

Common Oral Conditions in Older Persons

WANDA C. GONSALVES, MD, *Medical University of South Carolina, Charleston, South Carolina*

A. STEVENS WRIGHTSON, MD, *University of Kentucky College of Medicine, Lexington, Kentucky*

ROBERT G. HENRY, DMD, MPH, *Veterans Affairs Medical Center and University of Kentucky College of Dentistry, Lexington, Kentucky*

Older persons are at risk of chronic diseases of the mouth, including dental infections (e.g., caries, periodontitis), tooth loss, benign mucosal lesions, and oral cancer. Other common oral conditions in this population are xerostomia (dry mouth) and oral candidiasis, which may lead to acute pseudomembranous candidiasis (thrush), erythematous lesions (denture stomatitis), or angular cheilitis. Xerostomia caused by underlying disease or medication use may be treated with over-the-counter saliva substitutes. Primary care physicians can help older patients maintain good oral health by assessing risk, recognizing normal versus abnormal changes of aging, performing a focused oral examination, and referring patients to a dentist, if needed. Patients with chronic, disabling medical conditions (e.g., arthritis, neurologic impairment) may benefit from oral health aids, such as electric toothbrushes, manual toothbrushes with wide-handle grips, and floss-holding devices. (*Am Fam Physician*. 2008;78(7):845-852. Copyright © 2008 American Academy of Family Physicians.)

► **Editorial:** "Promoting Oral Health: The Family Physician's Role," p. 814.

It is estimated that 71 million Americans, approximately 20 percent of the population, will be 65 years or older by 2030.¹ An increasing number of older persons have some or all of their teeth intact because of improvements in oral health care, such as community water fluoridation, advanced dental technology, and better oral hygiene.¹ However, this population is at risk of chronic diseases of the mouth, including dental infections (e.g., caries, periodontitis), tooth loss, benign mucosal lesions, and oral cancer. *Table 1* summarizes common oral conditions in older patients.¹⁻²⁰ Increasing evidence has linked oral health and general health, suggesting a relationship between periodontal disease and diabetes, cardiovascular disease, pneumonia, rheumatologic diseases, and wound healing.^{8,21-24}

Poor oral health is often associated with lower economic status; lack of dental insurance; being homebound or institutionalized; and the presence of physical disabilities that limit good oral hygiene, such as arthritis and neurologic impairment.²⁵ Because older patients are more likely to visit a physician than a dentist, primary care physicians have an opportunity to improve oral health in this population by assessing oral health risk, identifying and treating common oral conditions, and referring patients to a dentist, if needed.

Oral Health Assessment

An abbreviated history checklist that patients may fill out in the physician's office or at home can help physicians assess oral health risk. There are also screening tools that can be administered by non-dental professionals in a residential care facility. *Figure 1* is a simple, valid, and reliable dental screening tool.²⁶ The only materials needed to perform the assessment are a penlight, gloves, and a tongue blade. Eight oral health categories are marked as healthy, changed, or unhealthy to help determine the next steps in the patient's care.

Smiles for Life: A National Oral Health Curriculum for Family Medicine is an educational resource developed by the Society of Teachers of Family Medicine Group on Oral Health.²⁷ The Web site (<http://www.smilesforlife2.org>) includes free pocket cards and personal digital assistant downloads.

Age-Related Oral Changes

With aging, the appearance and structure of teeth tend to change.²⁸ Yellowing (*Figure 2*) or darkening of the teeth is caused by changes in the thickness and composition of the underlying dentin and its covering, the enamel. Abrasion and attrition also contribute to changes in tooth appearance.²⁹ The number of blood vessels entering a tooth and

SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendations</i>	<i>Evidence rating</i>	<i>References</i>
Fluoride gels, rinses, and varnishes may prevent or reduce root caries.	C	7
Patients with xerostomia should be encouraged to drink water, avoid alcohol and foods and drinks that contain sugar, and use over-the-counter saliva substitutes as needed.	C	19
Topical antifungal therapies are effective for treating denture stomatitis and angular cheilitis caused by candidiasis.	A	17

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort.xml>.

Table 1. Common Oral Conditions in Older Persons

<i>Condition</i>	<i>Clinical presentation</i>	<i>Treatment</i>	<i>Comments</i>
Dental caries ¹⁻⁶	Coronal (above the gum) or root: painful brownish discoloration with cavitation	Root caries may be treated with fluoride gels, varnishes, or toothpaste; effective for some shallow caries	Infection can be reduced with good oral hygiene and professional dental care; patients should avoid sugary foods and drinks; see Table 2 for risk factors
Gingivitis ⁷	Red, swollen, bleeding gums	Good oral hygiene, including brushing and flossing daily	—
Periodontitis ^{6,8-12}	Gingivitis, gingiva recession, loose or shifting teeth	Good oral hygiene, including brushing and flossing daily; dental scaling performed by a dental health professional; adjunct antibiotic therapy	Associated with cardiovascular disease, worsening diabetes, and aspiration pneumonia
Xerostomia ^{7,13}	Swollen, dry, red tongue; burning sensation; difficulty with speech and swallowing; change in taste	Saliva substitutes; sugar-free gum or pilocarpine (Salagen) and cevimeline (Evoxac) drops may stimulate saliva production	See Table 3 for risk factors
Candidiasis ¹⁴⁻¹⁷	Acute pseudomembranous (thrush): adherent white plaques that can be wiped off Erythematous (denture stomatitis): red macular lesions, often with a burning sensation Angular cheilitis: erythematous, scaling fissures at the corners of the mouth	Topical antifungals (e.g., nystatin oral suspension or troche [Mycostatin; brand no longer available in the United States]; clotrimazole troche [Mycelex]) Or Systemic antifungals (e.g., fluconazole [Diflucan]; ketoconazole [Nizoral; brand no longer available in the United States]; itraconazole [Sporanox])	Diagnosis can be confirmed with oral exfoliative cytology (stained with periodic acid-Schiff or potassium hydroxide), biopsy, or culture
Denture stomatitis ^{18,19}	Varying erythema, occasionally accompanied by petechial hemorrhage; localized to the denture-bearing areas of the removable maxillary prosthesis; usually asymptomatic	Removal of dentures at night; topical antifungals (see Candidiasis) placed inside the denture-fitting surface	Dentures should be removed and cleaned at least once daily
Oral cancer ²⁰	Nonhealing ulcer or mass	Refer for biopsy, staging, surgery, and other treatment	—

Information from references 1 through 20.

Oral Health Assessment Tool for Dental Screening

Resident: _____ Completed by: _____ Date: _____

Scoring: You may circle individual words as well as give a score in each category

Category	0 = Healthy	1 = Changes	2 = Unhealthy	Category scores
Lips	Smooth, pink, moist	Dry, chapped, or red at corners	Swelling or a lump; white, red, or ulcerated patch; bleeding or ulcerated at corners	
Tongue	Normal, moist, roughness, pink	Patchy, fissured, red, coated	Patch that is red or white, ulcerated, or swollen	
Gums and tissues	Pink, moist, smooth, no bleeding	Dry, shiny, rough, red, swollen, one ulcer or sore spot under dentures	Swollen, bleeding, ulcers, white or red patches, generalized redness under dentures	
Saliva	Moist tissues, watery and free-flowing saliva	Dry, sticky tissues, little saliva present, resident reports having a dry mouth	Tissues parched and red, very little or no saliva present, saliva is thick, resident reports having a dry mouth	
Natural teeth Yes/No	No decayed or broken teeth/roots	One to three decayed or broken teeth/roots or very worn-down teeth	Four or more decayed or broken teeth/roots, very worn-down teeth, or less than four teeth are present	
Dentures Yes/No	No broken areas or teeth, dentures are worn regularly and marked with the resident's name	One broken area or tooth, dentures only worn for one or two hours daily, dentures are not marked with the resident's name, or dentures are loose	More than one broken area or tooth, dentures are missing or not worn, dentures are loose and need adhesive, or dentures are not marked with the resident's name	
Oral cleanliness	Clean; no food particles or tartar in the mouth or dentures	Food particles, tartar, or plaque on one or two areas of the mouth or on a small area of dentures, or presence of halitosis (bad breath)	Food particles, tartar, or plaque in most areas of the mouth or dentures, or presence of severe halitosis	
Dental pain	No verbal/behavioral signs (pulling at face, not eating, aggression) or physical signs (cheek or gum swelling, broken teeth, ulcers) of dental pain	Presence of verbal/behavioral signs of dental pain	Presence of physical and verbal/behavioral signs of dental pain	

Arrange for a dentist to perform an examination

Total score: _____/16

Client or family/guardian refuses dental treatment for the resident

Initiate interventions, such as an oral hygiene care plan

Review resident's oral health again on Date: _____

Figure 1. Oral health assessment tool. This assessment may be completed by a non-dental professional at a residential care facility.

Interpretation: Any category that has changed should be reevaluated after two weeks, and follow-up should be performed to ensure that the changes return to normal over time. If the changes do not return to normal or if there is any unhealthy area, the patient should be referred to a dentist for a comprehensive evaluation. Training assistance for the use of this screening tool is available at <http://www.healthcare.uiowa.edu/igec/e-learn/lic/dentistry/default.asp>.

Adapted with permission from Chalmers JM, King PL, Spencer AJ, Wright FA, Carter KD. The oral health assessment tool—validity and reliability. Aust Dent J. 2005;50(3):197.



Figure 2. Age-related teeth yellowing and gingival recession.



Figure 3. Root caries: gingival recession and decay (black discoloration) on root surfaces.

the enamel decrease with age, leading to reduced sensitivity.³⁰ With less sensitivity to environmental stimuli, the response to caries (decay) or trauma may decrease. The cementum (i.e., the substance covering the root surface) gradually thickens, with the total width almost tripling between 10 and 75 years of age. Because the cementum is highly organic, it is less resistant to environmental agents, such as sugar, acids from soft drinks, and tobacco, which has a drying effect.

Age-related changes in the oral mucosa and dietary or hormonal deficiencies lead to diminished keratinization, dryness, and thinning of the epithelial structures. Additionally, the width and fiber content of the periodontal ligament, which is a part of the attachment apparatus of the periodontium, decreases with aging. Gingival recession is another common condition in older persons, but is not considered a normal age-dependent oral change. Gingival recession exposes the cementum, possibly leading to root caries.³¹

Dental Caries

Dental caries can occur at any age. However, because of gingival recession and periodontitis, older persons are at higher risk of developing root caries (Figure 3). The incidence of root caries in patients older than 60 years is twice that of 30-year-olds⁷;

Table 2. Risk Factors for Dental Caries in Older Persons

Decreased salivary flow rate
History of caries
Institutionalization
Lack of routine dental care
Low socioeconomic status
Nonfluoridated community water supply
Poor oral hygiene

Information from reference 13.



Figure 4. Gingivitis: erythema along tooth margins and gingival inflammation between teeth.

64 percent of persons older than 80 years have root caries, and up to 96 percent have coronal caries (above the gum).³² Risk factors (Table 2¹³) for coronal and root caries lead to increased exposure to cariogenic bacteria, such as *Streptococcus mutans*, *Lactobacillus*, and *Actinomyces*.⁷

Treatment of root caries includes regular oral hygiene and professional dental care. In addition, fluoride gels, rinses, and varnishes have been shown to help stabilize and reduce some shallow root caries.^{2,3,15}

Periodontal Disease

GINGIVITIS

Plaque is a biofilm composed of gram-negative bacteria and endotoxins that develops on teeth at the gingival margins, leading to gingival inflammation (gingivitis). Gingivitis (Figure 4) is characterized by erythematous and edematous gingival tissue, which often bleeds easily with instrument probing and gentle brushing. Other causes of gingivitis include trauma and tobacco use. Although gingivitis is more common in older persons, age alone is not a risk factor for gingivitis or periodontitis.⁷ Gingivitis can be reversed with good oral hygiene.



Figure 5. Severe periodontitis: gingival inflammation and recession, plaque formation, and tooth loss.

PERIODONTITIS

Periodontitis (*Figure 5*) occurs when gingival inflammation causes the periodontal ligament to detach from the cementum and tooth structure, leading to increased gingival pocket depth, loosening of the tooth, and, ultimately, tooth loss.³³ Many older persons are prone to periodontal detachment and tooth loss because of poor oral hygiene and gingival recession.³⁴ Periodontitis has been associated with cardiovascular disease, worsening diabetes control, poor wound healing, and aspiration pneumonia, particularly in institutionalized patients.^{4,8,21-23,35}

Treatment of periodontal disease includes daily brushing and flossing and professional dental care, ranging from plaque removal to surgical debridement of infected periodontium. Oral antibiotics, such as doxycycline (Periostat), have been used as adjuncts to scaling and root planing in older patients who are institutionalized.⁹ Along with regular dental cleanings, these interventions can reduce the need for surgical debridement and tooth removal.^{9-11,33}

Xerostomia

Xerostomia, the subjective sensation of dry mouth caused by decreased saliva production, affects 29 to 57 percent of older persons.^{13,36} Saliva lubricates the oral cavity, prevents decay by promoting remineralization of teeth, and protects against fungal and bacterial infections.³⁴ In addition to dry mouth, clinical manifestations of xerostomia include a burning sensation, changes in taste, and difficulty with swallowing and speech.¹³ Although salivary flow does not decrease with age alone, certain medications and illnesses increase the risk of xerostomia in older persons *Table 3*.^{13,37}

If a patient is taking a medication known to decrease salivary flow, the medication should be changed or eliminated, if possible. Patients should be encouraged to drink water, avoid alcohol, and decrease their intake of food and drinks that may promote xerostomia or caries (e.g., those that are caffeinated or contain sugar).³⁸ Any chewing gum or candy used to induce salivation should be sugarless. Over-the-counter salivary substitutes may offer temporary relief.^{7,38} Medications, such as pilocarpine (Salagen) and cevimeline (Evxac), may be beneficial, particularly in patients with Sjögren syndrome.¹³ Small studies have shown that acupuncture and electric toothbrushes increase salivary flow.^{13,25,38,39}

Candidiasis

Although it is estimated that *Candida* species are present in the normal oral flora of healthy adults,⁴⁰ certain conditions increase the risk of overgrowth in older persons. These conditions include the pathogenicity of individual *Candida* strains; local factors

Table 3. Risk Factors for Xerostomia

- Head or neck radiation
- Human immunodeficiency virus
- Medication use
 - Angiotensin-converting enzyme inhibitors
 - Alpha and beta blockers
 - Analgesics
 - Anticholinergics
 - Antidepressants
 - Antihistamines
 - Antipsychotics
 - Anxiolytics
 - Calcium channel blockers
 - Diuretics
 - Muscle relaxants
 - Sedatives
- Salivary gland aplasia
- Sjögren syndrome
- Smoking

Adapted from Douglass AB, Douglass JM, Barr C. Oral Health. Leawood, Kan.: American Academy of Family Physicians; 2004, with additional information from reference 13.

(e.g., xerostomia, denture irritation, tobacco use, steroid inhaler use); and systemic factors (e.g., immunodeficiencies, systemic corticosteroid use, antibiotic use, chemotherapy, radiation therapy, endocrine disorders, malabsorption, malnutrition).^{15,41-43}

CLINICAL PATTERNS

The clinical pattern of oral candidiasis varies; therefore, it may be difficult to recognize. The presentation ranges from no symptoms to a prominent burning sensation or an unpleasant salty or bitter taste. The most readily recognized clinical pattern, acute pseudomembranous candidiasis (thrush), is characterized by adherent, curd-like plaques that can be removed by wiping firmly with a tongue blade or gauze (Figure 6). In patients who wear dentures, oral candidiasis may also lead to an erythematous lesion called denture stomatitis (Figure 7). Angular cheilitis (Figure 8) is a manifestation of *Candida albicans* or *Staphylococcus aureus* infection. The condition is characterized by erythematous, scaling fissures at the corners of the mouth, is often associated with intraoral candidal infection, and typically occurs in patients with accentuated skinfolds and salivary pooling in the corners of the mouth.¹⁵

DIAGNOSIS

A presumptive candidiasis diagnosis usually can be made based on the patient's history, clinical presentation, and response to antifungal treatment. The diagnosis can be confirmed with a cytology smear of the lesion stained with periodic-acid Schiff or a wet mount stained with 20 percent potassium hydroxide, biopsy, or culture.

TREATMENT

Oral candidiasis may be treated with topical or systemic antifungal therapy. Topical agents that are generally effective for treating uncomplicated infections include nystatin oral suspension or troche (Mycostatin, brand no longer available in the United States) or clotrimazole troche (Mycelex).¹⁴ Topical nystatin/triamcinolone ointment or cream (Mytrex, brand no longer available in the United States) is usually effective



Figure 6. Acute pseudomembranous candidiasis (thrush): thick, curd-like plaques on buccal mucosa that can be removed with gauze or tongue blade.



Figure 7. Denture stomatitis: erythematous and edematous tissue on the hard palate below the dentures that is associated with candidiasis.



Figure 8. Angular cheilitis: erythematous fissures at the corners of the mouth that are associated with *Candida albicans* or *Staphylococcus aureus* infection.

for treating angular cheilitis.^{15,17} In patients with denture stomatitis, a topical antifungal should be applied to the mucosa and denture base.¹⁷ If the dentures are ill fitting, a dentist may need to relines or surgically remove the excess tissue before constructing new dentures. Patients should be advised to remove and clean dentures every night at bedtime by brushing or soaking them in sodium hypochlorite solution (6 percent bleach diluted by mixing 10 parts water to one part bleach).^{18,19}



Figure 9. Oral cancer: squamous cell carcinoma on the floor of the mouth.

Systemic agents, such as fluconazole (Diflucan), ketoconazole (Nizoral; brand no longer available in the United States), and itraconazole (Sporanox), are appropriate for treating infections that are resistant to topical therapy. Systemic agents are first-line therapies for patients who are unable to tolerate topical therapy, for those at high risk of systemic infection, and for those receiving chemotherapy for cancer treatment.^{44,45}

Oral Cancer

Tobacco and alcohol use are thought to be responsible for up to 75 percent of oral cancers.⁴⁶ Precancerous lesions and early oral cancer can be subtle and asymptomatic. Most oral and oropharyngeal cancers are squamous cell carcinomas that arise from the lining of the oral mucosa. Oral cancer most commonly occurs, in order of frequency, on the lateral borders of the tongue, on the lips, and on the floor of the mouth (Figure 9). Fifteen percent of patients with oral cancer will be diagnosed with another cancer in a nearby area, such as the larynx, esophagus, or lungs.⁴⁶ A lesion may begin as a white- or red-colored patch, progress to ulceration, and eventually become an endophytic or exophytic mass. Patients with any white or red lesion that persists for longer than two weeks should be referred to a subspecialist for evaluation. Treatment is guided by clinical staging.²⁰

Oral Health Aids

Good manual dexterity and a person's motivation are directly related to effective plaque removal. Diminished cognition, decreased visual acuity, or loss of strength or function in the hands may significantly alter a person's ability to maintain good oral

hygiene. Specialized oral health aids, such as electric toothbrushes, manual toothbrushes with wide-handle grips, and floss-holding devices, may be necessary to remove plaque in patients with chronic disabling conditions, such as arthritis or neurologic impairment.

The authors thank Jennie Ariail, PhD, Center for Academic Excellence, Medical University of South Carolina, for her assistance in preparation of the manuscript.

The Authors

WANDA C. GONSALVES, MD, is an associate professor of family medicine at the Medical University of South Carolina, Charleston. She received her dental hygiene degree from the University of Louisville (Ky.) and her medical degree from the University of Kentucky College of Medicine, Lexington, where she also completed a family medicine residency.

A. STEVENS WRIGHTSON, MD, is an assistant professor at the University of Kentucky Department of Family and Community Medicine and works with the department on oral health education for family physicians. Dr. Wrightson received his medical degree from the University of Kentucky College of Medicine, where he also completed his family medicine residency.

ROBERT G. HENRY, DMD, MPH, is director of geriatric dental services and assistant chief of dentistry at the Veterans Affairs Medical Center in Lexington. He is also a clinical associate professor at the University of Kentucky College of Dentistry, Lexington, and is assistant director of the Public Health Dentistry Department for the state of Kentucky. Dr. Henry received his dental degree from the University of Kentucky College of Dental Medicine and his master's degree from Loma Linda (Calif.) University College of Dentistry.

Address correspondence to Wanda C. Gonsalves, MD, Dept. of Family Medicine, Medical University of South Carolina, 295 Calhoun St., P.O. Box 250192, Charleston, SC (e-mail: gonsalvw@musc.edu). Reprints are not available from the authors.

Author disclosure: Nothing to disclose.

REFERENCES

1. Jeannotte L, Moore MJ. *The State of Aging and Health in America 2007*. Atlanta, Ga.: Centers for Disease Control and Prevention; 2007.
2. Shay K. Root caries in the older patient: significance, prevention, and treatment. *Dent Clin North Am.* 1997; 41(4):763-793.
3. Jones JA. Root caries: prevention and chemotherapy. *Am J Dent.* 1995;8(6):352-357.
4. El-Solh AA, Pietrantoni C, Bhat A, et al. Colonization of dental plaques: a reservoir of respiratory pathogens for hospital-acquired pneumonia in institutionalized elders. *Chest.* 2004;126(5):1575-1582.
5. Offenbacher S, Beck JD. A perspective on the potential cardioprotective benefits of periodontal therapy. *Am Heart J.* 2005;149(6):950-954.

6. D'Aiuto F, Parkar M, Nibali L, Suvan J, Lessem J, Tonetti MS. Periodontal infections cause changes in traditional and novel cardiovascular risk factors: results from a randomized controlled clinical trial. *Am Heart J*. 2006;151(5):977-984.
7. MacDonald DE. Principles of geriatric dentistry and their application to the older adult with a physical disability. *Clin Geriatr Med*. 2006;22(2):413-434.
8. Krall EA. The periodontal-systemic connection: implications for treatment of patients with osteoporosis and periodontal disease. *Ann Periodontol*. 2001;6(1):209-213.
9. Mohammad AR, Preshaw PM, Bradshaw MH, Hefti AF, Powala CV, Romanowicz M. Adjunctive subantimicrobial dose doxycycline in the management of institutionalized geriatric patients with chronic periodontitis. *Gerodontology*. 2005;22(1):37-43.
10. Loesche WJ, Giordana JR, Soehren S, Kaciroti N. The nonsurgical treatment of patients with periodontal disease: results after five years. *J Am Dent Assoc*. 2002;133(3):311-320.
11. Drisko CH. Trends in surgical and nonsurgical periodontal treatment. *J Am Dent Assoc*. 2000;131(suppl):315-385.
12. Burt BA. Periodontitis and aging: reviewing recent evidence. *J Am Dent Assoc*. 1994;125(3):273-279.
13. Guggenheimer J, Moore PA. Xerostomia: etiology, recognition and treatment. *J Am Dent Assoc*. 2003;134(1):61-69.
14. Epstein JB, Gorsky M, Caldwell J. Fluconazole mouthrinses for oral candidiasis in postirradiation, transplant, and other patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2002;93(6):671-675.
15. Neville BW. *Oral & Maxillofacial Pathology*. 2nd ed. Philadelphia, Pa.: W.B. Saunders; 2002.
16. Gonsalves WC, Chi AC, Neville BW. Common oral lesions: Part I. Superficial mucosal lesions. *Am Fam Physician*. 2007;75(4):475-476.
17. Pankhurst CL. Candidiasis (oropharyngeal). *Clin Evid*. 2006;(15):1849-1863.
18. Webb BC, Thomas CJ, Whittle T. A 2-year study of Candida-associated denture stomatitis treatment in aged care subjects. *Gerodontology*. 2005;22(3):168-176.
19. National Guideline Clearinghouse. Oral health management of children and adolescents with HIV infections. http://www.guideline.gov/summary/summary.aspx?doc_id=5905&nbr=003891&string=xerostomia. Accessed October 18, 2007.
20. National Cancer Institute. General information about lip and oral cavity cancer. <http://www.cancer.gov/cancertopics/pdq/treatment/lip-and-oral-cavity/patient>. Accessed October 18, 2007.
21. Limeback H. Implications of oral infections on systemic diseases in the institutionalized elderly with special focus on pneumonia. *Ann Periodontol*. 1998;3(1):262-275.
22. Rose LF, Steinberg BJ, Minsk L. The relationship between periodontal disease and systemic conditions. *Compend Contin Educ Dent*. 2000;21(10A):870-877.
23. Taylor GW, Loesche WJ, Terpenning MS. Impact of oral diseases on systemic health in the elderly: diabetes mellitus and aspiration pneumonia. *J Public Health Dent*. 2000;60(4):313-320.
24. Simonova MV, Grinin VM, Nasonova VA, Robustova TG. Clinical factors essential for dental caries intensity in rheumatic patients [in Russian]. *Stomatologiya (Mosk)*. 2002;81(2):15-19.
25. Jablonski RA, Munro CL, Grap MJ, Elswick RK. The role of biobehavioral, environmental, and social forces on oral health disparities in frail and functionally dependant nursing home elders. *Biol Res Nurs*. 2005;7(1):75-82.
26. Chalmers JM, King PL, Spencer AJ, Wright FA, Carter KD. The oral health assessment tool—validity and reliability. *Aust Dent J*. 2005;50(3):191-199.
27. Douglass AB, Gonsalves W, Maier R, et al. Smiles for Life: A National Oral Health Curriculum for Family Medicine. A model for curriculum development by STFM groups. *Fam Med*. 2007;39(2):88-90.
28. Berg R, Morgenstern NE. Physiologic changes in the elderly. *Dent Clin North Am*. 1997;41(4):651-668.
29. Baum BJ. Oral health for the older patient. *J Am Geriatr Soc*. 1996;44(8):997-998.
30. National Oral Health Surveillance System. Complete tooth loss. <http://apps.nccd.cdc.gov/nohss/ListV.asp?qkey=8&DataSet=2>. Accessed October 18, 2007.
31. Levy BM. Is periodontitis a disease of the aged? *Gerodontology*. 1986;5(2):101-107.
32. Warren JJ, Cowen HJ, Watkins CM, Hands JS. Dental caries prevalence and dental care utilization among the very old. *J Am Dent Assoc*. 2000;131(11):1571-1579.
33. Loesche W. Dental caries and periodontitis: contrasting two infections that have medical implications. *Infect Dis Clin North Am*. 2007;21(2):471-502.
34. Hazzard WR. *Principles of Geriatric Medicine and Gerontology*. 5th ed. New York, NY: McGraw-Hill Professional; 2003.
35. Mealey BL, Oates TW; American Academy of Periodontology. Diabetes mellitus and periodontal diseases. *J Periodontol*. 2006;77(8):1289-1303.
36. Saunders R, Friedman B. Oral health conditions of community-dwelling cognitively intact elderly persons with disabilities. *Gerodontology*. 2007;24(2):67-76.
37. Douglass AB, Douglass JM, Barr C. *Oral Health*. Leawood, Kan.: American Academy of Family Physicians; 2004.
38. Filshie J, Rubens CN. Complementary and alternative medicine. *Anesthesiol Clin*. 2006;24(1):81-111.
39. Papas A, Singh M, Harrington D, et al. Stimulation of salivary flow with a powered toothbrush in a xerostomic population. *Spec Care Dentist*. 2006;26(6):241-246.
40. Fotos PG, Vincent SD, Hellstein JW. Oral candidosis. Clinical, historical, and therapeutic features of 100 cases. *Oral Surg Oral Med Oral Pathol*. 1992;74(1):41-49.
41. Ghannoum MA, Abu-Elteen KH. Pathogenicity determinants of Candida. *Mycoses*. 1990;33(6):265-282.
42. Abu-Elteen KH, Abu-Elteen RM. The prevalence of *Candida albicans* populations in the mouths of complete denture wearers. *New Microbiol*. 1998;21(1):41-48.
43. Epstein JB, Gorsky M, Caldwell J. Fluconazole mouthrinses for oral candidiasis in postirradiation, transplant, and other patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2002;93(6):671-675.
44. Cha R, Sobel JD. Fluconazole for the treatment of candidiasis: 15 years experience. *Expert Rev Anti Infect Ther*. 2004;2(3):357-366.
45. Worthington HV, Eden OB, Clarkson JE. Interventions for preventing oral candidiasis for patients receiving cancer treatment. *Cochrane Database Syst Rev*. 2004;(4):CD003807.
46. Weinberg MA, Estefan DJ. Assessing oral malignancies. *Am Fam Physician*. 2002;65(7):1379-1384.