernia</td>
<td>64</td>
</tr>
<tr>
<td>9</td>
<td>Hemorrhoids</td>
<td>62</td>
</tr>
<tr>
<td>10</td>
<td>Chronic bronchitis</td>
<td>61</td>
</tr>
</tbody>
</table>

Another concern in the elderly population is access to medical and oral health care services. Overall, 4% of the older population lives in nursing homes; however, the prevalence increases dramatically with age. Approximately 1% of adults aged 65 to 74 years reside in nursing homes, compared with almost 20% of persons aged ≥ 85 years.25 Furthermore, the percentage of community-dwelling individuals needing personal assistance with activities of daily living, including oral hygiene, increases with age. The estimated number of persons served by home health care agencies rose from 1.2 million in 1992 to 2.4 million in 1996, doubling in less than 5 years.26 One-half of the population aged 65 years and receiving home health care requires help with personal hygiene, one-quarter requires assistance preparing meals, and nearly 10% needs assistance with eating. Therefore, the growing number of older adults with chronic medical problems and requiring assistance with activities of daily living will have a dramatic impact on geriatric dental health.

Oral health and function is commonly altered in older adults.5 However, age alone does not seem to play a strong role in the impairments. Dental, periodontal, oral mucosal, and salivary diseases have a detrimental and compounding affect on oral health in elderly persons, yet oral disease is not necessarily a concomitant of growing older. Importantly, numerous medical problems, medications, and other medical treatments can adversely affect oral function in an older adult.3,4,27 These disorders must be recognized and managed appropriately by health care practitioners to eradicate disease, restore function, and improve the quality of a person’s life. Stomatologic diseases in medically, physically, behaviorally,
and mentally compromised older adults can now be treated in a variety of patient care settings, including long-term care institutions, which will have a positive impact on the quality of life of these patients.

Importantly, the effects of stomatologic diseases are not necessarily limited to the oral cavity. Oral diseases give rise to pathogens that can be bloodborne or aspirated into the lungs. These pathogens can cause immediate systemic complications (eg, aspiration pneumonia, bacteremia) or (by complex immunologic pathways) may be associated with long-term problems (eg, coronary heart disease and cerebrovascular disorders).

This chapter is dedicated to geriatric oral medicine and attempts to summarize the effects of aging and the influence of systemic diseases and their treatment on a variety of vital oral health topics. Age-related changes in oral tissues (Table 24-6) and common oral conditions in the geriatric population are described (Table 24-7). Finally, an overview of the prevention and management of oral diseases in the geriatric population is provided.
AGE-RELATED CHANGES IN ORAL HEALTH

Oral Mucosa

The clinical appearance of the oral mucosa in many healthy older persons is indistinguishable from that of younger people. However, a lifelong history of oral mucosal trauma (eg, cheek biting), mucosal diseases (eg, lichen planus), oral habits (eg, smoking), and salivary disorders (eg, salivary hypofunction) can alter the clinical appearance and histologic character of the oral mucosa in an older adult. Histologically, there is evidence of epithelial thinning, less-prominent rete pegs, decreased cellular proliferation, loss of submucosal elastin and fat, and increased fibrotic connective tissues with degenerative alteration in collagen. Clinically, these structural changes may be accompanied by dry thin smooth mucosal surfaces, with loss of elasticity and stippling. These changes may predispose the oral mucosa to trauma and infection, particularly when they are associated with denture use and salivary hypofunction.

Oral mucosal immunity is believed to undergo some age-related changes. Wound healing and regeneration of tissue may be delayed in elderly individuals, yet older age plays only a minor role in the response of oral mucosa to injury. It is not known if advanced age per se has a clinically significant adverse effect on the appearance and function of the oral mucosa. However, the concomitant effects of oral mucosal diseases with age-related structural and immunologic changes, local trauma, systemic diseases, medications, and poor nutritional status can cause significant oral mucosal changes in an older adult.

Dentition

Major epidemiologic changes have occurred over the past several decades in regard to retention of the dentition. Only about 30% of adults aged ≥ 65 years are completely edentulous, and between 1983 and 1993, the prevalence decreased by 10% in all older age groups. These trends are expected to continue with improved oral health care, greater tooth preservation, and enhanced restorative techniques and materials.

Changes in the dentition due to aging can be attributed to normal physiologic processes and to pathologic changes in response to functional and environmental stresses. External tooth changes include discoloration (to a yellowish brown color) and loss of enamel due to attrition (Figure 24-1), abraison, and erosion. Severe enamel wear will ultimately expose underlying dentin, which produces sclerotic and secondary dentin in response to trauma, caries, and masticatory forces. Over time, dentin undergoes a reduction in thermal, osmotic, and electrical sensitivity and pain perception, and its susceptibility to caries decreases. Cementum thickness and pulp dimensions are reduced with age. Secondary dentin deposition, pulpal calcifications, external root resorption, increased density and volume of pulpal collagen fibers, and diminished nerve supply all contribute to a progressive decrease in the size of the pulp. These age-related pulpal changes diminish tooth sensitivity and pain perception, reduce responsiveness to pulp testing, and usually decrease the need for local anesthesia for dental procedures.
The prevalence of coronal and root surface caries increases with age, and greater than 30% of the population aged ≥65 years has untreated coronal and root caries. Increases in caries are influenced by two trends: a greater retention of teeth among elderly persons, and a decline in caries among younger people. Teeth are susceptible to new decay as well as recurrent caries around existing restorations. Due to gingival recession, these teeth are at risk for developing cervical or root surface caries. With extended retention of the natural dentition into older age, previously restored teeth are more prone to recurrent decay, due to defective restorations, fractured fillings, poor oral hygiene, and inaccessible restoration margins.

Dental plaque is the primary source of microorganisms (e.g., Streptococcus mutans and lactobacilli) causing coronal and root surface caries in elderly people. Individuals of all ages are susceptible to the development of dental plaque. However, following abstinence from daily oral care, older individuals form plaque more rapidly than do younger people. This occurs as a result of gingival recession, diminished salivary gland function, disturbances in oral motor function, and difficulty in performing oral hygiene. Since these factors are directly associated with dental caries, older patients are more susceptible to new and recurrent tooth decay. When detected early, caries can be restored with a variety of dental materials. In most circumstances, untreated caries will progress to severe or even total loss of tooth structure and possibly to pain, abscess formation, cellulitis, and bacteremia.

Periodontium

The clinical appearance of periodontal tissues in an elderly individual reflects age-related changes and an accumulation of previous disease experiences and trauma over time. With increased age, gingival recession (Figure 24-2) and loss of periodontal attachment and alveolar bone are essentially universal; nearly 95% of dentate Americans over the age of 65 years have measurable attachment loss. However, changes in the periodontium that are attributable solely to age are not sufficient to lead to tooth loss, especially in a healthy adult. Most frequently, periodontal changes over time lead to greater recession without significant increased periodontal pocket depth.

Age-related immunologic changes and histologic alterations in periodontal tissues could alter the host response to dental plaque microorganisms, affecting the patient’s ability to respond to periodontal treatment. It has been reported that following periodontal therapy, younger patients in studies healed with a higher frequency of shallow pockets and a greater gain of probing attachment, compared to older patients.

Several systemic conditions and medications that are more prevalent among older adults have been linked with periodontal disorders. Osteoporosis adversely affects collagen metabolism and bone mineralization, with a concomitant decrease in bone mass. There is some evidence that severe osteoporosis significantly reduces the bone mineral content of the jaws and that it may be associated with greater periodontal attachment loss and tooth loss. Interestingly, estrogen replacement for the treatment for osteoporosis in older women has been associated with less gingival bleeding and may be beneficial in preventing tooth loss in postmenopausal women. In older adults, diabetes is the sixth most common cause of death (see Table 24-1), the fifth most common chronic medical condition (see Table 24-2), and a risk factor for the development of periodontal diseases. Several classes of medications that are frequently prescribed for older persons have been associated with gingival overgrowth or hyperplasia. These include calcium channel blockers, the antiseizure drug phenytoin, and the immunosuppressant cyclosporine.

Finally, there are oral and sociobehavioral factors that influence the progression of periodontal disease in elderly people. Deep periodontal pocketing, irregular dental visits, smoking, psychosocial stress, and poor socioeconomic status all are predictors of periodontal attachment loss in older patients.

Salivary Glands

Saliva plays a critical role in the maintenance of oral health, and diminished output can cause dental caries, oral mucosal infections, sensory disturbances, speech dysfunction, decreased nutritional intake, and difficulty in chewing, swallowing, and denture retention. It was previously thought that changes in qualitative and quantitative salivary production were associated with normal aging. This may have been partly due to the common complaint of xerostomia (mouth dryness) in older people. However, it is now accepted that significant changes in salivary flow are not observed in healthy elderly persons. In addition, no age-related decreases in the secretion of certain salivary constituents (e.g., total proteins, proline-rich proteins, lactoferrin, sodium, and potassium) are seen in a healthy population.

Histologically, there are age-related alterations in the cellular makeup of salivary glands, with an increase in connective tissue and adipose deposition and a decrease in acinar cells.
loss of fluid-producing acinar cells increases the susceptibility of an older individual to salivary perturbations such as those caused by medications with anticholinergic side effects. However, in the absence of medical problems and their treatment in an older adult, it does not appear that these morphologic findings have a considerable impact on salivary secretions.

Taste and Smell

The chemosensory functions of smell and taste play a vital role in human physiology and in a patient’s quality of life. Many older adults complain of diminished food recognition and enjoyment, as well as altered smell and taste function.80 While gustatory function in healthy older adults remains remarkably intact,81 olfaction undergoes dramatic age-related changes, even in healthy older adults.82 The olfactory bulb and peripheral receptors are sensitive to a variety of environmental toxins, trauma, medications, and respiratory infections. Over the course of a lifetime, these common conditions cause a diminished sensitivity to olfactory cues and impair smell identification. Conversely, multiple taste buds that are located on the tongue, palate, and oropharynx, and innervation by three bilateral cranial nerves (VII, IX, and X) help produce a strong resistance to taste changes. Nevertheless, medications, chemotherapeutic agents, radiotherapy, trauma, surgery, and neurologic events can cause temporary or permanent taste changes in an older adult.

Other investigations have evaluated the more complicated problems of flavor perception, food recognition, and food preference. Although results are not uniform, older individuals do less well when performance is assessed in these tasks.7 While older age per se has been associated with certain chemosensory alterations, many oral and systemic conditions have been linked more strongly to smell and taste dysfunction.83 Therefore, age and oral and systemic disorders and their treatments can adversely affect smell and taste function, which could place an older adult at risk for developing nutritional deficits84 and could adversely affect his or her quality of life.

Mastication and Swallowing

The oral motor functions of mastication and swallowing require the coordination of intricate neuromuscular activities that are necessary for the translocation of foods and fluids into the gastrointestinal tract. The most frequently reported oral motor disturbance in older people is related to altered mastication, and even fully dentate older persons are less able to prepare food for swallowing as efficiently as are younger individuals.85 However, research data support the view that dentition, not age per se, has a direct influence on mastication.7 Altered masticatory ability in older age can be exacerbated further in individuals who are partially or fully edentulous, have painful or mobile teeth due to caries or periodontal diseases, or have a decreased salivary output.

Following mastication, the food bolus is translocated to the pharynx. The oral phase of swallowing requires well-coordinated neuromuscular processing, an intact mucosal barrier, and adequate salivary production.5 Alterations in any of these components can disturb deglutition and reduce nutritional intake. Normal aging has been reported to have minor adverse effects on swallowing86 although in the healthy older person, advanced age alone does not appear to cause any clinical dysfunction.57,88 Conversely, systemic and oral disorders have an adverse effect on swallowing, which could place an older person at risk of choking or aspiration.7,89,90 Cerebrovascular and neurologic diseases (eg, Parkinson’s disease, Alzheimer’s disease, and multiple sclerosis), head and neck cancer and its treatment (surgery and/or radiation), other systemic disorders (eg, arthritis and diabetes), and diseases and medications that decrease salivary output will adversely affect swallowing in older people.

Oral-Facial Pain

The presence of oral-facial pain in an older adult should not be attributed solely to the aging process. There is also no convincing evidence that age per se is a factor in treatment outcome for an older patient with pain.91 However, oral, systemic, psychological, and behavioral problems are more likely to be major contributors to oral-facial pain. Epidemiologic surveys suggest that both acute pain and chronic oral-facial pain are significant problems among elderly people92,93 and that they require a thorough multidisciplinary approach to diagnosis and management. Traditionally, it was accepted that there is a decrease in sensitivity to painful stimulation as persons get older. More recently, however, it has been shown that pain perception does not undergo dramatic changes with age94 but that differences in the clinical presentation of disease may account for altered pain association.95

Some oral findings in older persons include a lower incidence of dentinal sensitivity and a diminished use of analgesics and local anesthesia. Altered pain sensation in elderly persons may be related to the diminished functional capability of neurophysiologic components associated with pain or to the alterations in neural pathways that are involved in nociception.95 Aging and the incremental effects of dental wear, caries experience, trauma, previous restorative treatments, oral diseases, and oral hygiene practices can induce structural changes in teeth and periodontal tissues that can alter the perception of pain in elderly individuals.

Diagnosing pain in older adults may be challenging, especially for those patients who cannot respond to questions and who have difficulty communicating the nature of their problem.96 The most prevalent pain in the oral-facial complex involves the teeth and periodontium. However, neuropathic pain, which can be a sequelae of nerve injury, also affects elderly persons. Intraoral pain disorders affect teeth (eg, caries, root sensitivity), periodontium (eg, periodontal abscess), oral mucosa (eg, neoplasia, mucosal infection), and bone (eg, trauma, infection) and can also be idiopathic (eg, “burning mouth” syndrome). Extraoral pain disorders (exclusive of headaches) include disorders of the temporomandibular joint and of the muscles of mastication (eg, masticatory myalgia, internal joint disorder), neuralgias (eg, trigeminal or glossopharyngeal neuralgia), and atypical facial pain.95 Regardless of the etiology, oral and craniofacial pain in an older person
requires thorough examination and management, and may frequently involve multiple health care providers.

▼ COMMON ORAL CONDITIONS IN OLDER ADULTS

Oral Mucosal Diseases

Oral mucosal diseases and lesions are common in elderly people. Many older adults have pigmented (varices, lingual varicosities, melanotic macules) and benign soft-tissue (fibromas, Fordyce granules) and hard-tissue conditions (exostoses, tori). Tongue conditions include geographic tongue, black hairy tongue, lingual varicosities (Figure 24-3), and atrophy of filiform and fungiform papillae. The tongue may be fissured, coated, or enlarged (especially in edentulous individuals). A smooth, bald, or shiny tongue can indicate a nutritional or hematologic disorder (eg, iron or folate deficiency).

A variety of vesiculobullous and ulcerative mucosal conditions affect the elderly population. Many lesions are attributed to local trauma, such as denture-related irritation, accidental biting, and sharp dental and restorative surfaces. An ill-fitting denture can also cause inflammation (denture-induced stomatitis or papillary hyperplasia) and atrophy (resorption of residual alveolar ridges). Persistent low-grade irritation by an ill-fitting denture can induce a hyperplastic reaction, leading to the formation of an epulis fissuratum or traumatic hyperkeratosis.

Oral vesiculobullous diseases in older adults include lichen planus, pemphigus vulgaris, and cicatricial pemphigoid. The most common condition is lichen planus (Figure 24-4), a recurrent, chronic, inflammatory, and autoimmune mucocutaneous disorder that affects approximately 1% of the population, of which about 35% are aged ≥ 50 years (see also Chapter 4). Lichenoid mucosal lesions can also be caused by a variety of medications commonly prescribed in older patients (eg, acyclovir, gold salts, methyldopa, and thiazide diuretics). Pemphigus vulgaris is a potentially serious autoimmune vesiculobullous disorder that usually affects individuals in their fifth and sixth decades of life (see Chapter 4). Cicatricial pemphigoid is another immunologically mediated disorder; it affects primarily older women (see Chapter 4). The prolonged use of dentures in any of these conditions can cause exacerbation of oral mucosal lesions. Recurrent aphthous stomatitis is less common among elderly people; however, nutritional and hematologic deficiencies that are common in older adults can predispose to recurrent ulcers (see Chapter 4). Although erythema multiforme is also an unusual occurrence among the elderly population, it can develop and can persist, especially in immunocompromised persons (see Chapter 4).

Oral cancer is the most significant oral mucosal disease in older adults (see Chapter 8). Incidence rates increase with age; over 95% of all oral cancers occur in individuals aged 45 years and older. In the United States, 30,000 cases were diagnosed in 2000, with approximately 8,000 deaths. The most common premalignant oral lesion is leukoplakia, and the incidence of leukoplakic lesions undergoing malignant transformation rises sharply with age. Mortality rates for oral cancer also increase with age and are high compared with those of other cancers, with overall 5-year survival rates of only 50%. Typical sites of oral malignancy in elderly individuals include the tongue, lips, buccal mucosa, floor of mouth, and posterior oropharynx. The most common risk factors are increased age and the use of tobacco and alcohol. Approximately 90% of all oral cancers are squamous cell carcinomas, with the remaining 10% being salivary, bone, or lymphoid cancers. These lesions can appear as exophytic, poorly demarcated, and ulcerated, erythropsctic and/or leukoplakic masses that metastasize to regional lymph nodes before involving distant organs. Excellent information is provided in numerous texts and in Chapter 8.

Infectious Diseases

Due to numerous age- and disease-related changes in the oral and systemic immune systems, older adults are more susceptible to developing opportunistic oral infections. Viral, fungal, and bacterial organisms invade, infect, and become latent in...
The hard and soft tissues of the oropharyngeal region, predisposing the person to disseminated systemic infections.\(^7\)

The most common viral infections come from the herpes family (ie, herpes simplex virus [HSV] and varicella-zoster virus [VZV]). Initial infections typically occur in childhood; the viruses then remain dormant in sensory ganglia until reactivation occurs secondary to immunosuppression, trauma, stress, sunlight, gastrointestinal disturbances, or concurrent infections (see Chapter 4). The clinical presentation in an older adult will be similar to that in a younger person, but lesions may persist longer because of concomitant immunocompromising conditions. Shingles, a VZV infection, is an acute condition with very painful and frequently incapacitating oral-facial lesions (see Chapter 4). Its incidence exceeds 10 cases per 1,000 persons annually among adults aged 80 years and older, and it is most common in immunocompromised patients.\(^{104}\) The VZV infection is acquired from exposure to chickenpox during childhood. It is then reactivated, causing vesicular eruptions on the skin and mucous membranes in the areas that follow the unilateral distribution of ophthalmic, maxillary, or mandibular divisions of trigeminal sensory nerves. Postherpetic neuralgia has dangerous sequelae, including blindness, facial paralysis, auditory deficits, and vertigo.\(^{96}\) Postherpetic neuralgia occurs more frequently in older patients; more than 50% of zoster patients over 60 years of age will develop postherpetic neuralgia that may persist for months or even years.\(^{104}\)

The most frequent oral fungal infection in older adults is caused by *Candida albicans*.\(^{105}\) Several oral and systemic conditions in older adults lead to fungal proliferation and the subsequent development of infectious diseases. Removable dental prostheses (Figure 24-5), poor oral or denture hygiene, endocrine disorders (eg, diabetes), underlying immunosuppression, nutritional deficiencies, salivary gland hypofunction, and medications (eg, antibiotics, corticosteroids, immunosuppressants, and cytotoxic agents) have all been associated with oral fungal infections (see Chapter 5). The loss of vertical dimension, as well as drooling problems secondary to cerebrovascular accidents, creates a moist environment in the labial commissures that also favors yeast infection.

The bacteria that cause the most common infections are those associated with new and recurrent dental caries (*Streptococcus mutans*, *Lactobacillus*), periodontal diseases (*Porphyromonas gingivalis*, *Treponema denticola*), and acute and chronic salivary infections (*Staphylococcus aureus*, *Streptococcus viridans*).

### Dental Disorders

Root surface caries result from an age-related condition\(^50\) that develops on cementum following gingival recession (see Figure 24-2) or as an extension of existing coronal caries onto the root surface. Both new and recurrent root surface caries develop at the same rate.\(^{106}\) Since cementum is less mineralized than enamel, it is more susceptible to decay. These lesions appear as well-defined and discolored defects on cementum or at the cementum-enamel junction (Figure 24-6). The prevalence of untreated root surface caries has been reported as 22% in an older population,\(^{107}\) with an increased incidence in residents of facilities for long-term care.\(^{108}\) Individuals who have multiple medical conditions, who are taking numerous medications, and who are undergoing medical procedures are at risk.\(^{109}\) Other factors that predispose elderly individuals to root surface caries are a poor diet (with frequent sugar consumption), salivary gland hypofunction, insufficient fluoride exposure, gingival recession, oral-facial motor deficits, poor oral hygiene, and decreased access to regular dental treatment. A recent study also demonstrated that the presence of removable partial dentures are an independent risk factor for developing root surface caries in older adults.\(^{110}\) Root surface caries are a diagnostic and restorative challenge since they are frequently located on interproximal surfaces, may not be visible by intraoral radiography, and can extend into subgingival regions.

Coronal caries are also quite prevalent among older persons,\(^50\) and the risk factors are similar to those for root surface caries (with the exception of gingival recession). These enamel lesions present clinically as discolored defects on occlusal
and/or proximal tooth surfaces and range from soft to rubbery in texture. Although rapidly progressing decay is soft and can be painful, slowly developing long-standing lesions are typically harder (from remineralization) and are asymptomatic. As a tooth ages, deposition of secondary and reparative dentin occurs, which can aid in increasing caries resistance and in decreasing dental sensitivity.

A lifelong history of dental restorations places the older person at risk for developing recurrent coronal decay. Of the reported cases of coronal caries in one study of geriatric patients, 86% were recurrent lesions. Another study found that 31% of dentate individuals over the age of 70 years had clinically untreated coronal caries. Decay developing around furcation involvement, and tooth drifting and mobility lead to tooth loss if untreated. Significant attachment loss and/or proximal tooth surfaces and range from soft to rubbery in texture. Although rapidly progressing decay is soft and can be painful, slowly developing long-standing lesions are typically harder (from remineralization) and are asymptomatic. As a tooth ages, deposition of secondary and reparative dentin occurs, which can aid in increasing caries resistance and in decreasing dental sensitivity.

A lifelong history of dental restorations places the older person at risk for developing recurrent coronal decay. Of the reported cases of coronal caries in one study of geriatric patients, 86% were recurrent lesions. Another study found that 31% of dentate individuals over the age of 70 years had clinically untreated coronal caries. Decay developing around furcation involvement, and tooth drifting and mobility lead to tooth loss if untreated. Significant attachment loss and/or proximal tooth surfaces and range from soft to rubbery in texture. Although rapidly progressing decay is soft and can be painful, slowly developing long-standing lesions are typically harder (from remineralization) and are asymptomatic. As a tooth ages, deposition of secondary and reparative dentin occurs, which can aid in increasing caries resistance and in decreasing dental sensitivity.

Periodontal Diseases
With the increasing retention of the natural dentition, the number of teeth in older adults at risk of developing periodontal disease is growing. It is currently believed that only a small proportion of dentate older adults suffer from active advanced periodontal destruction. Conversely, gingivitis is much more likely to develop in older patients because of oral and systemic factors. Dental plaque, gingival bleeding, and calculus accumulations develop as a result of softer diets, reduced oral motor activity, and salivary gland hypofunction. Gingival recession, root caries, tooth furcation involvement, and tooth drifting and mobility increase the likelihood of developing gingivitis. Detriments in manual dexterity, vision, neuromuscular coordination, and physical, cognitive, and memory abilities (eg, as caused by arthritis, Parkinson’s disease, cerebrovascular accidents, and Alzheimer’s disease) can impair the daily performance of oral hygiene. Finally, older people (especially those living in extended-care institutions) are less likely to see dental professionals and therefore have a greater risk of developing gingivitis and periodontitis.

Medications and medical problems that are common among older adults have an adverse effect on periodontal health. For example, gingival hyperplasia has been associated with the use of phenytoin, cyclosporine, and calcium channel blockers. Diabetes, even when well controlled, is associated with rapid periodontal breakdown due to impaired leukocyte function, altered collagen metabolism, and microvascular changes. Oral mucocutaneous diseases such as erosive lichen planus and cicatricial pemphigoid will produce desquamative gingivitis.

The implications of age-related attachment loss and recession extend beyond periodontal concerns. Exposed cemental surfaces are more susceptible to root surface caries that can lead to tooth loss if untreated. Significant attachment loss and tooth mobility can cause tooth drifting and occlusal interferences. Finally, advanced periodontal diseases have been associated with non-oral diseases such as pneumonia, bacteremia, infective endocarditis, coronary heart disease, and brain abscesses, and they may interfere with the treatment of systemic diseases (eg, diabetes).

Salivary Gland Dysfunction
Salivary gland dysfunction in older persons can be a result of local and systemic disease, head and neck radiation treatment, chemotherapy, immunologic disorders, and prescription and nonprescription medications. Obstructions (due to mucous plugs or calcifications) and acute or chronic bacterial infections cause salivary dysfunction. Sjögren’s syndrome is an autoimmune disease that affects exocrine glands (salivary and lacrimal), predominantly in older females, and salivary dysfunction is a common sequela along with associated dry eyes and dry mouth. Other systemic conditions common in elderly people, such as Alzheimer’s disease, diabetes, and dehydration, have been implicated in salivary gland hypofunction. Finally, numerous prescription and nonprescription medications frequently taken by older persons cause salivary hypofunction. Many common drugs are antidepressants, antihypertensives, antiparkinsonian drugs, antipsychotics, and antihistamines, which have been reported to cause xerostomia and salivary dysfunction.

Extraoral manifestations of salivary gland dysfunction include candidiasis in the labial commissures and dry cracked lips (Figure 24-7). Parotid or submandibular gland enlargement with associated pain and suppuration may indicate infections or ducetal obstructions. The intraoral sequelae of insufficient salivary production are dental caries, gingivitis, materia alba, candidiasis, poorly fitting dentures, dysphagia, dysgeusia, and altered mastication and deglutition. These oral and pharyngeal problems can have serious consequences to an older adult. Impaired food and beverage intake can result in malnutrition and dehydration. Recurrent oral infections and impaired oral immunity can lead to aspiration pneumonia and systemic opportunistic infections.

Smell and Taste Dysfunction
The complaint of a smell or taste problem may be indicative of a chemosensory disorder, or it could be the manifestation

![FIGURE 24-7](image-url)
of an oral and/or systemic medical problem. For example, the sudden loss of either smell or taste may be a sign of a brain tumor. However, older subjects are more likely to have chemosensory complaints due to chronic and long-term problems. These patients may require a multidisciplinary approach to the diagnosis and treatment of the disorder.\textsuperscript{116,117} Since olfaction is more likely to undergo age-related decrements, compared to gustation, disorders that affect the sense of smell (such as sinus and respiratory diseases, head trauma, multiple systemic diseases, and disorders caused by medications) are more likely to adversely affect the sensation of flavor in an elderly person. Taste changes may be due to oral conditions (fungal infection, salivary hypofunction, gingivitis, halitosis, galvanism, poorly fitting prostheses, dentoalveolar abscess) and to systemic conditions (medications, medical problems, chemotherapy, radiotherapy) as well.

The most common medical conditions affecting smell and taste are neurologic (Alzheimer’s disease, Parkinson’s disease, multiple sclerosis), endocrine (diabetes), infectious (upper respiratory infection), and gastrointestinal (reflux, ulcers). These conditions and their treatment with multiple medications can impair the sensation of tastants and odorants. However, it is important to know that age-related losses in smell are gradual and are frequently undetected by the affected individual. Subjective changes in smell and/or taste may represent more than a “normal” aging phenomenon and require appropriate stomatologic and medical evaluation.

**Swallowing Disorders**

More than one-third of older adults in the general population complain of swallowing and esophageal problems,\textsuperscript{118} and the prevalence of such disorders is probably even greater among institutionalized adults and those receiving parenteral and enteral nutrition.\textsuperscript{119} Dysphagia in elderly persons can be caused by a variety of medical conditions; these include immunologic disorders (eg, arthritis, diabetes), neurologic or neuromuscular disorders (eg, Parkinson’s disease, stroke), and psychological disorders (eg, depression, dementia). Dysphagia in this population can also be caused by the environmental effects of certain conditions (eg, smoking, toxins) and by surgery (eg, for head and neck cancer).\textsuperscript{87–90,120,121} A common oral condition that is associated with dysphagia in elderly people is salivary gland dysfunction, which can decrease the transit time of the food bolus from the mouth into the esophagus.\textsuperscript{122} One study examined the influence of age and denture use on functional eating and swallowing and reported that denture use, not age, played the stronger role in impaired functional eating.\textsuperscript{123} Therefore, good oral and systemic health (as well as an intact dentition) probably play a strong role in preventing swallowing problems.

The most serious sequela of dysphagia is aspiration, particularly in a neurologically impaired person.\textsuperscript{120} An impaired or absent cough reflex is a strong indication that the airway cannot be protected even from oral and nasopharyngeal secretions. Oral motor weakness in the lips, tongue, and buccal mucosa are additional predictors of a poor swallow reflex. Lip weakness causes drooling from the lips, delaying the initiation of the oral phase of the swallow. Tongue weakness impairs the formation of a food bolus, and the food bolus then begins to drip down over the base of the tongue into the pharynx, pooling in the pharyngeal recesses. This is a frequent cause of aspiration after the swallow and can lead to pneumonia.

**Edentulousness**

A functional dentition plays an essential role in mastication, deglutition, phonation, facial aesthetics and expression, dietary selection, and the hedonic aspect of eating. Until recently, the loss of all teeth was considered a normal part of aging. With the increased retention of natural dentition by older adults,\textsuperscript{51} the traditional perception of an edentulous older person (with or without dentures) is now changing. Tooth loss is directly linked to dental caries and periodontal disease but may also be related to systemic conditions such as osteoporosis and diabetes mellitus. However, despite the decline in tooth loss over the last 30 years, the prevalence of edentulism among the elderly population is still quite high; about 30% of adults aged 65 years or more are completely edentulous.\textsuperscript{44}

Edentulous adults, even those with removable prostheses, have decreased masticatory forces and impaired chewing efficiency. Diminished oral motor function can induce masticatory muscle atrophy and deterioration of muscle contractile properties, further inhibiting chewing capability. Rapid alveolar bone resorption follows tooth loss and continues throughout life. In severe cases, alveolar ridge atrophy, especially in the mandible, can lead to significant problems in denture fabrication and retention and possibly to mandibular fracture. Furthermore, poorly fitting prostheses can accelerate the loss of alveolar bone.

**\textbullet\textsuperscript{PREVENTION AND TREATMENT OF ORAL CONDITIONS IN THE OLDER POPULATION**

**Oral Mucosal Diseases**

Prevention of oral cancer begins with the elimination of established risk factors (eg, the use of tobacco and alcohol). Early detection and recognition through regular comprehensive extra- and intraoral examinations in dentate and edentulous persons will enhance the prognosis and reduce the morbidity and mortality associated with cancer and its treatments.\textsuperscript{102} Oral cancer is treated by surgery, chemotherapy, and radiotherapy, which also have significant oral sequelae including stomatitis, dysphagia, dysgeusia, pain, paresthesias, facial disfigurement, oral motor dysfunction, salivary hypofunction, and an increased risk of developing osteoradionecrosis. Comprehensive dental management before, during, and after treatment is essential to prevent complications. Importantly, older edentulous individuals are four times less likely to see a dentist than are dentate individuals,\textsuperscript{124} and should therefore be targeted for regular annual examinations for head and neck cancer.\textsuperscript{125,126}
Treatment of traumatic oral lesions begins with the elimination of underlying factors. To this end, the most common measure is the repair of an ill-fitting denture flange/base or the removal of an epulis fissuratum. Palliative topical medications (analogesics) are helpful, and antibiotic coverage to prevent secondary bacterial infection should be considered for the immunocompromised patient. For most oral vesiculobullous and erosive diseases, therapy depends on the severity of the condition and may range from mild topical steroids and oral rinses to strong topical steroids to systemic steroids, with or without immunosuppressant agents. When high-dose steroids are considered, dentists should consult with the patient’s physicians, especially if the older patient has concurrent medical problems such as diabetes, coronary heart disease, hypertension, osteoporosis, or depression. Procedures and medications for the prevention and management of oral mucosal diseases in elderly people are summarized in Table 24-8.

**Infectious Diseases**

Prevention of the spread of viral lesions in elderly patients can be accomplished by their avoiding individuals who have active infections. Herpes simplex and zoster lesions are usually self-limiting. Supportive measures are necessary to maintain adequate nutritional and fluid intake and to diminish pain. However, early diagnosis can diminish morbidity in older patients. In particular, immunocompromised adults are susceptible to recurrent herpes infections and require immediate and aggressive antiviral treatment in such cases. Patients with renal insufficiency should receive adjusted antiviral doses (acyclovir, valacyclovir, famciclovir). The treatment of older patients who have postherpetic neuralgia requires analogesics, tricyclic antidepressants, and (sometimes) steroids.

Prevention of candidiasis involves meticulous oral and denture hygiene, the judicious use of antibiotics and immunosuppressants, and the elimination of underlying local and systemic etiologic factors (eg, salivary hypofunction, diabetes, or immunodeficiency). Comprehensive management of oral candidiasis with antifungal creams, rinses, and lozenges is usually successful, but persistent infections require systemic antifungal agents. Dentures are frequent sources of fungal infections and require antifungal therapy with a 10- to 15-minute 1% sodium hypochlorite soak and antifungal creams during use. The prevention and treatment of common oral bacterial infections (eg, dental caries, periodontal diseases, and salivary gland infections) are discussed below.

**Dental Disorders**

Dental caries in elderly persons can be prevented by the rigorous maintenance of oral hygiene, including brushing and flossing after each meal. The use of fluoride-containing dentifrices and rinses can aid in the remineralization of existing decay and in the prevention of new carious lesions. Lifelong exposure to fluoridated water has also been shown to diminish tooth loss and dental caries. Traditionally, fluoride was recommended for the prevention of coronal caries, but there is considerable evidence that fluorides are also effective

---

**TABLE 24-8 Prevention and Management of Oral Mucosal Diseases in Elderly Persons**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Prevention</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral cancer</td>
<td>Eliminate established risk factors. Ensure early detection and recognition.</td>
<td>Surgery; chemotherapy; radiation therapy</td>
</tr>
<tr>
<td>Traumatic lesions</td>
<td>Eliminate underlying factors.</td>
<td>Oral rinses</td>
</tr>
<tr>
<td></td>
<td>Viscous lidocaine HCL 2%</td>
<td>Dexamethasone elixir 0.5 mg/5 mL</td>
</tr>
<tr>
<td></td>
<td>Diphenhydramine elixir 12.5 mg/5 mL</td>
<td>Dyclonine HCL 1%</td>
</tr>
<tr>
<td></td>
<td>Dyclonine HCL 1%</td>
<td>Sucralfate</td>
</tr>
<tr>
<td></td>
<td>Pain control; oral hygiene; analgesics</td>
<td>Systemic medications</td>
</tr>
<tr>
<td></td>
<td>Penicillin VK tabs 500 mg qid</td>
<td>Amoxicillin tabs 500 mg qid</td>
</tr>
<tr>
<td></td>
<td>Erythromycin tabs 250 mg qid</td>
<td>erythromycin tabs 250 mg qid</td>
</tr>
<tr>
<td>Oral vesiculobullous and erosive</td>
<td>Avoid drug hypersensitivity, trauma, and allergies.</td>
<td>Topical medications</td>
</tr>
<tr>
<td>diseases</td>
<td></td>
<td>Flucinonide gel 0.05%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Triamcinolone acetonide gel 0.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clobetasol propionate gel 0.05%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oral rinses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dexamethasone elixir 0.5 mg/5 mL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diphenhydramine elixir 12.5 mg/5 mL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dyclonine HCL 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sucralfate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Systemic medications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prednisone 5 mg dose pak or maintenance dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Azathioprine 50 mg 1–2 tabs qd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nutritional supplements; fluid intake</td>
</tr>
</tbody>
</table>

HCL = hydrochloride; qd = every day; qid = four times per day; tabs = tablets.
in remineralizing carious dentin. The prevention and early treatment of dental caries requires regular dental visits for prophylaxis and examination. Since the bacterial acid production that causes tooth decay is precipitated by food intake, it is important to monitor the frequency of meals and snacking. Snacking on carbohydrate-rich foods and the consumption of sugar-containing beverages should be reduced.

The treatment of coronal and root surface dental caries has been facilitated by the development and perfection of numerous restorative materials. Enamel- and dentin-bonding techniques are helpful in restoring destroyed tooth morphology due to caries, abrasion, attrition, and erosion. Cosmetic dentistry has also made considerable advances that have implications for older adults. Conservative and esthetic restorative procedures have the potential to reverse the signs of dental aging, thereby making patients appear younger. Traditionally reserved for younger patients, cosmetic enhancement of teeth and smiles can now be used in many older individuals.

Salivary gland dysfunction is a common predisposing factor to dental caries, and early recognition and management is thus vital to avoiding extensive restorative procedures, den-toalveolar abscesses, and tooth extraction. Patients affected with medical conditions that are known to cause salivary hypofunction (eg, Sjögren’s syndrome, diabetes, head and neck irradiation, Alzheimer’s disease) must be monitored more closely for new and recurrent dental caries. Similarly, patients who are taking medications associated with salivary hypofunction (eg, antidepressants, antihypertensives, anti-psychotics) should be on a more frequent recall to dental professionals. The older patient with salivary hypofunction requires rigorous oral hygiene practices with the addition of supplemental fluoride gels and rinses.

Caries prevention in elderly residents of facilities and institutions for long-term care requires daily assistance from caregivers, depending on the level of dependency of the individual. An electric toothbrush can help patients with impaired manual dexterity and other motor disabilities maintain oral hygiene. Prescription fluoride gels (1.0 or 1.1% sodium fluoride or 0.4% stannous fluoride) and rinses and 0.12% chlorhexidine antimicrobial rinses are also extremely useful. Patients with arthritic deformities or minimal or no manual dexterity will benefit from the modification of toothbrush handles for easier manipulation.

Treatment of periodontal diseases in the elderly patient requires an assessment of the patient’s attitudes and expectations, previous dental and/or periodontal treatments, current oral health status, oral hygiene practices, medical conditions, medication use, physical and mental capacity, and level of caregiver support (if necessary). For most elderly patients, a nonsurgical approach with scaling and root planing and meticulous daily oral hygiene is indicated. Gingival recession, furcation involvement, and large embrasure spaces make periodontal treatment and maintenance more difficult in the older patient. Systemic antimicrobial therapy (eg, metronidazole, tetracycline, clindamycin) may be helpful, but the practitioner must ensure that these medications are not contraindicated (eg, by renal, liver, or gastrointestinal disorders). Older persons with local periodontal defects are also good candidates for the implantation of antimicrobial fibers and chips (eg, tetracycline, chlorhexidine gluconate). Advanced age is not a contraindication for periodontal surgery although certain systemic conditions (eg, congestive heart disease, diabetes) and medications (eg, anticoagulants, corticosteroids) may complicate surgical procedures. Nevertheless, the long-term results of nonsurgical and surgical periodontal therapy are similar in young and older persons, with plaque control being the key to success.

If the periodontal disease is believed to arise from the patient’s medical conditions and their treatment, then a systemic approach to oral health management is required. For example, stabilization of blood glucose levels in a patient with diabetes mellitus should be established prior to the initiation of extensive periodontal treatment. Drug-induced gingival hyperplasia (eg, from use of calcium channel blockers, cyclosporine, dilantin) frequently requires surgical reduction with concomitant plaque control and the consideration of substitute medication. Finally, periodontal therapy often requires concurrent dental treatment to eliminate comorbid factors (defective restorations, poorly fitting prostheses, caries) commonly found in older patients.

Salivary Gland Disorders

Disorders of the salivary glands require accurate diagnosis to initiate therapy and to avoid long-term oral and pharyngeal complications. Salivary gland infections require diagnostic culture and sensitivity tests and appropriate antibiotic therapy. Amoxicillin and clavulanic acid (clindamycin if the patient is allergic to penicillin) should be immediately prescribed and monitored until the culture and sensitivity report is received. Diagnosis and treatment of salivary gland obstructions may require imaging tests (radiography, sialography, technetium-99m-pertechnetate scanning) and subsequent removal of the obstruction. Systemic diseases (eg, Sjögren’s syndrome) should be identified, managed, and controlled. In medication-associated xerostomia, elimination or reduction
of the causative drug, in collaboration with the patient’s physician, is the ideal solution.\textsuperscript{114} However, if this cannot be achieved, the substitution of one xerostomia-causing medication with a similar drug that has fewer undesirable side effects or the alteration of medication dosing schedules should be considered. For patients receiving head and neck radiation therapy for oropharyngeal cancers, contralateral parotid gland preservation techniques are effective and can help diminish postirradiation xerostomia.\textsuperscript{136}

Patients with salivary hypofunction who have some remaining viable salivary parenchymal tissue will respond to salivary stimulants; these include sugarless candies, mints, and gums; nonsugared beverages, used frequently;\textsuperscript{73} cevimeline HCl (30 mg tid) and pilocarpine (5 to 7.5 mg three times daily [tid] and every night at bedtime [qhs])).\textsuperscript{137,138} Pilocarpine and cevimeline are contraindicated for patients with narrow-angle glaucoma, congestive heart disease, and pulmonary disease, and their major side effects are sweating and diarrhea. If there is little or no remaining viable salivary gland tissue, saliva substitutes\textsuperscript{139} and the frequent intake of nonsugared beverages are necessary. In dry climates, a humidifier may also help relieve xerostomic complaints. Finally, it is vital that precautions be taken to prevent the deleterious sequelae of salivary gland dysfunction. These precautions include frequent dental recall, daily use of fluorides, brushing and flossing after each meal, and rigorous prosthesis hygiene.

**Smell and Taste Dysfunction**

The primary step in treating smell and taste disturbances is identification of the etiology.\textsuperscript{117} A variety of oral problems can cause chemosensory alterations, including oral mucosal infections (eg, candidiasis), poorly fitting removable prostheses, periodontal and dental diseases, denture- alveolar infections, oral mucosal diseases (eg, pemphigus), and poor tongue hygiene. These underlying disorders should be managed, and their treatment may improve smell and/or taste function. Medications, chemotherapy, radiotherapy, and a myriad of systemic conditions can also cause chemosensory loss, and these should be monitored.\textsuperscript{80,83,140}

Unfortunately, many older people continue to suffer from chemosensory disorders despite thorough oral and medical evaluations. There are several ways to improve the smell, taste, and other sensory qualities of foods and beverages to prevent the development of subsequent nutritional deficiencies in these individuals. Improving the visual display of certain foods may be helpful. Flavor enhancers can counteract taste and smell deficits that can help in the maintenance of nutritional health.\textsuperscript{141} Foods and beverages that are salty or sweet or that stimulate the trigeminal nerve (eg, black or red pepper, carbonation) may add another dimension to the eating experience. However, the use of sweet and salty additives may be contraindicated for individuals with certain medical disorders such as diabetes and hypertension.

Older people may not recognize the olfactory decline that accompanies aging, yet they are capable of recognizing flavor improvements caused by odor fortification (eg, by the use of additional herbs and spices). Therefore, patients with chemosensory deficits should be encouraged to use herbs and spices that will augment flavor perception without adding unnecessary calories, fats, sugars, or salts. Finally, eating in a social atmosphere can draw a person’s attention away from food flavor and can enhance the enjoyment of a meal.

**Masticatory and Swallowing Disorders**

Many older individuals experience eating and swallowing disorders that could cause nutritional impairments such as dehydration and malnutrition. Therefore, masticatory and swallowing problems must be diagnosed, treated by appropriate specialists, and followed to ensure adequate stabilization. As previously discussed, the status of the dentition may have a direct influence on mastication. Therefore, dental and periodontal problems should be eradicated, and functionally stable removable prostheses should be constructed. While adequate nutrition can be maintained in an edentate adult, most individuals benefit functionally, aesthetically, and socially from adequately fitting dentures. Salivary dysfunction can alter denture use; therefore, treatment of salivary hypofunction in the denture-wearing older adult will also help improve mastication.

Masticatory deficiencies are likely to be managed by dental professionals, but the management of dysphagia may require a combination of dental and medical health care providers.\textsuperscript{142,143} If salivary hypofunction is suspected, diagnosis and treatment must be initiated. Increasing the patient’s salivary function immediately before or during mealtime (eg, with additional fluids or with 5 mg of pilocarpine or 30 mg of cevimeline HCl given 30 minutes before mealtime) may be effective. Older adults should be reminded to eat and swallow carefully and to avoid large ingestions of foods and fluids. Additional time spent sipping fluids between bites of food will aid in swallowing, especially with dry foods. Intubation and artificial nutrition may be required in some institutionalized older adults due to the high risk of developing dysphagia and aspiration.

**Edentulousness**

Removable dental prostheses are a poor substitute for the natural dentition; therefore, prevention of total tooth loss is recommended for people of any age. The prevention and early treatment of dental caries and periodontal diseases and the maintenance of daily oral hygiene and regular professional care require lifelong effort.

There is some evidence to support a relationship between osteoporosis and osteopenia with alveolar bone resorption and tooth loss.\textsuperscript{61–63} Furthermore, it has been suggested that the medical treatment of osteoporosis with estrogen supplements will help prevent tooth loss and will delay the atrophy of the mandibular and maxillary ridges.\textsuperscript{64} One study demonstrated that postmenopausal women with periodontally healthy dentition had greater bone mineral density than edentulous women.\textsuperscript{144} It was concluded that sufficient masticatory function in dentate older women could possibly inhibit or delay the progress of osteoporotic change in skeletal bone or that edentulous women might be more susceptible to osteoporosis.\textsuperscript{144}
In summary, there may be significant relationships between the systemic and oral manifestations of bone loss, and strategies to maintain or increase skeletal bone may prove useful in the retention of natural dentition and alveolar bone.

The fabrication of removable prostheses (when retention of natural dentition is not possible) requires thorough attention to retention, occlusion, aesthetics, and the extension of peripheral margins. Regular assessment of dentures, denture-bearing ridges, and all mucosal surfaces is required to reduce the risk of developing denture stomatitis, traumatic ulcerations, angular cheilitis, hyperplastic or granulomatous tissue reactions, and (ultimately) alveolar atrophy. Denture adjustments and/or relines are may be necessary at regular intervals for the lifetime of the patient.

Endosseous dentoalveolar implants for partially or completely edentulous adults have achieved remarkable success in the past several decades and can be included in the treatment plan of most older persons. Patients who have undergone surgery and radiotherapy for oral cancers have been reported to have 5-year survival rates of 90% for oral implants. Exceptions for implant use are (1) severely medically compromised and immunosuppressed patients and (2) individuals with severely atrophic edentulous ridges (although bony ridge augmentation can be considered).

Finally, there are additional issues pertinent to the edentulous older adult that are frequently neglected. Annual examinations for head, neck, and oral cancer screenings are required for older adults and are currently recommended by the American Cancer Society. As mentioned previously, many older adults have salivary hypofunction that can predispose to poorly fitting dentures and denture stomatitis. Efforts to increase salivary output may enhance denture retention. Lastly, in institutional settings, identification markings should be placed on each denture to avoid their misplacement.

▼ SUMMARY

Older adults are the most rapidly growing segment of the population. In the absence of major medical problems and interventions, aging is associated with few dramatic and deleterious consequences to the health and function of the oral cavity. However, oral and systemic diseases concurrently interact to produce a myriad of oropharyngeal disorders. Many older persons will thus experience oral mucosal, dental, periodontal, and alveolar diseases and chemosensory, masticatory, salivary, and swallowing disorders. Most of these problems can be treated to diminish morbidity and mortality in this population. Therefore, health care practitioners must be able to identify, manage, and prevent these problems in order to enhance the quality of life of older adults.

▼ REFERENCES


