The epidemiology, consequences and management of periodontal disease in older adults

Tobias K. Boehm, DDS; Frank A. Scannapieco, DMD, PhD

As baby boomers near retirement, dentists are faced with increasing numbers of older patients who have various types of periodontal disease (PD). Since PD in older adults is common and the consequences of PD are significant, we summarized the literature on this topic to help general practitioners manage the care of these patients.

In May 2007, we performed a systematic PubMed search using the terms “periodontal disease OR periodontitis” and “older adults.” Key words such as “geriatric,” “dementia,” “community-dwelling,” “independent-living,” “nursing home” or “dependent” did not provide additional relevant articles at the time we conducted our literature search. We evaluated 649 articles for relevance and validity and selected key references for the following subtopics: epidemiology of PD in older adults, oral and systemic sequelae, and management of PD in older adults.

CASE REPORT

Case report. A 69-year-old woman who had moderate generalized chronic periodontitis came to the

ABSTRACT

Background. This review summarizes the literature on periodontal disease (PD) in older adults. The authors focused on significant sequelae of PD and therapy in this population.

Types of Studies Reviewed. The authors conducted a search on PubMed for human studies using the terms “periodontal disease OR periodontitis” and “older adults.” They retrieved 649 articles and excluded studies that had poor experimental design. For each topic of the review, they selected one to three of the most recent studies or reviews for inclusion and cited classic articles where appropriate.

Results. PD is a common oral chronic inflammatory disease often found in older adults. In older patients, PD may lead to root caries, impaired eating and socialization. It also may increase patients’ risk of developing systemic diseases such as diabetes mellitus, lung disease, heart disease and stroke. Treatment is not limited by chronological age but depends on the patient’s medical and emotional status and the availability of financial resources.

Clinical Implications. General dentists usually can treat the majority of older people with mild or moderate PD. For older adults who are medically compromised and dependent, the literature supports treatment that prevents PD progression.

Key Words. Periodontics; geriatrics; caries; vulnerable populations; periodontitis.

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postgraduate periodontics clinic at the School of Dental Medicine, University at Buffalo, The State University of New York in May 2007 (Figure 1). She denied having any current symptoms of oral disease; however, she reported that over the last 20 years, her anterior teeth “have moved slightly out of place.” She was taking metoprolol, hydrochlorothiazide and atorvastatin for treatment of hypertension and dyslipidemia, and her dental history revealed periodontal surgical treatment 10 years ago and fair oral hygiene.

We conducted an oral examination and found recurrent caries on teeth nos. 17 and 31, generalized 3- to 4-millimeter pocketing with isolated 5- to 8-mm pockets in the mandibular molar areas and generalized bleeding on probing. Her teeth exhibited no greater mobility than Miller class I, with no fremitus. When we evaluated her oral hygiene, we found insufficient interproximal plaque removal (O’Leary plaque index score of 44 percent). Radiographic examination confirmed caries and provided evidence for 3 to 4 mm of generalized bone loss and furcation involvement of tooth no. 30. We saw no evidence for other bony defects. We found localized plaque and calculus deposits in the areas of marginal erythema, and gingival recession and pathological tooth migration provided evidence of past PD activity (Figure 1). The treatment plan involved oral hygiene instructions, scaling and root planing at selected sites, caries removal, and restoration and flap surgery if deemed necessary after initial therapy.

This case illustrates the importance of good long-term follow-up, as the patient’s oral hygiene measures had fallen behind and some sites exhibited active PD. Although general practitioners

**ABBREVIATION KEY.** **COPD:** Chronic obstructive pulmonary disease. **CVD:** Cardiovascular disease. **PD:** Periodontal disease. **VAP:** Ventilator-associated pneumonia.
usually would not provide flap surgery for a patient such as this one, it is possible that thorough scaling and root planing with improved oral hygiene could be used to manage the disease adequately.

**EPIDEMIOLOGY OF PERIODONTAL DISEASE IN OLDER ADULTS**

This case report is typical of mild PD seen in older adults, and PD is common in older adults throughout the world (Table).\(^1\)\(^6\) Net tissue destruction (for example, bone loss) due to PD is cumulative with age. Since 52 percent of adults in the United States have lost fewer than five teeth, most older adults are at risk of developing PD. Conversely, only 26 percent of Americans are edentulous and, therefore, not at risk of developing PD; in some states such as Hawaii and California, however, only 13 percent of the population is edentulous.\(^7\) In a study of older adults (mean age, 85 years) living in rural Iowa, 91 percent had PD, defined as at least one site with attachment loss of 4 mm or greater.\(^2\) However, only 15 percent of these subjects had attachment loss of 8 mm or greater (advanced PD), implying that PD in older people is limited and can be treated successfully by general dentists. Similar studies of German\(^3\) and Japanese\(^4\) populations demonstrated a similar prevalence of PD. The German study demonstrated lower prevalence of PD in women and people of advanced age with increased tooth loss.\(^4\) The Japanese study found abutment teeth of partial dentures more at risk of developing attachment loss.\(^5\) Clinicians note attachment loss resulting from gingival recession in older adults more often than that resulting from increased pocket depth, and attachment loss with gingival recession appears to be more pronounced in diabetic adults.\(^8\)

Oral health in older adults who are institutionalized often is worse than that in the general population and involves increased prevalence of edentulism and numerous unmet dental needs. As studies from Japan and Australia have shown, this often is related to poor oral health status and poor mental health status, because increased caries and PD lead to increased tooth loss.\(^5,9,10\) These findings confirm those of a 1993 study\(^6\) reviewed by Locker and colleagues,\(^11\) which also showed that a small percentage of subjects who are institutionalized account for most attachment loss. Fifty to 75 percent of older adults had at least one site with attachment loss of 2 to 3 mm, and new lesions were more common than were progressing existing lesions.\(^11\) Since general dentists are the primary oral health care providers for most older adults, these epidemiologic data suggest the need for general dentists to treat PD in most of these patients. Moreover, general dentists should work with the relatives of older adults who are institutionalized and administrators of local nursing homes to

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improve older patients’ routine oral hygiene and reduce the high prevalence of PD and edentulism.

**ORAL SEQUELAE OF PERIODONTAL DISEASE IN OLDER ADULTS**

The high prevalence of PD in older adults should be of concern because PD directly increases the patient’s risk of developing root caries, as well as tooth loss with resulting deficient masticatory ability, nutrition and speech, which can worsen the patient’s quality of life.

When combined with xerostomia, poor oral hygiene due to arthritis and deficient oral care, as well as uncontrolled dietary sugar consumption, gingival recession and the resulting exposed root surfaces, can lead to the development of extensive root caries that often are a challenge to treat. As studies have shown, this problem is common around the world. The prevalence of root caries has been reported to be 39 percent in older people living independently in Japan, 27 percent in elderly people in Germany, 29 percent in older African-American people living independently in North Carolina and 39 percent in older white people living independently in North Carolina. These data emphasize the need for prevention, as oral hygiene and fluoride treatment for patients at risk of developing PD is more cost effective than treating PD and root caries.

However, older adults often do not receive routine preventive dental treatment, and PD often progresses to the point at which bone loss leads to tooth loss. Ultimately, patients who have few teeth or teeth with advanced mobility experience poor oral health and have difficulty chewing, speaking or pronouncing words. Many patients with mobile teeth avoid crunchy or stringy foods, which often eliminates meat, bread and vegetables from their diets. Insufficient intake of nutritious foods can lead to malnutrition, with resulting unintentional weight loss, fatigue and poor general health. Nutritional deficiency can exacerbate PD, with gingival recession leading to exposed crown margins, stained roots and loss of interdental papillae. Although dental appearance usually is less important to older adults than younger adults, together with functional impairment and diminished general health, it might explain the association between tooth loss and avoidance of socialization, as observed by Jones and colleagues. PD almost certainly decreases the quality of life for older adults.

**SYSTEMIC SEQUELAE OF PERIODONTAL DISEASE IN OLDER ADULTS**

More subtle and sinister are the medical consequences of PD, in which PD might set the stage for the patient’s experiencing diabetes mellitus, respiratory disease, stroke and myocardial infarcts. It also appears to be connected to other chronic diseases such as osteoporosis, arthritis and Alzheimer’s disease.

**Diabetes mellitus.** Diabetes mellitus results from a derangement of glucose metabolism due to decreased production of or response to the hormone insulin released by specialized cells within the islets of Langerhans in the pancreas. Diabetes exerts most of its effects on peripheral blood vessels, leading to either vascular proliferation or impairment of blood perfusion by thickening of the basement membrane, and it can lead to blindness, peripheral neuropathy, nephropathy, secondary infections, heart disease and PD. Type 2 diabetes is common in older adults, as is periodontitis; uncontrolled type 2 diabetes is thought to be a risk factor for severe periodontitis. From a medical viewpoint, PD might influence the course of diabetes. Evidence suggests that PD is associated with poor glycemic control in prediabetic rats and treatment of PD improves glycemic control in diabetic patients.

**Respiratory disease.** Respiratory disease (especially pneumonia) is a common cause of mortality in older adults. Since the oral cavity is proximal to and contiguous with the trachea, it is a potential entry point for respiratory pathogens, and teeth likely serve as an important reservoir for these pathogens. Such pathogens colonize oral biofilms found on surfaces such as dentures or teeth. Once established in biofilms, pathogens can be shed and aspirated into the lower airway, increasing the risk of infection.

People living in nursing homes or staying in hospitals for extended periods have more exposure to pathogens, worse oral hygiene and worse general health than do community-dwelling adults (older adults who do not require assisted living or nursing home care). As a consequence, they are at more risk of experiencing respiratory pathogen colonization than are community-dwelling people. There is evidence that the genetic identity of respiratory pathogen isolates recovered from bronchoalveolar lavage fluid of elderly people who are hospitalized or institutionalized is the same as isolates from their dental
proinflammatory cytokines and enzymes,47 this may explain the improved pulmonary function after adjusting for the traditional risk factors for VAP.

While chronic obstructive pulmonary disease (COPD) commonly is associated with environmental factors such as smoking, epidemiologic studies suggest an association between PD and COPD.45,46 Although there is no evidence to date of a causal link between poor oral hygiene, PD and COPD, a three-year study of community-dwelling older adults found that gingival index and loss of attachment were significantly better in participants with normal pulmonary function than in those with an airway obstruction after adjusting for age, race, sex and field center location.46 While the biological relationship between COPD and PD is uncertain, it might be similar to the relationship of pneumonia and PD, with aspirated proinflammatory cytokines and enzymes being key players. Since PD features increased salivary proinflammatory cytokines and enzymes,47 this might explain the improved pulmonary function seen in the three-year COPD study.46

Cardiovascular disease (CVD). Oral hygiene and frequent professional oral health care also might be good for heart and brain health in the long term. There has been interest in the potential effect of periodontal inflammation on the process of atherosclerosis and its sequelae. Epidemiologic studies have found a stronger association between PD and CVD or stroke, especially in younger male subjects.48,49

In a panoramic radiograph study of 60- to 75-year-old subjects, researchers found a correlation between alveolar bone loss and an increased risk of experiencing CVD.50 However, this association was diminished when they accounted for the subjects' smoking histories. This contrasts with a radiograph study in which researchers associated alveolar bone loss, increased pocketing and clinical attachment loss with increased risk of experiencing CVD in subjects younger than 60 years, even after adjusting for smoking and diabetes.51 PD-induced gingival recession and subsequent root caries also might lead to an increased risk of experiencing cardiac dysrhythmia.52 Although PD may not be a major risk factor for some older adults,53 investigators in one study found 1.5-fold increased odds of experiencing atherosclerosis and coronary heart disease in older adults who had experienced both periodontitis and tooth loss, after adjusting for the traditional risk factors of heart disease.54

Stroke. One danger of atherosclerosis is an increased risk of experiencing stroke, and PD might be associated with this increased risk. For example, a case-control study found that men younger than 60 years who had severe periodontitis had a 4.3 times higher risk of experiencing stroke than did patients in the same age group who had mild or no periodontitis.55 Likewise, alveolar bone loss was associated with an increased risk of experiencing stroke in the panoramic radiograph study, although the subjects' smoking histories confounded this association.50 According to both studies, PD-related risk of stroke seems to be higher in younger people, which probably indicates that other risk factors such as smoking become more important in older patients. In addition, stroke risk might be influenced by "survivor bias," in which patients who are less susceptible to PD-mediated stroke live longer. As with all the association studies mentioned, caution must be exercised in interpreting statistical association as evidence for possible cause-effect relationships.

However, the possibility that poor oral health influences systemic health is interesting since many of the traditional risk factors for CVD and
stroke such as smoking, being male, sedentary lifestyle, obesity, hypertension and dyslipidemia are not easily modifiable. In contrast, provision of or improvement in oral care might prove to be an easily modifiable risk factor that could help reduce the incidence of the most common causes of mortality in this society.

**Osteoporosis, arthritis and Alzheimer's disease.** PD also might affect older adults through potential interactions with Alzheimer’s disease, arthritis and osteoporosis. In a longitudinal study, Ship and Pucket found that subjects with Alzheimer’s disease had diminished salivary flow and poorer oral health, and they recommended aggressive prevention of oral diseases as long as possible to maintain quality of life. Severe arthritis also can diminish quality of life for patients, and alveolar bone loss has been associated with arthritis. Bartold and colleagues hypothesized that there is a common dysregulation of proinflammatory pathways for both arthritis and periodontitis, and they strongly suggested evaluating patients who have arthritis for periodontitis. Unfortunately, a clear relationship between PD and arthritis has not been established, owing to conflicting studies. Since arthritis often limits manual dexterity and oral hygiene is key in preventing PD in patients with arthritis, the use of powered rotating-oscillating toothbrushes and antiseptic or fluoride mouthrinses has been recommended to improve oral hygiene. However, clinicians need to emphasize to patients the importance of achieving good mechanical plaque control using appropriate aids. PD is associated significantly with alveolar bone loss and self-reported osteoporosis. Some studies indicate that estrogen replacement therapy for osteoporosis prevention in women also reduces the risk of experiencing tooth loss, but estrogen has not been used as a potential agent to reduce tooth loss in older women.

**GUIDELINES FOR THE TREATMENT OF PERIODONTAL DISEASE IN OLDER ADULTS**

Periodontal infection and inflammation interact with many other ailments experienced by older adults, and they likely diminish oral function, reduce quality of life, imperil nutrition and increase the patient’s risk of developing several chronic systemic diseases. Since the consequences of PD are severe, general dentists need to help older adults preserve their periodontal health.

Most evidence indicates that older adults generally respond to periodontal therapy similar to they way younger adults do. As patients age, however, the presence of multiple chronic medical conditions and polypharmacy becomes a concern. Clinicians should review carefully the patient’s medical history and prescribe pharmaceuticals judiciously to prevent unwanted drug interactions. Some medical conditions such as Alzheimer’s disease and arthritis inhibit plaque control, so clinicians should provide individualized oral hygiene instructions with appropriate aids or caregiver involvement; however, no clinical trial data comparing plaque control strategies in patients with debilitating medical conditions have been reported. Friedlander and colleagues provide suggestions specific to Alzheimer’s disease. Receiving repeated personalized oral hygiene instruction in a group setting also might help patients achieve better plaque control. With increasing dependence or morbidity, however, controlling disease progression might be a more realistic goal.

In general, treatment is influenced by the patient’s overall health, functional and esthetic needs. Once the clinician determines the patient’s oral health goals, he or she should identify overriding issues and modifiable factors (Figure 2). The treatment plan should address the modifiable

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<td>1. Life expectancy</td>
<td>1. Tobacco use, plaque control</td>
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<tr>
<td>2. Financial commitment</td>
<td>2. Controllable medical conditions (for example, diabetes)</td>
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<td>3. Permanent medical conditions (for example, intravenous bisphosphonate treatment)</td>
<td>3. Active oral disease</td>
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<td>4. Biological issues (for example, gingival biotype, bone quality)</td>
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**Figure 2.** Treatment plan considerations for older adults. Sources: Ellen and Holm-Pedersen.
risk factors, including risk factors for disease progression, within the limits posed by overriding issues. No treatment is contraindicated per se, which allows for the reliable use of implants in elderly people to replace teeth lost due to caries or PD.74

Dentists should give special consideration to patients who are frail or institutionalized if they cannot maintain oral hygiene. In such cases, nonsurgical periodontal therapy might be the only feasible option.75 Dentists can use chlorhexidine as an adjunct for oral hygiene if home care is poor in patients who are debilitated,76 but it may not be sufficient by itself to preserve oral health.

CONCLUSIONS

Older adults often have a variety of chronic medical conditions and take many medications. At the same time, they often have poor oral hygiene and PD, which may promote additional oral health problems such as root caries and exacerbate systemic complications related to poor nutrition and progressive chronic systemic diseases. Therefore, dentists should make every reasonable effort to prevent PD progression as the case report demonstrates. Good communication between patients’ general dentists, primary physicians and medical specialists is essential for managing the care of patients who have medically complex conditions. General dentists should be able to manage mild-to-moderate PD in older patients, since treatment is similar for all adults with mild-to-moderate forms of the disease. Since the understanding of PD is evolving, general practitioners in 20 years likely will have many more tools available for diagnosing and treating PD.77 Perhaps one day this might include regenerative gene therapy procedures that will be applied as easily as local anesthetic is today.78

[References]

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