

The Importance of Oral Health in the Older Patient

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Oral health is important to general health because stomatologic disease affects more than the mouth. Increasing preservation of teeth among present and future cohorts of older people has increased their risk for serious disease from oral pathogens. The intent of this paper is twofold: first, to alert non-dental health personnel to the significance of oral health and oral disease in the older adult; and second, to recruit the assistance of non-dental professionals in helping patients to achieve and maintain an optimal oral condition. Normative aging processes alone have little effect on the oral cavity, but common disease processes affecting oral health include tooth loss, dental caries, periodontal diseases, and oral mucosal diseases (including candidiasis and squamous cell carcinoma). Systemic diseases and their treatments frequently affect salivary, oral motor, and oral sensory functions. As a result of bacteremia or aspiration of oral contents, organisms of oral origin can be responsible for serious nonstomatological infections. Clinicians caring for older people need to recognize the importance of stomatological health, include an oral component in the multidisciplinary geriatric assessment, support the education of patients on aspects of dental health, and advocate the expansion of personal and public oral health benefits for older adults. *J Am Geriatr Soc* 43:1414–1422, 1995.

Three essential physiological tasks are undertaken by the oral cavity: initiation of alimentation, production of speech, and host protection. Intake of nutrients is begun by chewing and mixing the food with saliva and then manipulating that combination into a bolus, transporting it to the pharynx, and initiating the swallowing process. Speech depends on delicate and precise positioning of teeth, lips, cheeks, and tongue; many nonverbal components of interpersonal communication revolve around the mouth and lower face as well. Finally, the airway and alimentary canal are protected by salivary secretions, as well as by proper functioning of the swallowing mechanism. These activities are important at all ages, but particularly in older people, who may be predisposed to malnutrition, whose social contacts take on growing importance, and whose susceptibility to infection is of particular concern.¹

Unfortunately, the health of the oral cavity and its ability to fulfill its functions is commonly impaired in older adults.² Age alone does not seem to play a strong role in the impairments.³ Rather, loss of one or more teeth as a result of disease can predispose to further tooth loss,⁴ destruction of alveolar bone,⁵ dependence on and compromised function of prosthetic replacements,⁶ and mucosal disease.⁷ The principal processes responsible for tooth loss—dental caries and periodontal diseases—also lead to sensitivity, pain, and impaired chewing and speaking ability. Lesions of the soft tissues of the mouth can interfere with mastication and oral motor function and can affect nutritional status.⁸ In extreme cases, such as squamous cell carcinoma, extreme morbidity and even mortality follow.⁹ Many of the key protective mechanisms of the oral cavity are compromised when saliva is altered or diminished by medications, irradiation, or disease.¹⁰ Furthermore, oral motor¹¹ and oral sensory dysfunctions are associated with salivary gland dysfunction as well as with medical conditions and therapies prevalent in old age.¹²

The effects of stomatological diseases are not limited to the oral cavity and its functions. Oral diseases give rise to pathogens, which can be blood borne¹³ or aspirated into the lungs,¹⁴ bringing about severe, even life-threatening consequences. Today's older adult is much more likely to have natural teeth compared with previous aged cohorts¹⁵ (Figure 1). Thus, older persons are currently at higher risk of developing serious dentally derived systemic disease than were earlier cohorts of elders.

Preserving oral health and avoiding stomatologic diseases should, therefore, be of interest to all health providers who care for older persons. The intent of this paper is, first, to alert non-dental health personnel to the significance of oral health and oral disease in the older adult. Second, it seeks to

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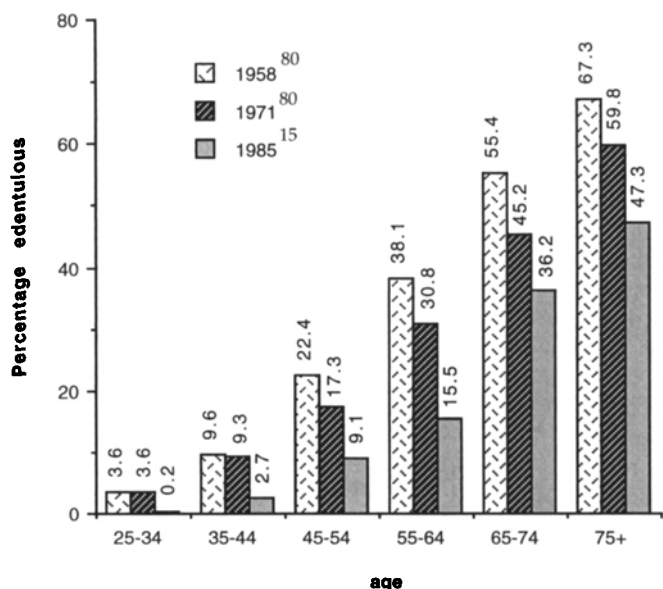


Figure 1. Edentulousness in the US adult population by age group, 1958, 1971, and 1985.

recruit the assistance of non-dental professionals in helping patients to achieve and maintain an optimal oral condition.

ORAL HEALTH AND ORAL DISEASE

Many specialized tissues have evolved in the mouth to fulfill functions related to nutrition, communication, and host protection (Table 1). Whereas some of these tissues undergo age-related changes, others can remain remarkably intact in healthy, older individuals.³ Impairment in any of these tissues can, of course, bring about oral problems; to describe the contributions of these problems to systemic diseases is one of the goals of this paper.

Tooth Loss

The loss of teeth, an irreversible and cumulative process, has long been associated with aging. Yet the major portion of tooth loss is attributable to two preventable diseases: dental caries and periodontal diseases.¹⁶ The 1985 National Institute of Dental Research (NIDR) National Survey of Oral Health in US Adults reported that more than 41% of Americans older than age 65 were edentulous (total absence of teeth) and that those older than 65 who retained one or more

teeth had an average of 11 missing teeth.¹⁵ However, the prevalence of edentulous adults has dramatically decreased since the first National Health Survey in 1957-58¹⁷ (Figure 1), and projections indicate that this trend will continue as older people retain more teeth than previous cohorts. This retention of teeth into advanced age is the result of greater retention earlier in life, advances in dental treatment and disease prevention, improved self-care behaviors, increased availability of dental care, and growing awareness of dental needs.¹⁸

Missing teeth can have profound effects on both oral and systemic health. Uncompensated tooth loss results in tipping and supereruption of other teeth, leading to food impaction, predisposition to dental and periodontal diseases (see below), impaired chewing, and further tooth loss.⁴ Partial or complete edentulism disturbs the preparation of food for deglutition¹⁹; food selection can be altered, leading to a softer, carbohydrate-rich diet lacking in fiber and protein.^{20,21} A recent population-based sample of older people found that edentulousness was correlated with lower nutrient intakes and multiple dietary inadequacies, and edentulous individuals were more likely to have an atherogenic diet.²² In the absence of teeth (with or without dentures), the discrimination of food particles using textural and tactile perceptions may become impaired,²³ and this could alter swallowing and predispose an individual to aspiration episodes.²⁴

The quality of a person's life can be dramatically affected by edentulism, even when replacement prostheses are worn. Partial and complete dentures are imperfect replacements for teeth and periodontal ligaments; chewing, swallowing, speaking, facial aesthetics, and social interactions are all potentially affected.⁶ This is particularly true for individuals who have been without teeth for a prolonged time because loss of alveolar bone in the edentulous jaws continues even decades after the removal of natural teeth.⁵ The resulting advanced alveolar ridge resorption is associated with diminished denture stability and retention, difficulties tolerating prostheses, limited bite force, and compromised facial esthetics.⁶

Dental Caries

Caries are classified depending on which surfaces of the tooth have been affected (Figure 2). Coronal caries occurs when the enamel and dentin of the coronal portion (the crown) of the tooth are affected. Dentate older adults are susceptible to coronal caries caused both by recurrent decay

Table 1. Oral Tissues and Their Functions

Oral Tissue	Function
Teeth	Mastication, bone regeneration
Periodontium	Mastication, bone regeneration, host defense
Salivary glands	Lubrication, oral mucosal repair, antimicrobial activity, remineralization of teeth, mediation of taste
Taste buds	Taste, host defense
Oral mucosa	Host defense, mastication, swallowing, speech
Muscles of mastication and facial expression	Mastication, swallowing, speech, posture

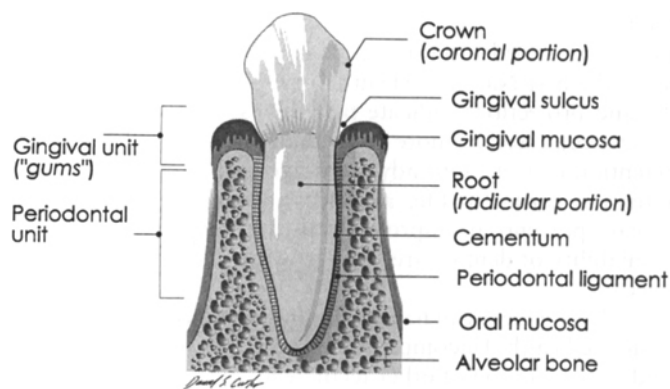


Figure 2. Schematic of dental and periodontal anatomic terms used in the text.

around existing restorations (fillings, crowns, etc.), and by new-onset decay of the coronal portion of the teeth.²⁵ Root surface or "cervical" caries may occur when active or prior periodontal disease (see below) has caused the root surfaces of the tooth to become exposed to the oral environment. Root surface caries increases dramatically with age because of greater prevalence and severity of such periodontal conditions in older persons.^{15,26}

The principal (though by no means the only) microorganism causing coronal caries in humans is *Streptococcus mutans*.²⁷ Oral streptococci, actinomycetes, and lactobacilli are organisms commonly associated with cervical lesions.²⁸ Caries-causing bacteria reside on the tooth surface in an adherent microbial colony (dental plaque). In the presence of sucrose and other simple sugars, bacteria of the plaque produce lactic acid, resulting initially in demineralization of tooth mineral and eventually in irreversible destruction of tooth structure.²⁷ 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,²⁹ possibly because they are more likely to have gingival recession, diminished salivary gland function (see below), disturbances in oral motor function, and difficulty performing oral hygiene.³ Since these factors are directly associated with dental caries, older patients are more likely to develop new and recurrent tooth decay.

Adult tooth surfaces can become resistant to decalcification and decay through repeated exposure to fluoride in water supplies, toothpaste, rinses, and gels. Yet even resistant tooth surfaces can become carious when oral hygiene is inadequate and there are dietary sources of fermentable carbohydrate.²⁷ When detected early, caries can be debried from a tooth and the missing tooth structure restored with a wear-resistant, insoluble dental material (e.g., silver amalgam, composite resin).³⁰ Untreated dental caries, however, will in most circumstances progress to severe or even total loss of tooth structure, and possibly pain, abscess formation, cellulitis, and bacteremia.

Periodontal Diseases

The periodontium consists of those tissues that invest and support the tooth (see Figure 2). Dental plaque is considered to be the principal source of pathogenic organisms in periodontal diseases.³¹ Gingivitis occurs when bacterial by-products and irritation cause inflammation of the gingival

unit. Under certain host-mediated conditions, the microbial species or their byproducts cross the gingival epithelium and enter subepithelial tissues, where specific host-defense mechanisms and osteoclastic activity are initiated. This state, periodontitis, eventually results in tissue destruction, including bone loss and tooth mobility. The loss of the connective tissue attachment between cementum and bone is termed attachment loss. In the dominant form of periodontitis, termed "chronic adult periodontitis," repeated, brief periods of periodontal destruction throughout adulthood are interspersed with intervals absent from inflammation, resulting in a net loss of attachment that increases with time.

Periodontal diseases and their most serious result, attachment loss, are among the most prevalent of all diseases known to humans. With increased age, some gingival recession and loss of periodontal attachment and bony support are essentially universal: nearly 95% of dentate Americans over the age of 65 years have measurable attachment loss.¹⁵ Yet changes in the periodontium attributed solely to age are not sufficient to lead to tooth loss.^{32,33} However, because multiple oral factors, systemic diseases, and medications have an adverse influence on periodontal health, and because these conditions are more prevalent among older adults, they are at a greater risk for experiencing morbidity as a result of periodontal diseases.

For example, studies implicate diabetes as a risk factor for developing periodontal disease,³⁴ and adult subjects with diabetes mellitus have a higher prevalence and severity of periodontal disease than age-matched healthy controls. Several classes of medications frequently prescribed in older people have been associated with gingival overgrowth or gingival hyperplasia, a condition that left untreated predisposes to both caries and destructive periodontitis.³⁵ The family of calcium channel blockers, including diltiazem, verapamil, nifedipine, felodipine, nitrendipine, and oxodipine, can cause this unwanted drug side effect, which may require resective periodontal surgery for definitive treatment. The antiseizure medication phenytoin and the immunosuppressant cyclosporin have also been associated with severe cases of this condition.³⁶

Periodontal diseases have oral and systemic effects on health. They are directly associated with halitosis, gingival bleeding, tooth mobility, and tooth loss. These outcomes can adversely affect food choice, mastication, swallowing, interpersonal relationships, and ultimately the nutritional intake of an individual.³⁷ Untreated periodontitis, a chronic infection, may interfere with blood glucose control in diabetic patients.³⁸ Recent epidemiologic studies report significant correlation between cardiovascular disease and periodontitis after controlling for such traditional risk factors as weight, gender, tobacco use, age, and blood lipid levels.³⁹ Gram-negative bacteria are implicated in the pathogenesis of periodontal disease,³¹ and colonization of the oropharynx with Gram-negative bacilli predisposes to Gram-negative bacillary pneumonia.¹⁴ These and other periodontal pathogens have also been associated with bacteremia,⁴⁰ infective endocarditis, and brain abscess.⁴¹

Oral Mucosal Diseases

In health, the mucosal tissues of the oral cavity contain the food bolus, control the flow of air in speech production, and serve as an important barrier against microbial invasion of the host. The mucosal tissues also provide the brain with

the dominant share of afferent tactile and thermal input from the mouth. For these reasons, diseases of the oral mucosa can be seriously debilitating and disruptive.

The oral mucosa is a common site for vesiculobullous, desquamative, ulcerative, and lichenoid lesions. Pemphigus vulgaris, cicatricial and bullous pemphigoid, lichen planus, recurrent aphthous stomatitis, Herpes simplex and Herpes zoster may present with painful oral and perioral lesions.⁸ Many medications prescribed for older patients can induce intraoral mucosal reactions.⁴² Cytotoxic antineoplastic agents commonly cause oral sloughing and subsequent painful bacterial and fungal colonization. Oral ulcerations are reported side effects of furosemide, hydrochlorothiazide, triamterene, and spironolactone, as well as of the β -blockers propranolol, metoprolol, atenolol, and timolol. Stomatitis has been reported by patients on cholestyramine, piroxicam, and desipramine. Prazosin and clonidine can both be responsible for reactions similar to oral lichen planus. The ACE-inhibitors captopril, lisinopril, and enalapril have all been associated with glossitis, and doxepine with aphthous stomatitis.

Candida albicans and (less commonly) *C. glabrata* are commensal fungi of the oral cavity that may become focally or systemically pathogenic under certain conditions. These conditions may include use of inadequately cleaned and/or ill-fitting dentures, suppression of normal oral flora as a result of broad-spectrum antibiotic use, impaired salivary flow (resulting in lowered oral pH and absence of fungistatic salivary histatins), use of corticosteroid inhalers, and immunocompromising conditions (e.g., diabetes, leukemias, AIDS).⁴³ Tingling, burning pain, and taste disturbance may be reported. Oropharyngeal candidiasis is highly prevalent in older people, particularly in denture-wearing and institutionalized older adults. Budzt-Jørgensen diagnosed the condition in more than 65% of denture-wearing community-dwelling older people,⁴⁴ and rates as high as 68 to 88% have been reported in institutionalized older populations.^{45,46} Although the disease is often asymptomatic, it is a pathological condition, and its presence signals the need to rule out potentially serious underlying causes.

More than 95% of oral malignancies are squamous cell carcinoma. Three out of four cases of oral-pharyngeal cancer occur in individuals 50 years of age and over.⁹ More than 28,000 new cases of oral cancer and about 8400 deaths caused by it are estimated in the United States for 1995, accounting for approximately 3% of cancer diagnoses (and 2% of cancer deaths) in males and 2% of cancer diagnoses (1% of cancer deaths) in females. Oral cancer is more prevalent than leukemia or malignancy of the stomach, cervix, esophagus, pancreas, liver, thyroid, brain, and ovary.⁴⁷ The major risk factors associated with oral cancer are advanced age, male gender, previous oral malignancy, use of tobacco and alcohol, and exposure to sunlight (for cancer of the lip). When diagnosed before lymph node involvement has occurred, management results in limited morbidity and impairment, and 5-year survival rates range from 50% (for tongue) to 95% (for lip).⁹ With nodal and metastatic spread, survival drops precipitously, and the morbidity associated with treatment (e.g., surgical resection, irradiation, and cytotoxic chemotherapy) becomes pronounced, often involving disfigurement, speech impediment, salivary gland hypofunction, and osteomyelitis. For high-risk older patients (e.g., smokers and

heavy drinkers), early detection through annual oral examination is imperative.⁴⁸

Salivary Function and Dysfunction

There are three major pairs of salivary glands (parotid, submandibular, sublingual) and several groups of minor glands (e.g., labial, palatal, buccal) whose principal function is the exocrine production of saliva. In health, saliva contains many constituents that are critical to the maintenance of oral health, including those involved in lubrication of the oral mucosa, in remineralization of teeth, and in protection against viral, bacterial, and fungal infections.¹⁰

Recent studies have revealed that in healthy older adults there is no general diminution in the volume of saliva produced.⁴⁹ Furthermore, there appear to be no significant alterations in the composition of saliva in older persons.⁵⁰ However, many older persons complain of a dry mouth (xerostomia) and have decreased salivary output. These problems are most likely caused by systemic diseases and their treatments rather than by the normal sequelae of aging.⁵¹ For example, many medications taken by older persons reduce or alter salivary gland performance. These include anticholinergic, antihypertensive, anxiolytic, antidepressant, diuretic, and antihistaminic preparations. Additionally, common forms of oncological therapy, such as radiation for neoplasms of the head and neck and cytotoxic chemotherapy, can have deleterious effects on salivary glands. The single most common disease specifically affecting salivary glands is Sjögren's syndrome, an autoimmune exocrinopathy occurring mainly in postmenopausal women.

All of the major physiological roles for saliva in the oral cavity can be adversely affected by its hyposalivation, regardless of etiology.⁵² With salivary gland dysfunction, increased dental caries will ensue rapidly because of the loss of the antimicrobial, buffering, and diluting properties of saliva. The greater adherence of plaque in the absence of adequate saliva creates an increased risk of developing periodontal diseases. The oral mucosa becomes desiccated and cracked, leaving the host more susceptible to microbial infection. Salivary gland dysfunction can also lead to difficulty in swallowing or speaking, pain (which may arise from either the teeth or the oral soft tissues), and diminished enjoyment of food. Finally, there is evidence that the lack of saliva may increase the risk of aspiration pneumonia (see below) and cause esophageal and gastrointestinal problems.^{53,54}

Oral Motor Function

The oral motor apparatus is involved in several routine yet intricate functions (see Table 1). Regulation of these activities may occur at three levels: the local neuromuscular unit, central neuronal pathways, and systemic influences. Furthermore, studies of oral motor function have shown that some alterations in performance (mastication, swallowing, oral muscular posture, and tone) can be expected with increasing age.^{11,24,55,56} The most often 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 younger individuals.^{19,24} This altered masticatory ability in older age can be exacerbated further among individuals with partial or total edentulousness, teeth rendered mobile or painful by periodontal diseases, and decreased salivary output.

Following mastication, the food bolus is translocated to the pharynx. This oral phase of swallowing requires well coordinated neuromuscular processing, an intact mucosal barrier, and adequate saliva production. Alterations in any of these components can disturb deglutition^{57,58} and reduce nutritional intake.⁵⁵ Although the oral phase of swallowing undergoes only subtle changes with increased age, under unusual or stressful conditions these perturbations can place older persons (especially those with dentures) at some risk of choking or aspiration.

Oral motor function also contributes to the production of speech, which undergoes changes with age. Specifically, there are alterations in tongue shape and function during production of specific speech sounds⁵⁷ and variability in frequency of speech patterns.⁵⁹ However, among healthy older persons, these changes do not compromise or alter speech in any perceptible way.⁵⁷ There are also age-associated alterations in intraoral and maxillofacial posture. Many older persons suffer from drooping of the lower face and lips and experience some difficulty with closing the lips competently while eating, drinking, or swallowing. Drooling in an older person may also be caused by reduced circumoral muscle tone and/or delayed swallowing. More commonly, exacerbations of these oral motor states are caused by systemic diseases (e.g., cerebrovascular accidents and Parkinson's disease) and therapeutic drug regimens (e.g., the association of tardive dyskinesia with phenothiazine therapy).⁶⁰

Sensory Function

Many older adults complain of diminished food recognition and enjoyment, as well as altered smell and taste function. Perturbations in taste and smell or other oral sensory modalities (temperature, viscosity, pressure) may occur with increased age⁶¹ and reduce the rewards of eating, thus contributing to a diminished interest in food.

Recent studies have objectively evaluated gustatory function in generally healthy persons of different ages, and have found no overall decremental changes.⁶² Conversely, objective studies of olfaction reveal dramatic age-related changes.⁶³ 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.⁶² It appears that chemosensory functions of older individuals are compromised by diminished olfactory performance, which can lead to a diminished interest in food. Furthermore, because sensory function plays an important role in warning the host of fire, natural gas, toxic vapors, and spoiled foodstuffs, older people may be at increased risk for failing to detect these potentially hazardous materials.

While older age has been associated with oral sensory problems, many oral and systemic conditions have been linked more strongly to chemosensory dysfunction.¹² Dental/alveolar abscesses, salivary gland dysfunction, periodontal diseases, oral candidiasis, and the utilization of removable dental prostheses can cause taste and smell problems. In addition, multiple systemic diseases (e.g., Alzheimer's disease and Parkinson's disease), medications (e.g., captopril and ferrous sulfate), and oncological therapies (e.g., head and neck irradiation and cytotoxic chemotherapy) can cause chemosensory disorders.^{64,65}

There are significant oral and systemic sequelae of taste and smell problems, including nutritional deficits,⁶⁶ and in-

dividuals with these problems suffer from a diminished quality of life. Because oral diseases in older people have been associated with nutritional deficiencies,²² it is likely that chemosensory dysfunction will increase the risk of an older person developing a significant nutritional disorder.

SYSTEMIC EFFECTS OF ORAL BACTERIA

The oral cavity supports a diverse microbiota. Microenvironmental niches such as the buccal mucosa, tongue dorsum, gingival sulcus, and the teeth each support their own microbiological communities in health^{41,67} (Table 2). In the presence of oral disease and in association with fixed and removable prosthetic devices, additional microenvironments may be present. The composition of the bacterial colonies of the teeth and gingival sulcus in particular are dynamic and reflect the combined influences of host defense, oral hygiene, and the presence or absence of dental and periodontal diseases.⁴¹ The pathogenic impact of oral bacteria is generally restricted to the mouth and perioral structures by host-protective mechanisms such as epithelial barriers, specific and nonspecific antimicrobial properties of saliva (e.g., immunological and nonimmunological aggregating factors, lysozyme, lactoferrin, and salivary peroxidase),¹⁰ and the surveillance of the immune system. But dental and periodontal bacteria spread by bacteremia or aspiration can be the source of life threatening diseases. For this reason, the aforementioned trend for increased tooth retention in advanced age should be viewed as a sign of improved health that nevertheless carries its own set of risks.

Bacteremia of oral origin is readily induced by manipulation of teeth or gingiva, such as tooth extraction, periodontal scaling, flossing, and tooth brushing.^{40,68,69} Even chewing can result in cultivable blood-borne oral bacteria in the host with gingival and/or periodontal inflammation.⁴⁰ Bacteremia of oral origin may be of little acute significance in the healthy host. But for many older adults, the use of implanted devices, cardiac flow abnormalities, and/or increased susceptibility to infection make the potential consequences of bacteremia particularly dire.⁷⁰ The American Heart Association has published recommendations for antibiotic prophylaxis before many dental procedures performed on patients with certain cardiac conditions and valve replacements.⁷¹ The need for similar preventive approaches to patients with other conditions is less well supported. For instance, more than 119,000 total hip arthroplasties are placed annually in the United States,⁷² and orthopedists strongly favor the use of prophylactic antibiotics before dental treatment for patients with these implanted devices.⁷³ Nevertheless, clinical and experimental data have not established whether such measures are indicated, or, if so, what agent and dosage schedule is optimal.⁷⁴ There is even less information regarding the management of patients with venous catheters, ventricular shunts, or organ transplants.

Aspiration of oral secretions and their bacteria is increasingly being recognized as an important factor in pneumonia. Normative decrements in swallowing function¹¹ and age-prevalent diseases that cause dysphagia (e.g., stroke, Parkinson's disease, and Alzheimer's disease) predispose to repeated aspiration of oral contents. As stated previously, bacteria implicated in the pathogenesis of periodontal disease can colonize the oropharynx with Gram-negative bacilli. Further, salivary gland hypofunction places an individual at increased

Table 2. Common Oral Bacteria, Associated Oral and Non-oral Pathoses, and Oral Distribution^{41, 67}

Organism	Oral Pathosis	Non-oral Pathosis	Relative Distribution in Different Sites of the Oral Cavity*
Facultative, Gram (+) cocci			
<i>Streptococcus salivarius</i>			T = S > B
<i>S. mitis</i>			B > S > P > T = G
<i>S. sanguis</i>			P > B > S = G > T
<i>S. mutans</i>	coronal caries		P > S
<i>S. faecalis (Enterococcus)</i>	dental abscess	infective endocarditis	G
<i>S. milleri</i>	dental abscess	infective endocarditis	G > T = S
<i>S. pyogenes</i>	dental abscess	pharyngitis, rheumatic fever, glomerulonephritis	P
Anaerobic, Gram (+) cocci			
<i>Peptostreptococcus</i> species	pulpitis	lung abscess, brain abscess	P = S > G > T
Facultative, Gram (-) cocci			
<i>Neisseria</i> species			T = B = S
Anaerobic Gram (-) cocci			
<i>Veillonella</i> species			T > G = S > P = B
Facultative Gram (+) rods			
<i>Lactobacillus</i> species	root caries	pleuropulmonary infection (rare)	P > S
Anaerobic, Gram (-) rods			
<i>Bacteroides</i> species	periodontitis, gingivitis	pneumonia, infective endocarditis	G > P = T
<i>Vibrio sputorum</i>	ulcerative gingivitis	bacteremia and sequelae; upper respiratory infection	
<i>Fusobacterium</i>			
Facultative, Gram (-) rods			
<i>Haemophilus parainfluenza</i>		upper respiratory infection	T = S > G
<i>Actinobacillus actinomycetemcomitans</i>	juvenile periodontitis		G
Filaments, Gram (+)			
<i>Actinomyces</i>	root caries	cervicofacial and thoracic actinomycosis; bacteremia and sequelae; brain abscess	P > G > T > S
<i>Clostridium</i> species	orofacial infection following trauma		
Spirochetes: <i>Treponema</i>	acute necrotizing ulcerative gingivitis, periodontitis		G

* G = gingival sulcus; P = coronal plaque; T = tongue dorsum; B = buccal mucosa; S = saliva.

risk for oropharyngeal Gram-negative colonization,⁷⁵ which can result in bacillary pneumonia.¹⁴

THE NON-DENTIST'S CONTRIBUTION TO THE OLDER PATIENT'S ORAL HEALTH

Oral health is inextricably linked to the overall health of the older patient because stomatologic diseases have consequences that extend beyond the confines of the mouth. Moreover, many stomatologic conditions in older people are caused or worsened by systemic diseases and their treatments rather than by the aging process alone. Therefore, the health care provider who diagnoses and treats older patients' medical conditions should strive to identify individuals at risk for developing oral problems and collaborate with oral health

specialists to treat and prevent oral disease. Patients of all ages report more physician visits per year than dental visits, and this difference increases with increasing age^{76,77} (Figure 3). Inasmuch as most oral diseases are preventable and treatable, physicians and nurses caring for older patients need either to recruit dental expertise routinely as part of their overall assessment or to familiarize themselves with the appearance of oral health and diseases states.⁷⁸ Dentists should refer patients to physicians for previously undiscovered or inadequately controlled medical problems such as diabetes, hypertension, and cardiovascular disease, and often need to draw on medical expertise in order to provide dental treatment at minimal risk to the patient. Similarly, patient well-being is also optimized when non-dentists detect oral disease

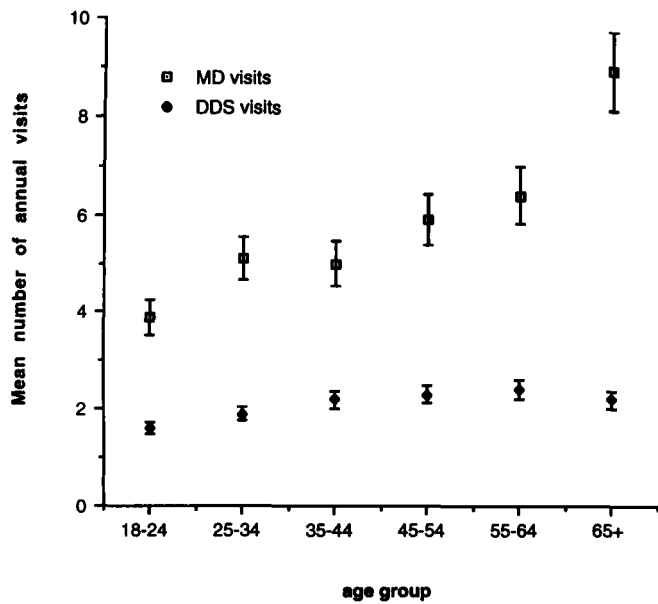


Figure 3. Relationship between age group and mean number of annual patient visits to physician and to dentists, based on the 1989 National Health Interview Survey.^{76,77} Error bars reflect maximum calculated estimates of standard errors of the mean for each age group. Analysis of variance demonstrates statistically significant increase ($P = .0007$) in the difference between number of physician visits and dentist visits as a function of age.

and recommend attention to preventive and interventional treatment.

Clinicians need to take into account the significance of oral side effects of drugs prescribed for non-oral conditions. Painful mucositis can impair nutritional intake and undermine the patient's ability to complete a course of chemotherapy. Medications that interfere with oral health by contributing to salivary hypofunction or gingival hyperplasia signal a need to consider a different therapeutic regimen. In cases where an alternative is not feasible, prescription of such agents should be accompanied by a referral to a dentist to mitigate the oral impact of the drug.

Although it is important that geriatric health providers recognize the relationships between oral and systemic health, that knowledge alone will not be sufficient to improve oral health. Providers must share this information with patients, stressing the fact that oral diseases are not unavoidable concomitants of aging and that they can be prevented. As other aspects of healthy lifestyle and preventive health are advocated for patients, so should be limitation of refined sugar intake, performance of daily oral hygiene (including use of a fluoride dentifrice), and regular dental visits.

Finally, there are, at present, serious financial constraints to obtaining dental care.⁷⁹ The number of annual dental visits is strongly positively correlated with income, although the number of annual physician visits is independent of that factor^{76,77} (Figure 4). Medical insurance is a strong predictor for use of dental services (Figure 5), yet fewer than 15% of people older than age 65 have private dental insurance, compared with about 45% for Americans of all ages. Medical insurance seldom, if ever, includes coverage for dental procedures. Medicare currently covers essentially no dental costs. Medicaid reimbursement for adult dentistry is available in fewer than half of the states and, where offered, covers at

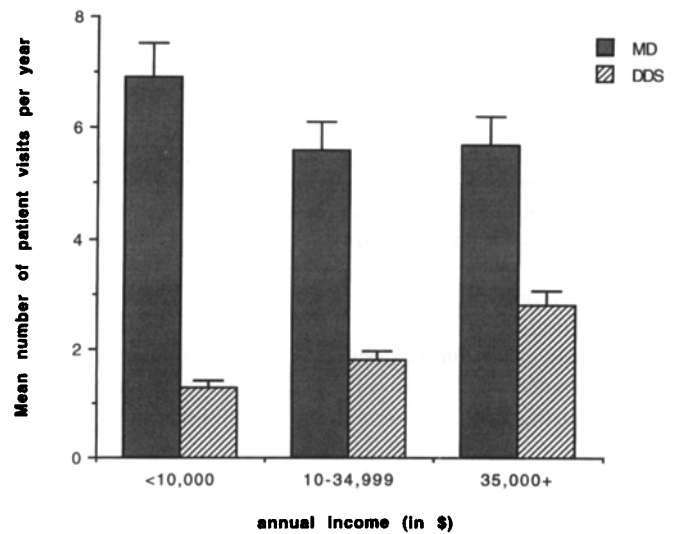


Figure 4. Relationship between annual patient income and mean number of annual patient visits to physicians and to dentists, based on the 1989 National Health Interview Survey.^{76,77} Error bars reflect maximum calculated estimates of standard errors of the mean for each age group. Analysis of variance demonstrates no statistically significant income effect for physician visits, but a strong positive relationship between the number of dentist visits and patient income ($P < .005$).

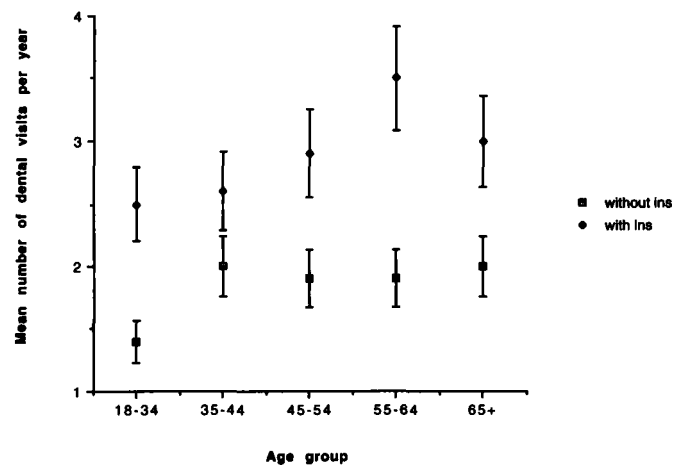


Figure 5. Relationship between private dental insurance status ("ins"), age group and mean number of annual patient visits to dentists, based on the 1989 National Health Interview Survey.⁷⁷ Error bars reflect maximum calculated estimates of standard errors of the mean for each age group.

state-specific rates that many dentists consider unacceptably low. In light of the central importance of oral health to an older patient's overall well-being, it is essential that all health providers support and advocate the expansion of oral health benefits for older adults.

SUMMARY

Oral health is important for general health because stomatologic diseases affect more than the mouth. Furthermore, systemic conditions can have a strong impact on oral health and function. Oral problems in advanced age are largely attributable to preventable diseases rather than the aging process per se. Stomatologic disease and dysfunction impact older persons' general health, making oral health a concern

for all who care for them. Translating that concern into positive benefits for older patients requires effective interdisciplinary collaboration, patient education, and advocacy for dental care.

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