Systemic Diseases and Oral Health

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KEYWORDS

• Chronic illnesses • Diabetes mellitus • Cardiovascular diseases
• Systemic complications

KEY POINTS

- Oral disease management is more complex in patients with several systemic diseases.
- Severe periodontitis adversely affects diabetes control.
- Additional considerations exist for diabetic patients in a dental office setting.
- Osteoarthritis of the hands reduces manual dexterity and constrains the patient's capability of maintaining adequate oral hygiene.

INTRODUCTION

Several new studies have shown that an association exists between oral diseases and systemic chronic diseases. Inflammation has additionally been recognized as the key factor that connects many of these diseases.[1] Chronic diseases are defined as long-lasting illnesses, with duration of more than 3 months that affect a person's life and require constant medical treatment. Chronic diseases more frequently affect aging individuals; 80% have one chronic condition, and 50% have at least 2 conditions.[2] Chronic conditions are the leading cause of death and disability in the United States. According to the National Vital Statistics, the 10 leading causes of death among the 65-years-and-over age group are heart diseases, malignant neoplasm, chronic lower respiratory diseases, cerebrovascular diseases, Alzheimer diseases, diabetes mellitus (DM), influenza and pneumonia, nephritis, unintentional accidents, and septicemia.[3] The authors have chosen to select cardiovascular diseases (CADs), hypertension,

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diabetes, arthritis, osteoporosis, and stroke to discuss in this article. Their connection to oral health is highlighted and oral recommendations are provided. Aspiration pneumonia and cognitive impairment of older adults are discussed in the articles written by Drs Scannapieco, Shay, Brennan, and Strauss.

Fig. 1 shows the percentage of elder individuals affected by one or more chronic diseases.

The complexity of dental treatment in the elderly is greater because of the effects of these chronic diseases, the medications prescribed, and their adverse effects. Systemic diseases can influence oral health, and oral health has an impact on overall health. Social interactions, self-esteem, dietary choices, and nutrition are enhanced by good oral health.

It is important for oral health professionals to understand and recognize the impact of systemic diseases on oral health. With this expanded knowledge, they will be better able to recommend adequate prevention mechanisms and design appropriate oral health treatment plans.

DM

DM is a group of diseases characterized by high levels of blood glucose resulting from defects in insulin production, insulin action, or both. There are 2 main types of diabetes.

- Type 1 diabetes, or insulin-dependent diabetes mellitus (IDDM), is an autoimmune disease that causes the destruction of the insulin-producing β-cells in the pancreas.[4] IDDM is primarily seen in children and younger adults and accounts for approximately 5% of diabetes cases.
- Type 2 diabetes, or noninsulin-dependent diabetes mellitus (NIDDM), is characterized by resistance to insulin and inadequate production of insulin.[5] NIDDM is the most common form of diabetes seen in adults, accounting for between 90% and 95% of cases.

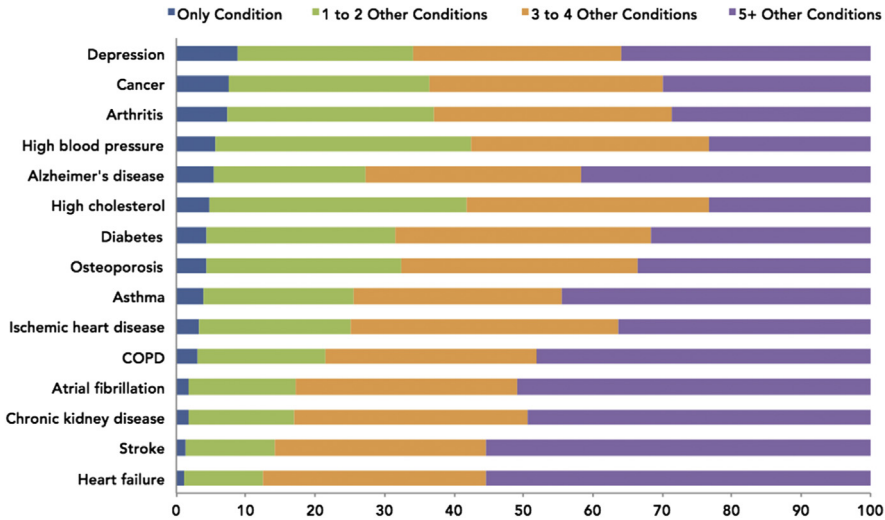

Fig. 1. Co-morbidity among chronic conditions for Medicare fee-for-service beneficiaries, 2010. (*From* Centers for Medicare and Medicaid Services. Chronic conditions among Medicare beneficiaries. Available at: http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/Downloads/2012Chartbook.pdf. Accessed June 13, 2014.)

- Other types of diabetes including gestational and other genetically specific forms of diabetes account for less than 5% of total diabetes cases.[6]

The following criteria from the American Diabetes Association may be used for the diagnosis of diabetes[7]:

- A1C $\geq$6.5%. The test is performed in a laboratory using the method of the national glycohemoglobin standardization program certified and standardized to the diabetes control and complication trials assay.
- Fasting plasma glucose $\geq$126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 hours.
- Two-hour plasma glucose $\geq$200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
- In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose $\geq$200 mg/dL (11.1 mmol/L).

Data from the 2011 National Diabetes Fact Sheet show that the prevalence of diabetes in people aged 65 years or older was approximately 26.9% (10.9 million).[6] After adjusting for age and gender, the annual per capita health care expenditure is 2.3 times higher for diabetics than for those without diabetes. Diabetes is especially costly when it presents with complications.[8] It is the seventh leading cause of death in the United States.[6] According to the HealthPartners Dental Group, patients with poorly controlled or uncontrolled diabetes are more susceptible to other illnesses, including periodontal disease.[9,10] Diabetics aged 60 years and older are more likely to be unable to walk one-quarter of a mile or climb stairs when compared with nondiabetics of the same age.[6]

Systemic Complications of Diabetes

- *Heart disease and stroke.* In 2004, heart disease was noted on 68% of diabetes-related death certificates and stroke was noted on 16%. Diabetics have 2 to 4 times greater incidence of stroke and/or heart disease death rates compared with adults without diabetes.[6]
- *Hypertension and dyslipidemia* are risk factors for CVD, and diabetes itself confers an independent risk.[11]
- *Blindness and ocular problems.* The leading cause of new cases of blindness among adults is diabetes.[6]
- *Kidney disease.* Diabetes is the leading cause of kidney failure, accounting for 44% of all new cases of kidney failure in 2008.[6]
- *Neurologic problems.* About 60% to 70% of people with diabetes suffer from some degree of nerve damage including impaired sensation on feet or hands, slowed digestion of food in the stomach, or other neurologic problems.[6]
- *Amputations.* Peripheral neuropathy and decreased pain sensation has been shown to increase the risk of skin breakdown and severe nonhealing infections. More than 60% of nontraumatic lower-limb amputations occur in people with diabetes.
- *Mental health.* People with diabetes have twice the risk of depression. Depression is also associated with a 60% increase of developing type 2 diabetes. Diabetes management is further complicated by mental illness because it often leads to poor patient compliance. Patients with diabetes may also experience anxiety, stress, and anger.[6,12]
- *Hearing loss.* According to the American Diabetes Association, hearing loss is twice as common in people with diabetes. The results of a 2013 study revealed

a close link between audiovestibular dysfunction and diabetes. Based on these findings, vestibular dysfunction and sensorineural hearing loss may be considered among the chronic complications due to NIDDM.[13]

Oral Health Implications of Diabetes

- *Gingivitis and periodontal disease.* Periodontitis is the major cause of tooth loss in elderly subjects and is considered to be the sixth complication of DM.[14,15] Adults aged 45 years and older with poorly controlled diabetes (A1C >9%) are 2.9 times more likely to have severe periodontitis than those without diabetes. The likelihood is even greater (4.6 times) among smokers with poorly controlled diabetes.[6] Diabetes also delays healing and increases the risk of oral infection and abscess formation.

A recent Korean study of an elderly population demonstrated the relationship between metabolic conditions and the prevalence of periodontal disease. The results showed that participants with longer durations of diabetes, high blood pressure, and obesity were significantly more likely to have periodontal disease.[16]

Periodontal disease is associated with hyperglycemia and poor control of diabetes. The association is considered to be bidirectional: diabetes is a risk of periodontitis and periodontitis is a possible severity factor for diabetes.[17]

Diabetes induces the formation of AGE (advanced glycation end-products), elevates cytokines levels, and enhances oxidative stress in periodontal tissues exacerbating periodontal disease. However, periodontal treatment can play an important role in controlling diabetes by reducing plasma HbA1C at 3 months by levels equivalent to adding a second drug to a pharmacologic regimen (**Fig. 2**).[18]

- *Xerostomia* is dryness of the mouth, which is caused by salivary dysfunction. Researchers in Macedonia concluded that there is a significant correlation between the degree of xerostomia and salivary levels of glucose.[19] Salivary

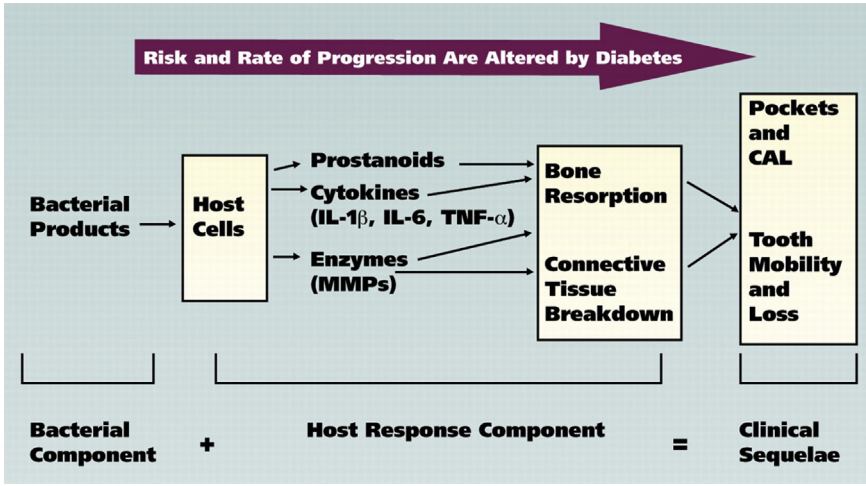

Fig. 2. Simplified schematic depicting etiologic factors and cascade of events contributing to periodontitis that are altered by diabetes. CAL, clinical attachment loss; IL-1β, interleukin-1β; IL-6, interleukin-6; MMPs, matrix metalloproteinases; TNF-α, tumor necrosis factor-α. (*From* Ryan ME, Carnu O, Kamer A. The influence of diabetes on the periodontal tissues. J Am Dent Assoc 2003;134:34S–40S; with permission.)

hypofunction leads to dry and friable oral mucosa, decrease in lubrication, decreased antimicrobial activity, increased caries activity, increased oral fungal infections, glossodynia, dysgeusia, dysphagia, difficulty with mastication, and impaired retention of removable prostheses.[20] Elderly populations are more often affected by xerostomia because of a higher prevalence of systemic diseases and the increased use of prescription drugs.

- *Dental caries* have been found to be more common and more severe in diabetic patients. A decreased salivary flow rate, along with poor glycemic control and significantly increased value of HbA1C, was found to be associated with a higher number of carious teeth. Further research is needed to establish a better role for salivary flow rate and minerals with regard to dental caries of diabetic patients.[21]
- *Oral mucosa lesions.* Studies have shown that specific lesions, such as geographic tongue, denture stomatitis, and angular cheilitis, occur with significantly greater frequency among diabetics.[22,23] The cause of geographic tongue in diabetics is still unknown, but may be associated with slower repair and delayed healing caused by the microangiopathy of the oral vasculature in diabetic patients.[22]
- *Fungal infections.* Several researchers have reported that diabetics have an increased predisposition to oral candidiasis, denture stomatitis, and angular cheilitis.[24] There is a high incidence of candidiasis as well as a secondary relationship with salivary dysfunction in diabetic patients.

Drug Interactions and Effects

Polypharmacy is a constant issue in the care of geriatric patients. For this reason, potential interactions with medications should always be considered when administering or prescribing any drugs in the dental setting.

- Insulin, a hormone used to treat IDDM, is compatible with most medications prescribed in the dental office. However, extended doses of aspirin can enhance the hypoglycemic effect of insulin.[25] Consequently, these drugs should not be used for prolonged periods of time.
- Metformin is an oral antidiabetic drug that may cause an increased hypoglycemic effect with extended use of nonsteroidal anti-inflammatory drugs (NSAIDs) and aspirin. Similarly, the tablet form of the antifungal agent Ketoconazole can also enhance this hypoglycemic effect.[26] Long-term use of metformin can lead to vitamin B12 deficiency.[27] This deficiency is associated with atrophic glossitis, angular cheilitis, candidiasis, and recurrent aphthous stomatitis.[28]
- The quantity of epinephrine contained in the dental anesthetic has no significant effect on the diabetic patient's blood sugar level.[29]

Recommendations for Providing Dental Care to Diabetics

- Dental providers should assess glycemic control routinely before any invasive procedures.
- Patients should be asked about any changes in insulin dosage, hypoglycemic medications, and diet before their dental appointment.
- Consultations with an interdisciplinary health team should be done when needed.
- Routine screening for diabetes complications and close monitoring of patients should be done at each visit.
- The oral health provider should emphasize preventive procedures, periodic oral examinations, and prevention of periodontal disease. Patients with diabetes require good oral hygiene habits for maintenance of their oral health.

HYPERTENSION

Hypertension is defined as systolic blood pressure greater than 140 mm Hg or diastolic blood pressure greater than 90 mm Hg. It is one of the most common and potentially dangerous medical conditions among the elderly, affecting approximately two-thirds of men and three-quarters of women 75 years and older.[30,31]

The World Health Organization (WHO) describes hypertension as a global public health issue. In the United States, about 77.9 million (1 of every 3) adults have high blood pressure, and future projections suggest that the prevalence will increase by 7.2% by 2030 (**Table 1**).[32]

It is very important to routinely measure blood pressure at each geriatric patient's dental appointment. Hypertension is called "the silent killer" because individuals do not present with signs or symptoms and may not realize they have it. Hypertension presents differently in elderly and younger people. **Box 1** summarizes the specific features of hypertension among the elderly.[30]

Systemic Complications of Hypertension

- Hypertension is associated with shorter overall life expectancy and a shorter life free of CVD.
- Atherosclerosis is caused when hypertension damages the endothelium in the wall of the blood vessels[33]; it affects the aorta and its major branches, the coronary artery and the larger cerebral artery. The arterial changes include the narrowing of the lumen of the vessels, weakening of the arterioles, and eventual rupture of the vessel. Atherosclerosis is a common cause of myocardial infarctions and cerebrovascular accidents.[34]
- CVDs are associated with advanced hypertension. About 50% of people who suffer a first heart attack have blood pressure greater than 160/95 mm Hg.[35] Reducing diastolic blood pressure from 90 mm Hg to 80 mm Hg in a study of people with diabetes reduced the risk of major cardiovascular events by 50%.[36]
- Cerebrovascular accident or stroke constitutes the leading cause of death in the United States and is also the leading cause of serious long-term disability. High blood pressure, high low-density lipoprotein cholesterol, and smoking are the key risk factors for strokes.[37] Approximately 66% of people experiencing a first stroke have high blood pressure.[35]
- Increased blood pressure can cause dilation of the wall of an artery or vein, forming an aneurysm. If an aneurysm ruptures, it can be life-threatening.
- Hypertensive retinopathy refers to the rupture and hemorrhage of the retinal arterioles. Examination of the eyes may show early changes of hypertension consisting of narrowed arterioles with sclerosis.
- Alzheimer disease and hypertension are major determinants of cognitive dysfunction and are associated with alterations in the structure and function of

Table 1
Hypertension among elder adult populations (2007–2010)

	65–74 y	75 + y
Men	64.1%	71.7%
Women	69.3%	81.3%

Data from National Center for Health Statistics. Health, United States, 2012: Table 64. Hypertension among adults aged 20 and over, by selected characteristics: United States, selected years 1988–1994 through 2009–2012. Hyattsville (MD): 2013. Available at: http://www.cdc.gov/nchs/data/hus/2012/064.pdf. Accessed August 1, 2014.

Box 1
Features of hypertension among the elderly

- Elevated systolic blood pressure (BP) is more common in the elderly
- Impaired baroreflex sensitivity (receptor responsible to buffer blood pressure against sudden changes in posture)
- Variability in blood pressure during daily activities
- Hypotension during activities such as standing upright and eating
- Association with cognitive and functional decline
- CVD or sleep apnea increases BP at night or awakening

Adapted from Lipsitz LA. A 91-year-old woman with difficult-to-control hypertension: a clinical review. JAMA 2013;310(12):1274–80.

cerebral vessels. These vascular alterations may impair delivery of energy substrates and nutrients to the brain and impede the clearance of potentially toxic products.[38] A systematic review published in September 2013 showed the paucity of research addressing the association between hypertension and dementia. The available data point toward antihypertensives being effective in lowering blood pressure in people with mild to moderate dementia, but there is no evidence of benefit in cognitive outcomes.[39]

- Hypertensive nephropathy or end-stage renal disease is closely related to chronic hypertension.

Oral Health Implications of Hypertension

- Drugs used for the treatment of hypertension can cause xerostomia, which potentially causes extensive tooth decay, mouth sores, and oral infections. Patients with xerostomia often complain of difficulty in swallowing and glossodynia. Thiazide diuretics, α-/β-blockers, angiotensin-converting-enzymes inhibitors, and calcium channel blockers increase the risk of xerostomia.[40]
- The Puerto Rican Elderly Dental Health Study suggests that periodontitis may contribute to poor blood pressure control among adults.[41] However, more studies are needed to ascertain this finding.
- Gingival hyperplasia is a side effect of Nifedipine, Diltiazepan, Verapamil, and Amlodipine (calcium channel blockers) used in the treatment of hypertension.[42] In severe cases, surgical removal of tissue may be required.[43]
- Mucosa lesions such as lichenoid reactions may also be caused by several hypertensive medications.

Drug Interactions and Effects

- Diuretics are the drugs mostly used for the management of hypertension. NSAIDs can decrease the efficacy of thiazide diuretics and β-blockers if used for more than 5 days.[44,45] Elderly patients should be prescribed the lowest effective NSAID dose for the shortest duration possible. NSAIDs may also induce new onset hypertension or worsen pre-existing hypertension. Blood pressure should be routinely monitored in patients prescribed NSAIDs.[46]
- Patients medicated with nonselective β-blockers are at risk for acute hypertensive episodes if they receive vasopressors (ie, epinephrine) in local anesthetics.[45] α-/β-Blockers and diuretics may potentiate the actions of anti-anxiety medications and sedative drugs.[47]

- β-Blockers affect the central nervous system and may cause orthostatic hypotension resulting in fainting and falls after a patient gets up from the dental chair.[48] The prevalence of orthostatic hypotension is higher in older community-dwelling adults with uncontrolled hypertension than in those with controlled hypertension.[49]
- Calcium blockers cause vasodilation and reduction in heart rate.[50]
- Calcium blockers, such as Verapamil and Diltiazem, compete with macrolide antibiotics, such as erythromycin and azithromycin, for liver metabolism. The potentially elevated levels of macrolides could result in cardiac toxicity, and elevated levels of calcium blockers can cause bradycardias and atrioventricular block.[50]

Recommendations for Providing Dental Care to Hypertensive Patients

- Measure a patient's blood pressure before the initiation of any dental treatment. Follow guidelines noted in **Box 1**.
- Consultation with an interdisciplinary team may be needed to establish a parameter in which a patient can be safely treated in the dental office.
- Use caution when administrating local anesthetics that contain epinephrine. Limit their usage to 1 or 2 cartridges of 2% lidocaine with 1:100,000 epinephrine.
- In patients with uncontrolled and severe hypertension, anesthetics without vasoconstrictors should be used. Vasoconstrictors impregnated in gingival cords should also be avoided.
- Minimize the potential of orthostatic hypotension by raising the dental chair gradually and allowing the patient to remain in an upright seated position before standing.[49]
- Reduce stress and anxiety to avoid an acute elevation in blood pressure as a result of the released of endogenous catecholamines (**Table 2**).

CVDs

CVD refers to any disease that affects the heart, the blood vessels (arteries, capillaries, and veins), or both. The causes of CVD are diverse. Some risk factors can be controlled through lifestyle changes and/or medications, such as hypertension, hypercholesterolemia, obesity, diabetes, unhealthy diet, stress, tobacco use, and physical inactivity. On the other hand, nonmodifiable risk factors include advanced age, inherited disposition, gender, and ethnicity.

Table 2
Dental management and follow-up recommendations based on blood pressure levels

Blood Pressure	Dental Treatment	Referral to Physician
≤120/80	Any required	No
≥120/80 but <140/90	Any required	Encourage patient to see physician
≥140/90 but <160/100	Any required	Encourage patient to see physician
≥169/100 but <180/110	Any required; continuous monitoring of blood pressure during procedure	Refer patient to physician within 1 mo
≥180/110	Defer elective treatment	Refer patient as soon as possible; if patient is symptomatic, refer immediately

From Little JW, Falace DA, Miller CS, et al. Little and Falace's dental management of the medically compromised patient. 8th edition. Philadelphia: Elsevier; 2012; with permission.

The preferred clinical approach to cardiovascular prevention is to address all modifiable risk factors and support healthier lifestyles in the community. A healthy diet, moderate physical activity, and smoking cessation can prevent 80% of premature heart disease.[51] Heart disease is the leading cause of death in the United States, accounting for 1 in every 4 deaths.[52]

CVDs include:

- Coronary heart disease is the most common type of heart disease, occurring when the coronary arteries become narrowed or blocked as a result of the formation of plaques within the artery walls, reducing blood flow to the heart.
- Peripheral artery disease refers to the obstruction of large arteries (outside the heart and brain) from atherosclerosis. As a result of the inflammatory process, stenosis, thrombus, or embolism can develop.
- Cerebrovascular disease refers to a group of dysfunctions that affect the circulation of blood to the brain. Ischemic or hemorrhagic events result in tissue necrosis and neuronal injury (stroke). Stroke remains one of the major public health problems in the United States; approximately 795,000 new or recurrent cases occur each year.[53]

Oral Health Complications of CVDs

No oral manifestations are related to CVDs per se; however, side effects of medications used to treat CVDs affect the oral cavity. Dry mouth, burning of the mouth, taste changes, and lichenoid reactions are linked to side effects of heart failure medications.[54]

Epidemiologic evidence suggests an association among periodontal infections, atherosclerosis, and vascular disease. According to the American Academy of Periodontology, periodontal disease may double the likelihood of having coronary artery disease. The relationship between CVD and periodontal disease may be explained by different biological mechanisms.[55]

Dental professionals should follow the American Heart Association guidelines for antibiotic prophylaxis for those patients at risk of bacterial endocarditis.[56] Some patients on long-term anticoagulant therapy (Coumadin) are at an increased risk of excessive bleeding during surgical procedures. Dentists should consult with their patients' physicians about the type of procedure and the level of the international normalized ratio (INR). For patients who have stable INR, in the therapeutic range 2 to 4, oral anticoagulants should not be discontinued, even in cases where the patient requires a dental extraction.[57]

Patients on antiplatelet therapy, such as aspirin combined with clopidogrel/dipyridamole, could have increased postoperative bleeding after dental procedures. However, this bleeding can be managed using local haemostatic measures.

Drug Interactions and Effects

Digitalis glycosides is used to increase the myocardial contractility in patients with congestive heart failure. If digoxin toxicity occurs, signs and symptoms include hypersalivation, nausea, and vomiting. Digoxin may also increase the gag reflex.[58]

Because hypertension is a risk factor for stroke, many stroke patients take antihypertensive medications, such as β-blockers, calcium channel blockers, and anti-arrhythmics. Therefore, the same considerations as described in the section of hypertensive patients should be taken into account.

Recommendations for Providing Dental Care to Patients with CVDs

- Evaluate vital signs before any dental procedure.
- Schedule short appointments, preferably in the morning.
- Use caution when administering epinephrine (maximum 0.036 mg epinephrine or 0.20 mg levonordefrin) and anticholinergics; the use of these drugs may lead to cardiac excitation.[58]
- For patients taking digoxin, avoid the use of vasoconstrictors; these may cause arrhythmias. Watch for signs of digoxin toxicity, such as hypersalivation, because macrolide and tetracycline antibiotics may lead to digoxin toxicity.[58]
- Avoid the use of NSAIDs.[58]
- Avoid the use of gingival retraction cords impregnated with epinephrine in all patients with CVDs. Use alternatives such as tetrahydrozoline HCl 0.05% or oxymetazoline HCl 0.05%.
- Be cautious when using electrical devices that might interfere (eg, ultrasound scalers) in patients with pacemakers or implantable defibrillators.[59]
- The INR or the prothrombin time laboratory values should be measured when performing dental procedures in patients with anticoagulant therapy to assure that they are in the acceptable range.

CEREBROVASCULAR DISEASE

Stroke is a cerebrovascular disorder characterized by a sudden interruption of blood flow to the brain, causing oxygen deprivation. It is frequently seen in patients with current CVDs.[60] Stroke is the fourth leading cause of death in the United States and a major cause of adult disability.[32,61]

Systemic Complications of Stroke

- Cardiac complications, such as myocardial infarction, cardiac arrhythmias, congestive heart failure, and cardiomyopathy, can occur after a stroke.[62]
- Pulmonary complications, such as pneumonia, are the most frequent complications within the first 48 hours after a stroke. Most stroke-related pneumonias result from aspiration.[63]
- Gastrointestinal complications, such as dysphagia, which could lead to restriction of oral intake, can cause malnutrition and dehydration in stroke patients.[64]
- Genitourinary complications, including urinary incontinence and urinary tract infections, delay hospital discharge and can lead to institutionalization of patients.[65]
- Venous thromboembolism, some of which are deep vein thrombosis and pulmonary embolism, can occur within 2 weeks after a stroke.[62]
- Other complications include depression, pain, fatigue, decubitus ulcers, hip fractures, immobility, or being bedridden.

Oral Health Complications of Stroke

Stroke patients are very vulnerable to oral diseases because of the limitations in the activities of daily living and impaired manual dexterity.[66] Inadequate oral hygiene combined with xerostomia leads to additional oral problems, such as candidiasis, dental caries, periodontitis, mucosal lesions, and tooth loss.

Drug Interactions and Effects

These drug interactions and effects are similar to those discussed in the CVDs section.

Recommendations for Providing Dental Care to Patients Affected by Stroke

- More frequent recall appointments are recommended and preventive oral care is critical.
- Electric toothbrush or adaptive holders are recommended when impaired manual dexterity exists.
- Dentists should defer elective and invasive dental care for patients within the first 3 months after a stroke.
- Seat the patient in an upright position and use caution to avoid aspiration of foreign objects by the patient during dental treatment.[67]

ARTHRITIS

Arthritis is a musculoskeletal disorder characterized by the inflammation of one or more joints, causing pain and stiffness in the affected joints.[68] There are more than 100 types of arthritis; some of the more common types include osteoarthritis (OA), rheumatoid arthritis, systemic lupus erythematosus, Lyme disease, scleroderma, gout, fibromyalgia, and psoriadic arthritis.[69]

OA is a degenerative joint disease that is the most common form of arthritis among the elderly. OA affects both men and woman, but after age 45, it is more common in women.[70] An estimated 27 million adults had OA in 2005, and 50% of those 65 and older were diagnosed with the condition.[71,72] OA is the most common form of joint disease and is a leading cause of disability in elderly people.[73]

There is no cure for arthritis; treatments serve to reduce pain, improve function, and slow disease progression. Acetaminophen is recommended as a first-line drug, with aspirin and NSAIDs also commonly used. Narcotic analgesics and intra-articular steroid injections are reserved for acute flares over short periods of time. Surgery, including joint replacement, may be indicated to improve function.[47]

Oral Health Implications of Arthritis

- Arthritis can affect the temporomandibular joint, compromising the range of jaw aperture and affecting mastication.
- OA of the hands causes pain and reduces manual dexterity, which can affect oral hygiene by making routine brushing and flossing more challenging.
- Patients with prosthetic joints need antibiotic prophylaxis before invasive dental treatment to prevent oral bacteria from traveling through the bloodstream to the prosthetic joint. Dental providers should follow the updated guidelines by the American Academy of Orthopaedic Surgeons for antibiotic prophylaxis for patients with joint replacements.

Drug Interactions and Effects

- Aspirin and NSAIDs may increase bleeding during dental procedures, but it is usually not clinically significant.[69,74,75]
- As previously noted, blood pressure should be routinely monitored in patients taking NSAIDs because these drugs may induce new onset hypertension or worsen pre-existing hypertension by causing fluid retention or edema.[46]

Recommendations for Providing Dental Care to Patients with Arthritis

- The use of an electric toothbrush and floss with a long handle can facilitate daily oral hygiene for patients with manual limitations.
- Short appointments are preferable in patients with multiple joint problems because these patients may have joint discomfort and pain in numerous regions

of their bodies. Patients should also be allowed to adjust their positioning as needed.[69]
- Additional pillows, cushioning, and/or adjustments of the dental chair can aid in patient comfort.
- For patients with removable partial dentures, clasps should be designed to maximize ease of placement and removal.

OSTEOPOROSIS

Osteoporosis is defined as a skeletal disorder that compromises bone strength, predisposing a person to an increased risk of bone fracture due to inhibited calcium intake and mineral loss. Osteoporosis can be characterized as either primary or secondary. Primary osteoporosis occurs in both genders at all ages, but typically follows menopause in women and occurs later in life in men. Secondary osteoporosis is the result of medications (glucocorticoids), other conditions (hypogonadism), or diseases (celiac disease, cystic fibrosis).[76]

Osteoporosis has been defined from bone mineral density (BMD) assessment. According to the WHO criteria, osteoporosis is defined as a BMD 2.5 SDs or more less than the average value for young healthy women (a T score of < -2.5 SD).[77]

The National Osteoporosis Foundation estimates that more than 10 million people over the age of 50 have osteoporosis and another 34 million are at risk for the disease. Bone fractures among the elderly reduce mobility and potentially increase the need for long-term care. Hip fractures are particularly problematic; 1 in 3 older adults who lived independently before a hip fracture remained in a nursing home for at least 1 year after their injury.[78]

Oral Health Implications of Osteoporosis

Studies have shown that mandibular and maxillary bone densities, as well as alveolar BMD and height, are modestly correlated with other skeletal sites. However, whether low BMD in the jaw results in other adverse changes, such as missing teeth, gingival bleeding, greater probing depth, and gingival recession, is still unclear.[79]

Drug Interactions and Effects

Bisphosphonates are the primary drugs used to treat osteoporosis by suppressing osteoclast activity and increasing BMD. Intravenous (IV) bisphosphonates are used in the treatment of certain malignancies, skeletal-related events associated with bone metastases, and multiple myeloma. Oral bisphosphonates are used to treat osteoporosis and osteopenia (decrease of calcification and bone density). Patients treated with IV bisphosphonates have a risk of developing bisphosphonates-related osteonecrosis of the jaw (BRONJ). This risk increases when the duration of the therapy exceeds 3 years.[80] Patients taking oral bisphosphonates are at a considerably lower risk.[81]

According to the American Academy of Oral and Maxillofacial Surgeons, patients with BRONJ present all of the following characteristics: current or previous treatment with bisphosphonates, exposed bone in the maxillofacial region that has persisted for more than 8 weeks, and no history of radiation to the jaw.[82,83]

Recommendations for Providing Dental Care to Patients with Osteoporosis

- Dentists should be aware of the implications and possible risks when patients are under bisphosphonates therapy.[84]

Table 3
Dental treatment recommendations for patients treated with bisphosphonates

Patient Therapy with Bisphosphonates	Recommended Oral Treatment
• Oral bisphosphonate therapy • Beginning IV bisphosphonate therapy • IV bisphosphonate therapy for <3 mo with no osteonecrosis of the jaw	• Treat active oral infections • Eliminate sites at high risk for infection • Remove nonrestorable teeth and teeth with substantial periodontal bone loss • Encourage routine dental care, oral examinations, and cleanings. Minimization of periodontal inflammation, restorative treatment of caries, and endodontic therapy where indicated
• IV bisphosphonate therapy for 3 mo or more with no osteonecrosis of the jaw	• Seek alternatives to surgical oral procedures with appropriate local and systemic antibiotics • Conduct extractions and other surgery using as little bone manipulation as possible, appropriate local and systemic antibiotics, and close follow-up to monitor healing
• Bisphosphonate therapy with osteonecrosis of the jaw	• Follow all recommendations for group 2 above • Consider additional imaging studies such as computed tomography scans. • Remove necrotic bone as necessary with minimal trauma to adjacent tissue • Prescribe oral rinses, such as chlorhexidine gluconate 0.12% • Prescribe systemic antibiotics and analgesics if needed • Fabricate a soft acrylic stent to cover areas of exposed bone, protect adjacent soft tissues, and improve comfort[85] • Suggest cessation of bisphosphonate therapy until osteonecrosis heals or the underlying diseases progresses (discussion with patient's medical providers)

Adapted from Kelsey JL. Musculoskeletal conditions. In: Lamster IB, Northridge ME. Improving oral health for the elderly. New York: Springer; 2008; with permission.

- The recommendations to dental professionals for managing patients on bisphosphonates therapy are presented in **Table 3**.

SUMMARY

This article summarizes some of the most common systemic diseases affecting the elderly population. Preventive approaches are emphasized and recommendations are offered for patient management to provide an improved understanding of systemic disease complications affecting the oral and systemic health of older patients.

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