When it comes to the complications of oral disease, the elderly are particularly vulnerable

AS THE BODY AGES

In the U.S., periodontal disease affects an estimated one in 10 adults, and one in five over the age of 65. It is the leading cause of tooth loss in adults. But emerging evidence linking periodontal disease to serious health problems, particularly in the elderly, is making diagnosis and treatment even more crucial. | BY **FRANK A. SCANNAPIECO**

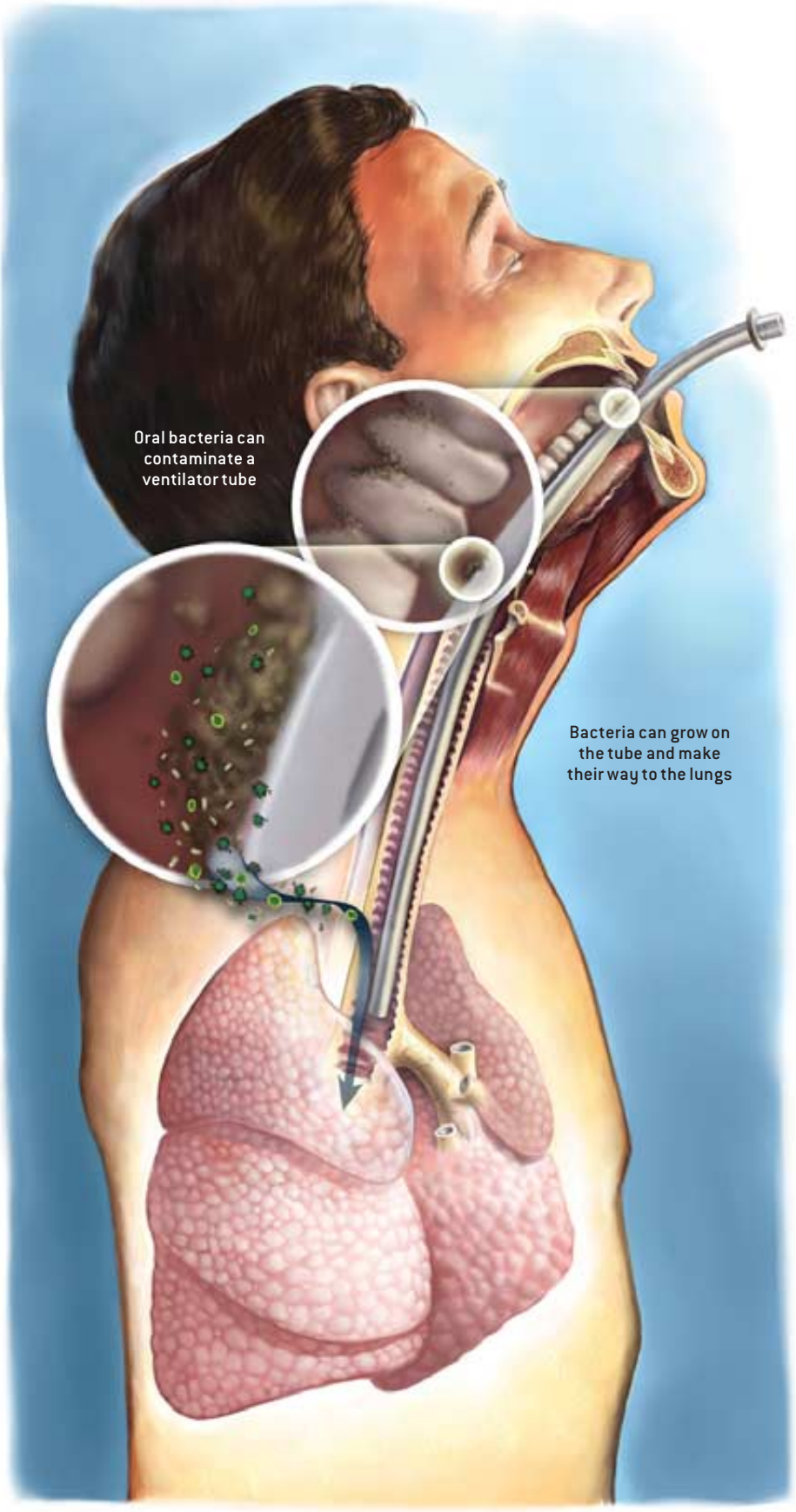
EVELYN JONES, an 89-year-old woman, came to my office last year for a routine dental cleaning. She lived in a local nursing home and had not been to a dentist in over a year. Aside from high blood pressure, which was being treated with diuretics, she apparently had no other medical problems. A dental exam revealed red, swollen gums and several loose teeth.

Mrs. Jones said she'd had a cold and felt tired. She also appeared short of breath, light-headed, and complained of chest pain. I took her blood pressure, which was elevated. Suspecting that she might have a heart problem, I urged her to see a physician immediately. Her caregiver drove her from my office to the hospital, where she was admitted with a diagnosis of pulmonary hypertension: high blood pressure had narrowed and thickened the vessels carrying blood to her lungs, making her heart work harder and causing fluid to build up in her lungs.

After treatment with calcium channel blockers, which increase blood and oxygen flow to the heart, her condition improved. But on her third day in the hospital she developed a fever and cough, which proved to be pneumonia. She was placed on antibiotics. Two days later, lung cultures revealed that her pneumonia had been caused by the intestinal bacterium *Escherichia coli*, which was also found in her blood. She was switched to a different antibiotic on day six, but her condition worsened. She experienced kidney failure on day seven, and died on day nine. Believe it or not, Mrs. Jones's poor oral health may have contributed to her death.»

JOHN SOARES

HEALTHY MOUTH, HEALTHY BODY: Maintaining proper oral health is important at any age. Diseases that threaten the elderly can be exacerbated by poor oral care.



AN INFECTIOUS PATH: When patients are hooked to a ventilator, their risk of pneumonia can increase 20-fold, making it the leading killer among hospital-acquired infections. Oral bacteria in dental plaque can "jump" to the tube and begin to grow on it, eventually making their way down into the lungs.

MATT COLLINS

Over the past several decades, researchers have found that tooth and gum health may influence the health of the entire body. Their provocative studies have shown that gum disease may increase a person's risk for heart attack, stroke, diabetes and—as in Mrs. Jones's case—pneumonia. These findings are especially pertinent to older people, because the likelihood of developing oral disease increases with age.

How poor oral health might affect overall health still is being actively investigated. Some researchers theorize that when the gums bleed, bacteria from the mouth enters the bloodstream and migrates to other parts of the body where they trigger health problems. For example, some heart valve infections are clearly linked to recent dental work. Among people with heart valve problems, oral bacteria that enter the blood may attach to the valves, causing a potentially fatal inflammatory disease called endocarditis. As a preventive measure, dentists since the 1950s have routinely prescribed antibiotics to patients with valve problems before even the simplest of procedures, such as a routine cleaning or filling a cavity.

To see if oral health might be associated with heart disease, in 1989 a team of Finnish investigators studied 100 recent heart attack patients and a similar number of closely matched people without a history of heart disease. The heart patients had substantially worse dental health, including a much higher prevalence of periodontal disease, than the control subjects. This finding sparked considerable interest. Numerous follow-up studies conducted since then have mostly supported a link between periodontal disease and an increased risk for heart disease. Other research has found a similar association between periodontal disease and stroke.

Both heart attack and stroke are caused by atherosclerosis, the buildup of fatty deposits within the arteries that channel blood to the heart and brain. With evidence now showing that inflammation helps fuel atherosclerosis, researchers are exploring whether cyto-

ORAL DISEASE & OSTEOPOROSIS

BY **JEAN WACTAWSKI-WENDE**

IS BONE LOSS from oral infection associated with osteoporosis? Research on osteoporosis and oral bone loss has shown a fairly consistent relationship, including a recent University at Buffalo study that linked osteoporosis and periodontal disease, which caused loss of both oral bone and teeth—especially in women aged 70 years and older. But other types of studies have produced inconsistent results, or have revealed no connection at all. This is due, in part, to study design variation. For example, several negative studies have included subjects in their 40s and 50s, when osteoporosis and low bone density prevalence is low. Assessment of both osteoporosis and periodontal disease can also differ across studies, which sometimes makes comparison and interpretation difficult.

How does bone loss occur? Bones are living, growing tissues that undergo constant remodeling in response to the stress placed upon them. About 10 percent of the body's total bone mass is "remodeled" each year—removed and then replaced. Cells called osteoclasts lay on the bone surface, breaking down existing bone in a process known as resorption. Their counterparts, osteoblasts, then secrete collagen and minerals to lay down new, replacement bone.

In osteoporosis, there is an imbalance: Either too much bone is resorbed or too little bone is formed. This skeletal disorder decreases the quality, density (amount) and strength of bone, which becomes abnormally porous and spongy, and fractures easily. According to the National Osteoporosis Foundation, an estimated 10 million Americans have the disease; almost 34 million more have low bone mass. Three quarters of these are women.

Periodontitis, a bacterial infection in the mouth, is the primary cause of tooth loss in adults. It destroys both gum tissue and the alveolar bone that supports the teeth. Researchers are exploring how alveolar bone is lost—and how it may be connected to osteoporosis and body-wide bone loss. Because osteoporosis is a systemic disease, it may affect bones in the mouth in a number of ways. Bone loss around teeth may occur independent of oral inflammation. Osteoporosis may lead to more rapid breakdown of alveolar bone after oral bacteria invades.

Systemic factors that affect bone remodeling may also modify how local tissues respond to periodontal infection. Specifically, people with overall bone loss are known to have increased system-wide production of cytokines (specifically IL-1 and IL-6) that may impact bone quality throughout the body—including the bones of the oral cavity. Periodontal infection, in turn, increases local cytokine production that boosts local osteoclast activity—accelerating alveolar bone loss.

Both osteoporosis and gum disease share a number of risk factors. Individuals with a genetic predisposition to bone loss are also more vulnerable to periodontal destruction. Lifestyle factors such as cigarette smoking and low calcium intake as well as the effects of aging may also put individuals at greater risk for low bone density and loss of alveolar bone.

Ongoing studies will provide further insight into the interaction of osteoporosis and periodontal bone loss, which will be increasingly important in the prevention of these two very prevalent disorders in older Americans. ●

JEAN WACTAWSKI-WENDE is associate chair of the Department of Social and Preventive Medicine at the State University of New York at Buffalo.

JOHN SOARES

kines and other inflammatory chemicals from diseased gums may travel through the blood and contribute to the problem.

In Mrs. Jones's case, excess dental plaque and periodontal disease may have set the stage for nosocomial (hospital-acquired) pneumonia, a leading cause of death among older Americans. Elderly, institutionalized people like Mrs. Jones are at particular risk for developing pneumonia while hospitalized because, along with other factors, they tend to have poor oral hygiene. So when they enter the hospital, their dental plaque—the bacterial biofilm that forms on teeth—is more likely to become colonized by the disease-causing bacteria that lurk in hospitals. The swallowing difficulty that often accompanies old age also increases the amount of bacteria in the mouth—it is not washed away by saliva, increasing the likelihood that it and other oral debris will inadvertently be inhaled into the lungs.

This risk is magnified if a mechanical ventilator is needed to assist patients who cannot breathe on their own by pumping air into the lungs via a tube inserted into the mouth or nose. Ventilated patients are up to 20 times more likely to develop pneumonia than those breathing on their own. Oral bacteria can grow on the tube and travel into the lungs. Not surprisingly, between 10 and 25 percent of these patients develop ventilator-associated pneumonia (VAP), making it the leading cause of death from hospital-acquired infections.

Improving oral hygiene among the institutionalized elderly would be a cost-effective way to reduce the risk of pneumonia caused by bacteria in the mouth. More than a dozen studies have shown that simple measures, such as supervised toothbrushing and regular use of antibacterial mouthwashes, can reduce by more than half the risk of pneumonia in those people living in nursing homes or admitted to the hospital.

Chronic obstructive pulmonary disease (COPD), which limits the flow of air into the lungs, is also associated with poor oral hygiene and periodontal disease. COPD usually stems from long-term cigarette smoking and can involve a spectrum of conditions, including emphysema and chronic bronchitis. People with COPD are at increased risk for periodontal disease, which, when present, seems to cause lung function to deteriorate further. Because smoking is also a major risk factor for periodontal disease, it is difficult to separate the roles that each of them plays in COPD. Preliminary studies by my colleagues and me indicate that, while smoking is clearly the major cause of COPD, periodontal disease may exacerbate it.

Clearly, more dedicated efforts to keep gums healthy may reap health dividends far beyond improving oral health and keeping your teeth.

Other systemic diseases that affect older individuals may also be influenced by oral health status. For example, osteoporosis disproportionately affects postmenopausal women, thinning bones and often leading to bone fracture. Periodontal disease apparently does not increase one's vulnerability to osteoporosis, but people with the latter appear to face an increased risk of developing oral disease and tooth loss. My colleague Jean Wactawski-Wende and our research group at the University at Buffalo have found a strong and consistent association between osteoporosis and periodontal disease that causes both tooth and jawbone loss—especially among women ages 70 and older [*see box on page 33*].

Oral infection and the gum inflammation it causes may also contribute to oral cancers. Researchers hypothesize that bacterial toxins, enzymes and the chemicals involved in inflammation may cause mutations in human cells that lead to uncontrolled growth and, ultimately, cancer. This work is still in its infancy, but results so far are provocative.

One recent study on the health status of a cross-section of the U.S. population included an assessment of the oral health of more than 13,000 people. People diagnosed with periodontal disease had a significantly higher risk of also having oral cancer compared with those who had healthy gums, even after controlling for age, a history of smoking and other factors that might have skewed the results.

Finally, periodontal disease has also been associated with rheumatoid arthritis (RA), an autoimmune disease that inflames joints and can cause destruction of cartilage, bone and ligaments. The two diseases share some basic characteristics: both the gum tissues affected by periodontal disease and the joints affected by RA contain similar cytokines and growth factors. These chemicals promote the dissolution of bone, a problem shared by both diseases. This suggests the presence of a common underlying inflammatory mechanism. People with advanced RA are known to be at increased risk for developing periodontal problems—and vice versa.

Clearly, more dedicated efforts to keep gums healthy may reap health dividends far beyond improving oral health and retaining your teeth. The good news is that controlling and even preventing periodontal disease is possible through relatively low-tech means: daily brushing and flossing, plus regular trips to your dentist's office for cleanings and checkups. Knowing that maintaining oral hygiene could help prevent more serious conditions may be just the incentive both young and old need to make it a habit.

FRANK A. SCANNAPIECO studies oral microbiology and the interface between oral and systemic health—specifically, the role of oral conditions in the process of respiratory infection. He is professor and chair of the Department of Oral Biology, School of Dental Medicine at the State University of New York at Buffalo. He has been engaged in dental research and education for over 20 years.