

# Aging, Systemic Disease and Oral Health: Implications for Women Worldwide (Part I)



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**Conflict of Interest Disclosure Statement**

- Ms. Hughes had done consulting work for P&G.
- Ms. Goldie reports no conflicts of interest associated with this course.

**Introduction – Geriatric Dentistry**

This course will review global prevalence and risk factors of three common health conditions among aging women: cardiovascular disease, diabetes, and osteoporosis. It explores prevention and treatment approaches, connections to oral health, and specific treatment plans for each condition. (This is Part 1 of a 2-part series on women, aging and oral health. [Part 2](#) is available in the dentalcare.com CE library.)

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## Overview

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## Learning Objectives

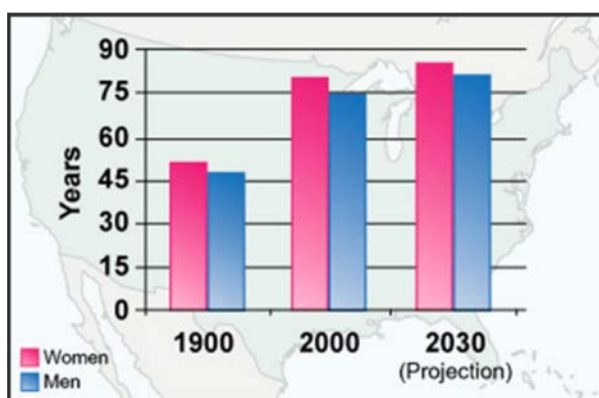
**Upon completion of this course, the dental professional should be able to:**

- Identify three women’s health concerns observed worldwide.
- Identify common risk factors linked to systemic diseases and oral implications from medication use.
- Outline essential steps for the dental professional to use in adequately delivering comprehensive care.
- Examine specific treatment protocols and product recommendations based on medical and/or dental assessments.

## Changing Patient Demographics

Technological advances, improved screening tools, and better disease management are among several factors that have led to the expression “sixty is the new forty.” Retirement today often means a transition to a new career as people are enjoying greater longevity. An average American female and male today are expected to live to be 81.1 and 76.3 years of age, respectively (Figure 1).<sup>1</sup> Women generally live longer than males, an average of six to eight years.<sup>7</sup> According to the U.S. Census Bureau, 20.7% of the population will be 65 years or older by 2050.<sup>2</sup> These changing demographic trends are similar across most of the globe. The World Health Organization (WHO) estimates by the year 2025 that 50 million people live in countries with a life expectancy less than 45 years and today roughly 5 billion people living in over 120 countries will have a life expectancy greater than 60 years.<sup>3</sup>

Women represent the larger portion of the 65+ age group, as well as the 85+ group, in the US and many other countries.<sup>4</sup> Despite the universal appeal of extending our life expectancy, living longer may also bring health complications that can negatively impact overall well-being in those later years. Women are more susceptible to certain chronic diseases as they age,<sup>4</sup> and recent studies suggest periodontal health may play a role in the progression of many systemic conditions.<sup>5</sup>



**Figure 1.** Average Life Expectancy in the U.S. for Men and Women.

This increased risk also presents at a time when oral hygiene may be challenging, since dexterity can be impaired by poor vision, arthritis and other factors.

Oral health care professionals have the opportunity to improve the health of patients by understanding their individual needs based on factors such as health status, age, and gender. Since older female patients will represent a growing portion of our patient population, it is important that we are familiar with their specific health concerns. This article will concentrate on three common conditions women may experience as they age: cardiovascular disease, diabetes, and osteoporosis. It will discuss risk factors and common approaches to treatment and prevention. It will also explore links to oral health and outline treatment plans, including home care products to promote optimal oral health.

### Cardiovascular Disease: No Longer a “Man’s” Disease

The media has typically portrayed cardiovascular disease (CVD) as a “man’s” disease and has clouded the importance and significance of CVD in women until now. CVD - including coronary heart disease, high blood pressure, and stroke - is now the leading cause of death among American women. Heart disease is the leading cause of death for women in the United States, killing 299,578 women in 2017, or about 1 in every 5 female deaths.<sup>6</sup> In 2017, CVD was the disease with the highest percent of total deaths for all subgroups of females.<sup>7</sup> The reports indicate in those who have had a heart attack, 42% of women will die within one year opposed to 24% of men. Heart attacks in women under the age of 50 are twice as fatal as in men, and women are more than twice as likely to die within a few weeks from the heart attack versus men.<sup>8</sup> Approximately 46% of women who survive heart attacks become disabled by heart failure in six years,<sup>8</sup> while 64% will die suddenly.<sup>9</sup> Ischemic heart disease will account for 3.4 million and approximately 3 million women will die yearly from stroke and a remaining 2.2 million will die from hypertensive heart disease, rheumatic heart disease, and inflammatory heart disease.<sup>9</sup>

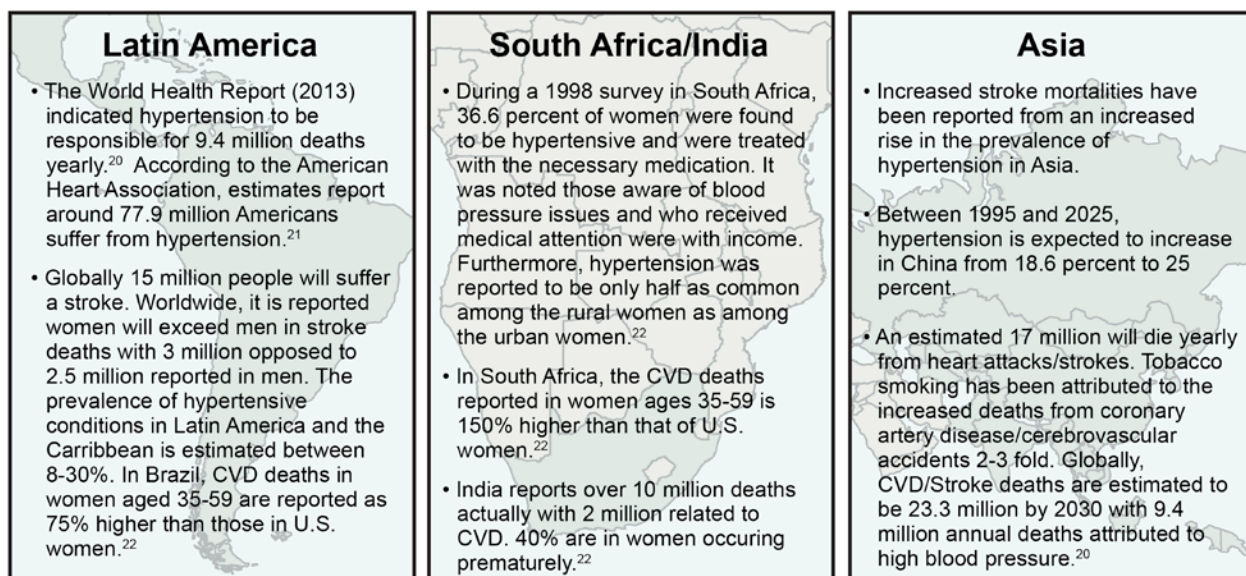
A global study reported that women are less likely to have heart disease and die of it, than men.<sup>10</sup> Current trends indicate CVD and stroke, the first and second leading causes of death globally; will be responsible for increasing deaths and disabilities worldwide by 2020. The number of fatalities is expected to increase to 20 million yearly. By 2030, the rate is estimated to be 24 million.<sup>11</sup>

Fortunately, CVD is beginning to decrease in many developed countries due to factors such as public prevention programs and medical advances. However, the lower socioeconomic groups in developed countries have a greater prevalence of risk factors, higher incidence of disease, and higher rates of mortality exist. The rate is also increasing in many developing and transitional geographies (Figures 2-3). It is estimated by 2040, women from Russia, Brazil, China, South Africa, and India will represent higher proportions in deaths from CVD than men.

From a historical perspective, CVD in men has overshadowed some sex and gender differences related to its diagnosis, presentation, and treatment. Biologically, women have smaller hearts than men, making diagnosis and treatment more challenging.<sup>15</sup> Symptoms of



**Figure 2.** Cardiovascular Disease - Spotlight on Canada and the United Kingdom.



**Figure 3.** Hypertension – Spotlight on Latin America, South Africa and Asia.

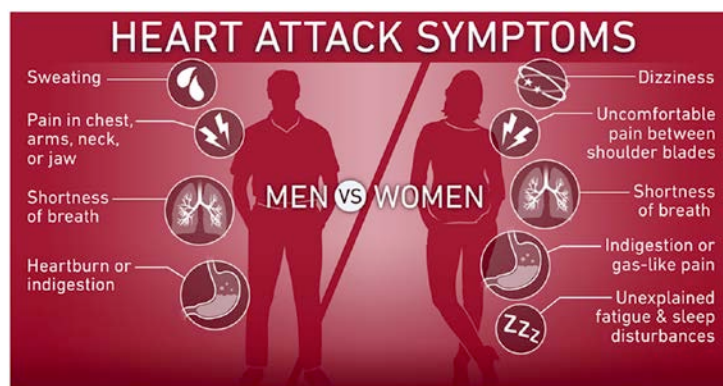


Image Source: Temple Health<sup>16</sup>

a heart attack can be very different between individuals, but especially for men and women. The most common signs of a heart attack are the same for both, such as shortness of breath, sweating, pain in the chest, neck, or arms. Women can present with additional subtle symptoms unrelated to those classic symptoms, such as unusual fatigue, nausea, anxiety, uncomfortable pain between the shoulder blades, and sleep disturbance. Men will typically describe chest pain as “crushing” rather than women referring to an “aching or squeezing.”<sup>16</sup>

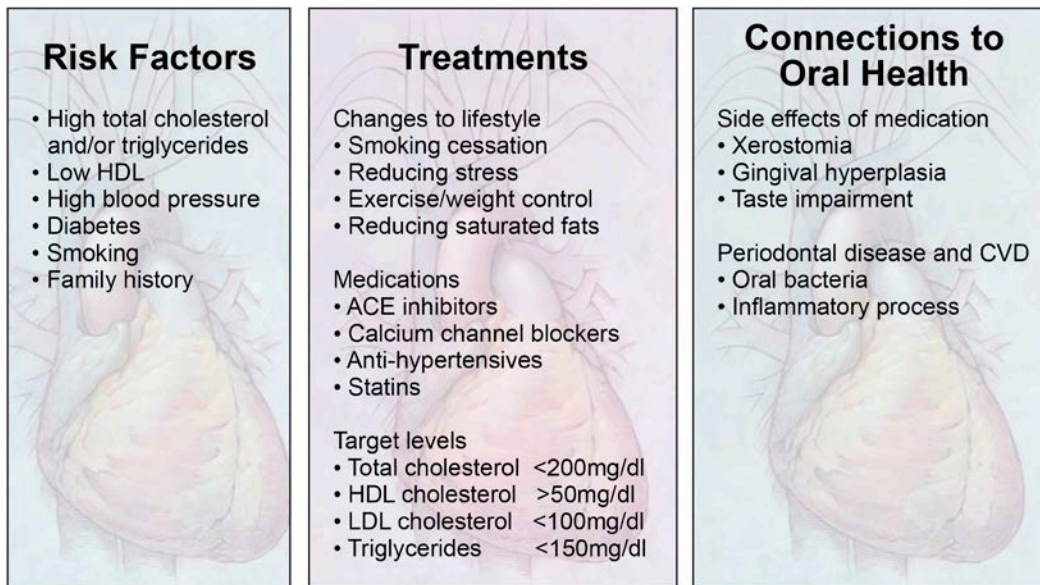
Oftentimes these signs are associated with stress and panic disorders and, consequently, lead to a misdiagnosis and/or mistreatment of a potentially serious and deadly condition.

Some treatments may be less aggressive for women due to their age, since heart disease is often diagnosed in their later years when estrogen production has diminished.<sup>16</sup>

#### **Risk Factors, Prevention, and Treatment**

Heart attack and stroke share many similar risk factors such as elevated blood pressure, smoking, elevated cholesterol, diabetes, obesity, and physical inactivity (Figure 4). A family history of heart disease co-existing with diabetes can contribute to even greater risk.<sup>16</sup> According to the WHO, tobacco use worldwide will contribute to the single greatest cause of death and disability with a projected 7 million deaths yearly by 2030.<sup>17</sup> Smoking the equivalent of one cigarette per day carries a risk of developing coronary heart disease





**Figure 4.** Cardiovascular Disease – Risk Factors, Treatments and Connections to Oral Health.

and stroke much greater than expected, that is, around half that for people who smoke 20 per day.<sup>18</sup> Smoking e-cigarettes daily doubles risk of heart attacks, and when combined with daily cigarette use, heart attack risk rises five-fold.<sup>19</sup> Obesity is another risk factor for several chronic conditions. Older women are heavier now than they were a decade ago. Approximately 62% of American women 20 years of age and older are reported overweight and 33% of the women are identified as extremely overweight.

Fortunately, there are preventive treatment and lifestyle recommendations that can significantly reduce risk. Research indicates when smoking, obesity, stress, and physical inactivity are altered with lifestyle changes, positive health benefits are realized.<sup>20</sup>

In 2019, the ACC/AHA issued a “Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.”<sup>21</sup> The most important way to prevent cardiovascular disease is to promote a healthy lifestyle throughout life. The guidelines are helpful in assessing for other risk-enhancing factors can help guide decisions about preventive interventions in select individuals, such as coronary artery calcium scanning, as well as

treatments pharmacological therapy. A healthy diet healthy that focuses on consumption of vegetables, fruits, nuts, whole grains, lean vegetable or animal protein, and fish and minimizes the intake of trans fats, red meat and processed red meats, refined carbohydrates, and sweetened beverages is encouraged.<sup>22</sup> Maintaining a healthy weight and exercising are part of the regimen, and tobacco use should be stopped.

When lifestyle changes are inadequate, medications are often used to reduce risk, such as:

- Calcium channel blockers (Calan®, Procardia®, Cardizem®) to dilate coronary arteries that in turn increase blood flow to the heart
- Angiotensin-converting enzyme (ACE) inhibitors (Vasotec®, Prinivil®, and Zestril®) that aid in lowering blood pressure by inhibiting the formation of angiotensin II
- Statins (Zocor®, Lipitor®) that block the enzyme (HMG-CoA) necessary for cholesterol production

Medications such as anti-hypertensives are frequently used to lower blood pressure.<sup>24</sup>

In addition to these preventive and pharmaceutical approaches, new scientific breakthroughs are on the horizon. For



**Figure 5.** Spotlight on a Finnish Study.

example, research is being conducted on stem cell applications that actually repair the damaged heart muscle and improve cardiac function. According to the National Institute of Health, stem cells can create new blood vessels to supply the necessary oxygen to the heart.<sup>26,27</sup> Researchers in a 2020 study found that human cardiopoietic cells focus on damaged proteins to reverse complex changes caused by a heart attack.<sup>27</sup> Cardiopoietic cells are derived from adult stem cell sources of bone marrow. These medical advances may lead to significant reductions in cardiovascular disease for future generations.

### Oral Connections

The relationship between cardiovascular disease and periodontal disease has been the topic of many reports in contemporary dental literature. Experts generally agree that some level of association exists. However, the exact nature of this relationship has yet to be definitively established.

Studies have shown patients with periodontal disease are more likely to have cardiovascular disease than those without periodontal disease<sup>28</sup> and numerous reports from leading dental and medical journals substantiate a link.<sup>29-32</sup> Periodontal disease is an important risk factor for total cerebrovascular accidents (CVA) and, in particular, nonhemorrhagic stroke.<sup>28</sup> A

conclusion of a 2014 study showed a correlation between putative bacteria contributing to atheromatous plaques and species associated with periodontal disease.<sup>30</sup> Several studies found periodontal disease to be independently associated with increased risk of CHD.<sup>32</sup> A 2007 trial published in the New England Journal of Medicine, showed patients with severe periodontitis had improved endothelial function (blood flow) following 6 months of intensive periodontal treatment.<sup>29</sup> Endothelial function of arteries is an important factor in CVD. Knowing, this, how can we intervene to keep patients healthy, especially those at increased risk and co-morbidities? One study showed that advanced periodontal therapy lowers the rate of CVD, especially myocardial infarction and heart failure. Dental management has a beneficial effect on the overall and cardiovascular health of patients with type 2 diabetes.<sup>33</sup> While there is a significant body of evidence supporting an association between CVD and periodontal disease, there are also conflicting findings and causality has yet to be proven. At the present time, there is insufficient but evidence for a possible causal relation between periodontal disease and atherosclerotic disease, with a little stronger evidence for stroke. If future studies show consistent associations, periodontal disease may be revealed as an independent and potentially modifiable causal risk factor for atherosclerotic disease.<sup>34</sup>

A common element between CVD and periodontal disease is inflammation, which contributes to narrowing of the arteries in CVD and tissue destruction in periodontitis.<sup>35</sup> Researchers believe the outcomes from the inflammatory process in periodontal disease are related to the components of specific bacteria destroying gingival tissues and trigger host responses to rupture atherosclerotic plaques. Most heart attacks are believed to be triggered by ruptured plaques rather than arterial blockage.

While the link between periodontal disease and cardiovascular continues to be investigated, the oral manifestations commonly associated with medications used to treat CVD are well-known.<sup>36</sup> Gingival hyperplasia, xerostomia, and/or taste impairment are common manifestations encountered from such medications. Oral healthcare professionals are challenged to stay abreast on the potential links between CVD and periodontal disease, as well as recognize potential associations during clinical assessments, active treatment, and maintenance phases of patient care.

## Diabetes

Diabetes is a disease occurring when the pancreas produces an inadequate amount of insulin or when insulin is improperly used by the cells, thus, leaving the body incapable of breaking down carbohydrates and starches into energy. Insulin, an important hormone, is used to regulate blood sugar. An increase in the amount of blood sugar is known as hyperglycemia, which is a common reaction from uncontrolled diabetes over a period of time. Many of the body's systems such as the heart, eyes, kidneys, oral cavity, nerves, and blood vessels can become damaged due to uncontrolled diabetic conditions.

People with Type 1 diabetes do not produce insulin and represent about 5% of those diagnosed with the disease. It is essential that people with Type 1 diabetes receive insulin daily. A person with Type 1 diabetes produces very little, or no insulin. Without insulin, you cannot convert food into usable energy. Without insulin, a person with Type 1 diabetes cannot survive.<sup>37</sup> About 90% of those

with diabetes globally have Type 2 diabetes, which is largely due to excessive body weight and inactive or limited physical activity. Those with Type 2 produce insulin either at insufficient amounts or the body uses what is produced improperly. Oftentimes, the disease is diagnosed years after symptoms have been identified and serious complications have already developed. According to the WHO, almost half of the deaths associated with high glucose usually occur before age 70 and diabetes is projected to be the 7th leading cause of death in 2030.<sup>38</sup> Nearly 10 percent of pregnancies in the U.S. are affected by gestational diabetes mellitus (GDM) every year. It has been well documented that women found to have GDM are at high risk for development of type 2 diabetes mellitus in subsequent years.<sup>39</sup>

The Centers for Disease Control and Prevention have reported diabetes as the seventh leading cause of death among American women and the fourth leading cause of death among Hispanic and African-American women.<sup>40</sup> Women with diabetes can experience two-to-four times higher risk of heart issues than women without a diabetic diagnosis. If blood glucose levels can be controlled, the risk of a CVD event can be reduced by 42% and the risk of a stroke, heart attack or death from CVD can be reduced by 57%.<sup>41</sup> Many do not even know they have diabetes. In fact, of the 29.1 million American adults who have the disease, it is estimated that 1 out of 4 are unaware of their diagnosis.<sup>42</sup>

Globally in 2015, diabetes had affected around 415 million with estimated projections to reach 642 million by 2040. (Table 1, Figure 6).<sup>43</sup> According to the IDF, 5.0 million died in 2015 from diabetes and 1 in 11 adults were diagnosed. The IDF estimates 1 in 10 adults will be diagnosed with diabetes in 2040 along with 1 in 2 adults undiagnosed. In countries with high-income, the IDF reports 91% of adults having type 2 diabetes. During 2015, 199.5 million women were diagnosed with diabetes and projections are 313.3 million by 2040. Progress has been noted from implementing screening programs and risk scores are now being tested globally in more than 32 countries.<sup>43</sup>

**Table 1. Top 5 Countries/Territories with Diabetes among Adults–2015.\***

Country	Numbers
China	109.6 million
India	69.2 million
United States	29.3 million
Brazil	14.3 million
Russian Federation	12.1 million

\*International Diabetes Federation<sup>43</sup>



**Figure 6. Top 5 Countries with Largest Numbers of Diabetics–2015.\***

\*International Diabetes Federation<sup>43</sup>

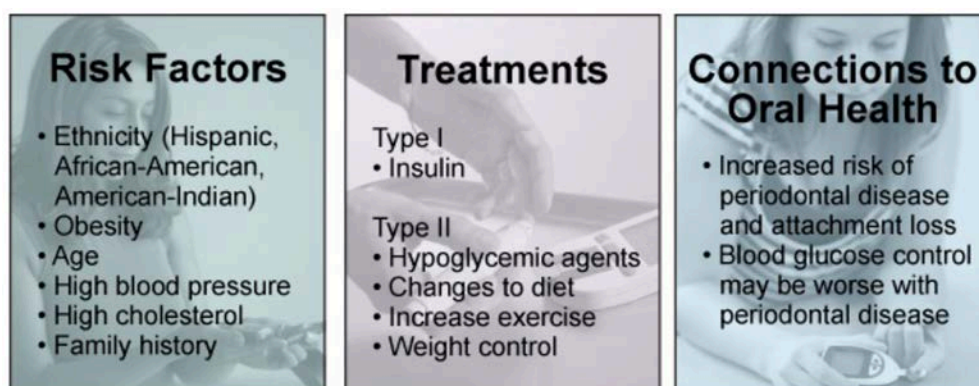
Significant economic burdens are placed on families, individuals, countries, and healthcare systems due to diabetes and its numerous complications. Countries in the Western world report those with Type 2 diabetes frequently experience kidney disease, which has exorbitant costs associated with dialysis.<sup>43</sup>

#### **Risk Factors, Prevention, and Treatment**

Ethnicity is one significant contributing factor for diabetes as Hispanic, American Indian,

African-American, and Pacific/Asian Islander women are at a two-to-four times greater risk than white females for diabetes.<sup>44</sup> Being over age 45, having a family history of diabetes (parent or sibling), being overweight, having elevated cholesterol and having high blood pressure are other contributing factors for diabetes (Figure 7). Fortunately, adopting a healthier diet and increasing daily physical activity can significantly decrease the risk of Type 2 diabetes. Eating a high-fiber, low-fat diet





**Figure 7.** Diabetes Risk Factors, Treatments, and Connections to Oral Health.

and working on measures to control weight are important steps to take while focusing on an effective plan against diabetes. Relatively inexpensive blood testing can assist in an early and proper diagnosis.

If diagnosed, diabetes can be controlled with minimal effect on quality of life. Insulin injections or an insulin pump is the common method of treating the Type 1 diabetic. (Glipizide) Glucotrol® or (Glyburide) Micronase® are hypoglycemic agents used to slow digestion of carbohydrates while (Metformin) Glucophage® is used to decrease blood glucose. These medications are commonly prescribed for treating the Type 2 diabetes. With CVD reported as a primary complication of diabetes, it is not unusual for a statin medication to be prescribed for the Type 2 diabetes. Blood pressure control and foot care are other vital interventions used in treating diabetes. Tobacco cessation is also an important consideration to avoid complications in diabetic-related cases. Important cost-saving interventions can include screenings for retinopathy, a condition known to cause blindness; blood lipid panels that assist in regulating cholesterol; and additional screenings to assist in early signs of diabetes-related kidney disease.

The WHO's work focusing on population-wide strategies is aimed to promote healthy diets and regular physical activity, thereby attempting to reduce the global concern of overweight and obesity issues. In raising awareness regarding the global epidemic surrounding chronic diseases, healthier

environments for the poor and disadvantaged populations can be created. A goal to reverse and even slow trends identified among common disease risk factors will prove beneficial in the prevention of premature deaths and potentially limit the enormous financial and medical burdens created by diabetes and other chronic conditions.

### Oral Connections

Diabetes is one of the most obvious systemic diseases that predisposes a patient to oral infections and in turn worsens the existing disease. Diabetes increases the risk of periodontal disease, and the risk is further increased for diabetics with poor glycemic control.<sup>45</sup> According to the US Centers for Disease Control and Prevention, almost one-third of diabetics have severe periodontal disease with 5mm or greater attachment loss. Diabetes causes blood vessels to thicken, resulting in reduced circulation and a slower flow of nutrients to areas in the body where they are needed. This can create longer periods of healing and increase the potential for infection.

The inverse relationship - the effect of periodontal disease on diabetes - has been the subject of many recent investigations. Studies suggest periodontal disease may worsen glycemic control and contribute to complications (e.g., heart and kidney disease) associated with diabetes.<sup>44</sup> Evaluations of the benefit of periodontal treatments (e.g., scaling & root planning, tetracycline) on glycemic control have yielded mixed results. Some investigations have shown significant benefits

on periodontal health and glycemic control<sup>47,48</sup> while others have only shown significant improvement in periodontal status.<sup>49,50</sup> Separate research has demonstrated a reduction in blood inflammatory mediators associated with insulin resistance following periodontal therapy.<sup>51</sup> The development of a triangular model linking periodontal disease, diabetes and obesity has been reported.<sup>46</sup> The common factor linking all three diseases is inflammation. According to the report by Dr. Robert Genco, fat tissue can trigger production of proinflammatory cytokines, which can intensify infections and promote insulin resistance.

Understanding these connections should lead to more comprehensive disease management for patients, both diagnosed and undiagnosed. In many instances, the presence of an undiagnosed or uncontrolled diabetic might be more accessible to your care than realized. Commonly recognized oral symptoms may include severely inflamed tissues, ranging from red to magenta in color, acute gingival and/or periodontal abscesses (oftentimes recurrent and/or multiple), and rapidly advancing periodontitis along with candidiasis represented by fungal infections and commonly experienced painful xerostomic conditions.<sup>51</sup>

### **Osteoporosis: A Global Concern for Women**

Osteoporosis is not typically seen or felt by the patient, referred to as “the silent disease,” since it oftentimes progresses slowly without symptoms. Bone density loss or osteoporosis is characterized by porous bone causing bones to become fragile, thin, and high risk for fracture. From the loss of bone, fractures occur more easily, and the accompanying loss of height and severe back pain can leave the patient suffering from permanent disabilities and even death if serious spinal or vertebral fractures occur.

Having low bone density or osteoporosis is affecting 54 million Americans. Roughly eight million of the ten million Americans with osteoporosis are women. It is estimated that one in two females over age 50 will suffer with a broken bone due to osteoporosis. Two million broken bones yearly have been attributed to osteoporosis and nearly 80% of older American

women who have suffered broken bones are not tested or even treated for osteoporosis. A woman can lose up to 20% of bone density within five to seven years following menopause. In the US alone an estimated 52% of postmenopausal white women are osteopenic and 20% are osteoporotic.<sup>52</sup>

Osteoporosis accounts for 1.5 million fractures annually, primarily in the hip, spine, and wrist. Average rate of hip bone mass density (BMD) loss is twice as great in white women compared to African-American women and with aging increases occur in both groups (Table 2). An osteoporotic fracture risk for women over the age of 50 is 50%, equivalent to the combined risk of developing breast, uterine, and ovarian cancers. Fracture incidence is also usually higher for whites and lower for other ethnic groups in the U.S.<sup>52</sup> However, osteoporosis is typically under recognized and undertreated in African American women and their risk for hip fracture can double every 7 years and they can be more likely to die from a hip fracture than a white woman.<sup>51</sup>

Osteoporosis related fractures are expected to be greater than 3 million by the year 2025.<sup>52</sup>

Morbidity rates are reported to occur more from hip fractures, and mortality rates occurring after hip fractures are up to 24% in the first year from the fracture;<sup>52</sup> for at least 5 years afterwards a greater risk of death may exist. Loss of independence and function can be profound among survivors along with the inability to walk independently. For those ambulatory prior to the hip fracture, now one in five require some form of long-term care. Up to six months following the fracture incidence, 85% require assistance in walking across the room and 33% are solely dependent on nursing home care for one year. Among women over 45 years of age, osteoporosis accounts for more days being spent in hospitals than any other disease including diabetes, myocardial infarction, and breast cancer.<sup>52</sup> As indicated by statistics across Asia, Europe, Latin America and North America (Figure 8), osteoporosis and its associated morbidity is a growing concern worldwide.

**Table 2. The National Osteoporosis Foundation Guidelines indicate BMD Testing for:**

- All women age 65 and older regardless of risk factors
- Younger postmenopausal women with one or more risk factors other than being white, postmenopausal and female
- Estrogen-deficient women at clinical risk for osteoporosis
- Individuals receiving, or planning to receive, long-term glucocorticosteroid therapy
- Individuals with primary hyperparathyroidism
- Postmenopausal women who present with fractures
- Individuals being monitored to assess the response or efficacy of an approved osteoporosis drug therapy

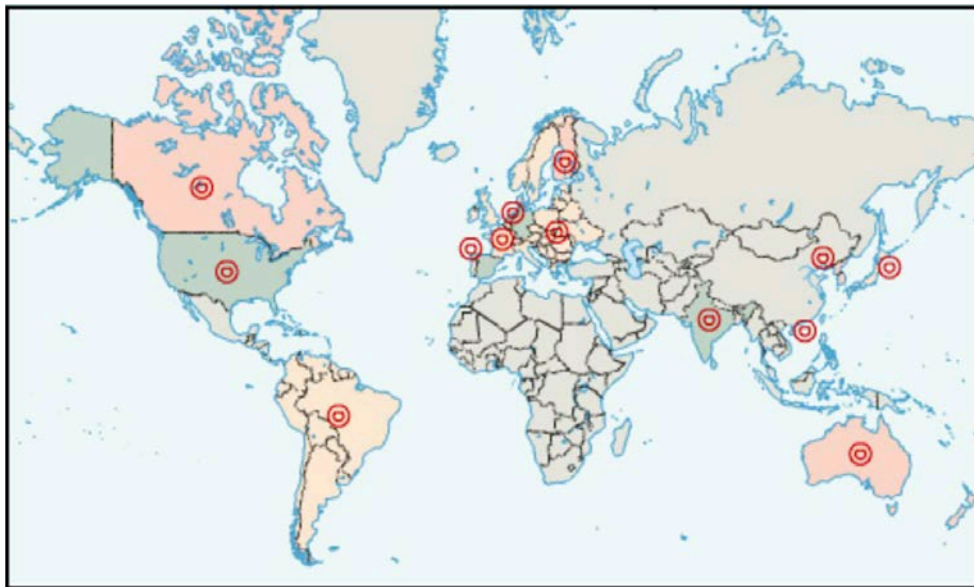
### **Risk Factors, Prevention, and Treatment**

Being female poses a greater risk for developing osteoporosis than male; however, the risk increases in each gender with age. Low bone mass, family history, amenorrhea, estrogen deficiency, cigarette smoking, certain medications, and Caucasian or Asian ethnicity are all risk factors (Figure 9).

Weight loss and low body weight can be associated with an increased risk of fractures due to a greater loss of bone mass.<sup>55</sup> The prolonged use of corticosteroids is a common cause witnessed in osteoporosis. It has been estimated that 30-50% of long-term users of corticosteroids will experience an incidence of fracture.<sup>56</sup> Smoking, a modifiable factor, has been identified in leading to lower bone density.<sup>57</sup> There are different mechanisms by which alcohol intake may decrease bone mass and strength. The effects of alcohol on bone hypothesized to be direct and indirect. The decrease in bone mass and strength following alcohol consumption is primarily due to a bone remodeling imbalance, with a major decrease in bone formation. Fairly recent studies, have described new mechanisms by which alcohol may act on bone remodeling, including osteocyte apoptosis, oxidative stress,

and Wnt signaling pathway modulation.<sup>58</sup> A sedentary lifestyle and/or physical inactivity contribute to reduced muscle strength and impaired balance and gait, each impairing neuromuscular function contributing to fragility and fractures. Maintaining physical strength is a vital approach that leads to healthy ageing. Impairments in skeletal muscle leads to reductions in muscle mass and strength, factors directly associated with mortality rates in the elderly.<sup>59</sup>

While there is no cure for osteoporosis, prevention and treatment is available. Before age 20 is when most skeletal mass forms; therefore, preventive measures are important to implement at even young ages. Eating a diet rich in calcium, vitamins D and K, avoiding smoking or excessive use of alcohol, and exercising regularly (including weight-bearing exercises) are important preventive steps. Childhood and adolescence are critical periods of bone mineral content accumulation that may have long-term consequences for osteoporosis in adulthood. Adequate dietary calcium intake and weight-bearing physical activity are important for maximizing bone mineral content growth.<sup>60</sup> Daily calcium enriched foods, milk, and supplementations



**Figure 8.** Osteoporosis – Global Spotlight on Latin America, North America, Europe and Asia.

### United States

According to the International Osteoporosis Foundation low bone mass and osteoporosis have been identified as a public health threat for over 44 million U.S. men and women ages 50 and over. It is estimated that over 52 million men and women within the same age category will be affected by osteoporosis and should the trend continue, the numbers will continue to over 61 million by 2020. Broken bones and serious falls in age 50 and over is the first sign of low bone density and often osteoporosis related.<sup>54</sup> Subsequently, the increase in cases could create the number of hip fractures to double or triple by 2040. It is estimated over the next ten years, postmenopausal white women in the US will experience 5.2 million fractures of the hip, spine, or distal forearm leading to over \$45 billion in direct medical costs.<sup>54</sup>

### Canada

Approximately 1.4 million Canadians are affected by osteoporosis, most of those being postmenopausal women and the aging.<sup>54</sup> The prevalence of osteoporosis among Canadian women age 50 years or older is about 16%. Women over the age of 50 having evidence of a vertebral fracture from an osteoporotic condition has been reported to be 1 in 4. Each year Canadian women have been reported to encounter over 30,000 hip fractures and the number of fractures is expected to quadruple by 2030.<sup>54</sup>

### Latin America

Projections from 1990 to 2050, the number of hip fractures for women and men ages 50-64 will increase by 400%. For age groups older than 65 the increase will be 700%. Among five Latin American countries (Argentina, Brazil, Colombia, Mexico and Puerto Rico), the prevalence of vertebral fractures in women 50 and older has been around 15%, with 7% occurring within the 50-60 year old age group and increasing to 28% for those greater than 80 years old.<sup>54</sup> The prevalence in women 50 years and older for osteopenia is 50% and 25% for osteoporosis. It is projected that by 2050, 5.24 million and 2.62 million women will have osteopenia and osteoporosis



respectively.<sup>54</sup> 34,000 hip fractures occur yearly in a population 50 years and older, averaging 90 fractures/day. By 2050, there are estimates for >63,000 hip fractures in women and the prevalence for the vertebral fractures is 16.2%. Hospitalization costs for the hip and vertebral fractures is anticipated to exceed 190 million USD yearly.<sup>54</sup> In Brazil, the economic burden of osteoporosis hip fractures to private health companies is estimated at \$6 million.<sup>54</sup>

### **Japan**

By 2050, Asia is projected to experience more than 50% of all osteoporotic hip fractures globally.<sup>54</sup> Asian women have as many and as frequent vertebral fractures as white women; however, hip fractures in comparison are less prevalent among Asian women.<sup>54</sup> In the Japanese female population aged 50-79 years, the prevalence of osteoporosis in the spine is estimated at 35% and at the hip 9.5%.<sup>52</sup> The total number of hip fractures is forecast to be 238,000 in 2030.<sup>54</sup>

### **Korea**

After 75 years of age, the number of hip fractures was 4.3 per 1000 women and 2.97 per 1000 in men. The occurrence of hip fractures in Korean women increased about 4-fold during the years 1991-2001.<sup>52</sup>

### **Hong Kong**

Even with a stabilization of hip fracture rates, fractures remain a burden on health services and society. The acute hospital cost of hip fractures is estimated at 1% of the total annual hospital budget, or 17 million USD for a population of 6 million. The incidence of hip fractures among women in Hong Kong has increased by 200% in the last 30 years.<sup>54</sup>

### **India**

Indian women 30-60 years of age from low-income levels reported bone mass density levels from all skeletal sites to be lower than values reported from developed countries, attributed to factors such as inadequate nutrition. A high prevalence of osteopenia was reported at 52% while osteoporosis was reported at 29%.<sup>54</sup>

### **Australia**

Osteoporosis affects about 2.2 million Australian women and 27% of the women aged 60 and older are osteoporotic and 51% are osteopenic.<sup>54</sup> However, women 50 and older are at a 42% lifetime risk of suffering from an osteoporotic fracture versus men with a 27% risk. Australian women are suffering from 20,000 hip fractures yearly and at an increased rate of 40% every ten years resulting in osteoporotic medical costs totaling \$7.4 billion yearly and \$1.9 billion are direct costs.<sup>54</sup>

### **Europe**

In the EU, the annual number of fractures will rise from 3.5 million in 2010 to 4.5 million in 2025, an increase of 28%.<sup>54</sup> According to the International Osteoporosis Foundation (IOF), the under-utilization of bone mineral density measurements (BMD) in the majority of European countries accounts for limited availability of densitometers, restrictions in personnel allowed to perform such testing, and perhaps the unawareness of usefulness demonstrated from BMD testing along with non-existent or limited reimbursement.<sup>52</sup>

### **Germany**

Within the age range of 25-74 years, the prevalence from any fracture was 45% for men and 40% for women within the ages 65-74 years. In a 1998 report, the

European Commission estimated the incidence of hip fractures in Germany will increase from 117,000 in the year 2000 to 240,000 by the year 2040.<sup>54</sup>

### **Spain**

It has been reported that 13% of patients who suffer a fracture typically die 3 months post fracture and this percentage increases to 38% after 24 months. After experiencing a vertebral fracture, it has been reported 45% of patients suffer from functional damage while 50% are afflicted by partial or total disability. Approximately 2 million women have been reported to suffer from osteoporosis in Spain. It is prevalent among 26.1% of the women 50 years and older, and the increase in new cases has been documented in women more than men.<sup>54</sup>

### **Switzerland**

Between 2000-2020, osteoporotic hip, vertebral and wrist fracture are predicted to rise by 33%, 27% and 19%, respectively, if current prevention and treatment patterns are maintained. Osteoporosis has ranked number one in Switzerland among other common diseases in women. Of reported fractures, 51% were considered osteoporotic related.<sup>54</sup> The annual hospital costs (in terms of duration of stay) for osteoporotic fractures was greater than those being treated for myocardial infarction, stroke and breast cancer; nevertheless, slightly lower than for chronic obstructive pulmonary disease. For women, the costs associated with osteoporosis were higher than for all the combined diseases.<sup>54</sup>

### **Finland**

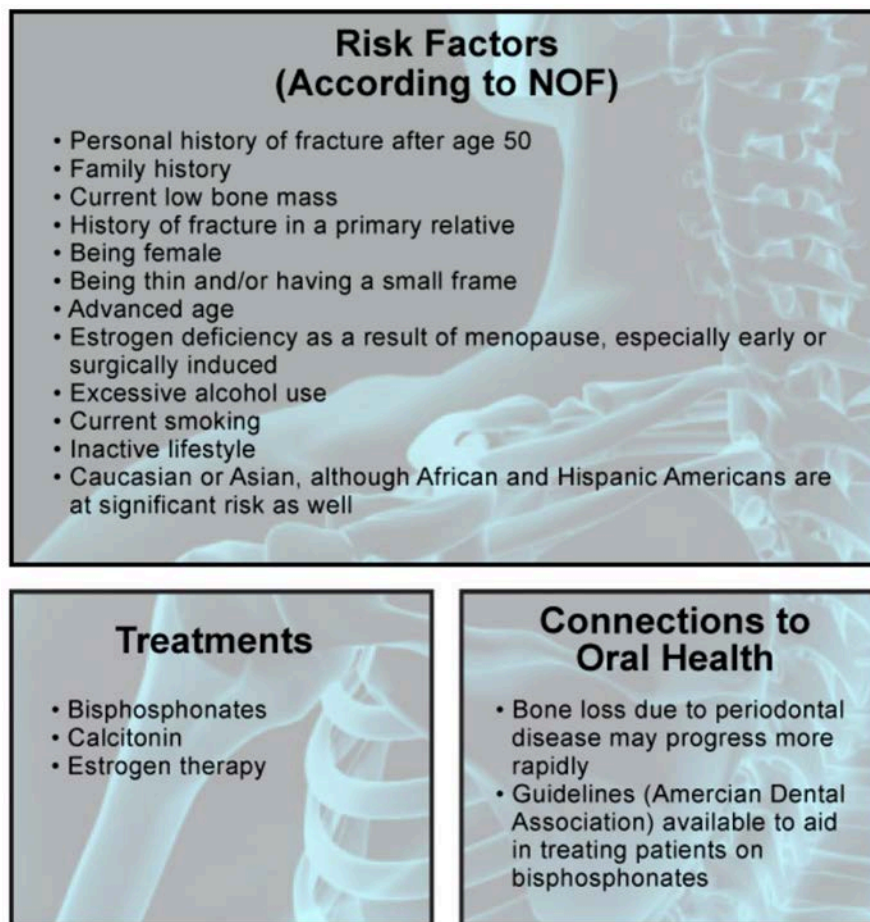
In Finland during 1992-2002, (a ten-year period) the total number of hip fractures for women increased by 70%.<sup>54</sup> In 2005, Denmark estimated the prevalence of osteoporosis among women 50 years and older at 41%. The risk of sustaining a second hip fracture during the first 12 months after an initial hip fracture is considered high. Denmark's economic burden from new and prior fractures soars to millions of dollars yearly (equivalent to the US dollar); by 2025 the burden will increase 27% creating soaring expenses and financial burdens to the country.<sup>54</sup>

with calcium have shown enhanced rates of bone mineral acquisition in children and adolescent studies.<sup>61</sup> It has been further noted the positive effects on bone mineral density in postmenopausal women taking calcium supplementations.<sup>62</sup> Good nutrition is an essential component for any successful rehabilitative program; however, it is critically important in the frail, elderly, and osteoporotic risk patients where poor nutritional levels can impair healing and increase further susceptibility to future fractures.<sup>63</sup>

Physical activity and fitness exercise programs have been shown to reduce the risk of osteoporosis,<sup>64</sup> and epidemiological evidence has suggested that physical activity can assist in reductions of hip fractures in both women and men in so much as strengthening

back muscles and improving strength and function.<sup>65</sup> With therapeutic exercise assisting in maintaining or increasing bone mineral density in postmenopausal women<sup>66</sup> studies have shown those early postmenopausal women practicing Tai Chi Chun to have a 47% decrease in falls.<sup>67</sup> In the 2004 Nurses Health Study, it was reported that women who walked at least four hours weekly experienced a 40% reduction in the risk of hip fractures.<sup>68</sup> It is important to value daily exercise with any age group, especially during the childhood and adolescent years where bone mass, strength, and balance develop into essential elements necessary for maintaining bone density in the aging years.

Early screening with a DEXA scan measuring bone density in critical areas of the body such



**Figure 9.** Osteoporosis – Risk Factors, Treatments and Connections to Oral Health.

as the hip and spine is recommended. It is a painless, non-invasive test that takes about 20 minutes. Follow-up DEXA scans should be performed in women who develop bone mass loss. Changes in height or complaints of back pain can require consulting with a physician and healthcare professionals about x-ray and bone density measurements to determine if a fracture is present. Monitoring bone health is essential and a baseline DEXA scan can be performed for women who experience premature menopause.

Once diagnosed, treatments for osteoporosis may include oral bisphosphonates (Actonel®, Actonel® with Calcium, Fosamax® or Fosamax Plus D, Boniva®, Reclast). Intravenous bisphosphonates (Zometa®, Aredia®) are used for patients with metastatic cancer and Paget's disease and in some cases are used

by physicians for osteoporosis. Calcitonin or Fortical®, an injectable or nasal spray, Reclast, an intravenous infusion once yearly, Foreto, a daily subcutaneous injection, Prolia, an intra-muscular injection administered every 6 months, Selective Estrogen Receptor Modulators (Evista®) and Hormone Therapies (HT) have also been used. Controversial theories exist around the use of HT's resulting in physicians prescribing treatment based on individual needs, whereas communication and patient advocacy are essential.

### **The Oral Connection**

Osteoporosis is a widespread disease affecting millions of people. If diagnosed early, it can be treated to prevent fractures. Understanding that osteoporosis acts as a 'silent disease' validates the importance for dental professionals to closely monitor high

**Table 3. Bisphosphonate Preparations by Name.**

Generic Name	Trade Name	Clinical Indication
<b>Oral bisphosphonates</b> 1. Alendronate 2. Risedronate 3. Etidronate 4. Ibandronate 5. Clodronate 6. Tiludronate	<i>Fosamax</i> <i>Actonel</i> <i>Didronel</i> <i>Bondronat, Bonviva</i> <i>Bonefos, Loron,</i> <i>Clasteon</i> <i>Skelid</i>	Treatment of osteoporosis and corticosteroid-induced osteoporosis, Paget's disease.
<b>Intravenous bisphosphonates</b> 1. Pamidronate 2. Zoledronate 3. Clodronate 4. Ibandronate	<i>Aredia</i> <i>Zometa, Aclasta</i> <i>Bonefos, Loron,</i> <i>Clasteon</i> <i>Bondronat, Bonviva</i>	Hypercalcaemia of malignancy, osteolytic lesions, Paget's disease, skeletal metastases, osteoporosis (at lower frequency and dose).

Source: Brock G, Barker K, Butterworth CJ, Rogers S. Practical considerations for treatment of patients taking bisphosphonate medications: an update. *Dent Update*. 2011 Jun;38(5):313-4, 317-8, 321-4 passim. doi: 10.12968/denu.2011.38.5.313.

risk patients exhibiting osteoporotic risk factors. Dental professionals should pay particular attention to attachment levels, rapid bone loss, and/or tooth mobility in their female patients who are post-menopausal and high risk for osteoporosis.

Findings from a cross-sectional study of 1256 postmenopausal women ranging in ages between 53 and 83 have indicated the prevalence of specific bacteria identified with a periodontal infection and oral bone loss. The strongest association between the bacterial infection and oral bone loss was discovered in overweight women who demonstrated the periodontal species, *T. forsythensis*. Since the greatest risk was identified among overweight women, future research should evaluate the impact of weight and body mass index (BMI) on the links between oral bone loss and bacterial infections.<sup>69</sup> Not every patient with osteoporosis will exhibit oral signs; nevertheless, when clinical and radiographic examinations, risk factors, and medical history findings identify concerns, dental professionals should refer to a physician for further medical assessments.

There has been much discussion as well as confusion regarding treatment of dental patients taking bisphosphonates. A report issued in August 2007 by a multi-disciplinary task force of the American Society for Bone and Mineral Research is a useful resource.<sup>70</sup> In addition, both the National Osteoporosis Foundation and the American Dental Association (ADA) have issued treatment guidelines for patients on intravenous bisphosphonates and oral bisphosphonates.<sup>71,72</sup>

The **ADA expert panel** recommends conducting a comprehensive oral evaluation prior to the beginning of bisphosphonate therapy (oral or intravenous) if possible, or as soon as possible after the initiation of therapy. Patients should also be educated on maintaining good oral hygiene. In general, the panel felt routine dental treatment should not be modified based only on the patient's use of oral bisphosphonates. However, dentists treating patients receiving intravenous bisphosphonates are advised to avoid invasive dental procedures while patients are receiving treatment, if possible. Professional judgment



must obviously be used to determine the need for invasive treatment based on the patient's individual situation.

The US Surgeons General Carmona (2002-2006) said it best, "Osteoporosis isn't just your grandmother's disease. We all need to take better care of our bones. The good news is that you are never too young or too old to improve your bone health. With healthy nutrition, physical activity every day, and regular medical check-ups and screenings, Americans of all ages can have stronger bones and live longer, healthier lives."

### The Dental Professional's Role

Dental professionals have a unique opportunity not only to influence patients' oral health status but also their quality of life. Understanding the relationship between oral health and systemic health allows us to assess, diagnose, and treat in a comprehensive manner rather than focusing solely on the oral cavity.

- **Assessments** – It is imperative to ask patients about any pre-existing medical conditions, medications, and other treatments that could impact oral health. Ascertaining patient compliance to medications and therapy is also helpful information to collect.
- **Screening** – Screening is one of the most critical steps to identify early stages of disease. Examples of screenings that can be done in the dental office include oral cancer evaluations, blood pressure monitoring, and/or bone density testing.
- **Education** – Several organizations distribute patient handouts, videos, and other materials for patients to read or access via the Internet. The ADA and the American Dental Hygienists' Association have online patient information ([www.ada.org](http://www.ada.org) and [www.adha.org](http://www.adha.org)) and [www.dentalcare.com](http://www.dentalcare.com) offers more than 150 continuing education courses; patient educational materials, along with oral health instructional videos and materials customized specifically for children.
- **Referrals** – Dental professionals should refer patients to the physician or the appropriate healthcare provider if a clinical

examination or screening test suggests presence of a systemic disease.

- **Treatment planning** – Recall frequency, treatments, and home care products can be tailored to the patient's health status and perceived compliance.

### Oral Hygiene Products for Home Care

Home care products to control plaque biofilm and maintain good oral health are a critical part of treatment planning. This is particularly important for older patients who have a higher prevalence of medical health issues. Dental professionals should consider a regimen that involves products to improve periodontal health, reduce the risk of dental caries, reduce sensitivity, and alleviate xerostomic conditions.

### Products for Plaque Control

#### *Mechanical Removal of Plaque Biofilm*

Controlling plaque biofilm interdentally is vital to good oral health. We know that plaque biofilm accumulation is a significant factor in the development of periodontal and peri-implant disease. There is a new periodontal disease classification system developed cooperatively by the American Academy of Periodontology (AAP) and European Federation of Periodontology.<sup>73</sup> The updated classification system uses four stages and three grades to describe disease status. The stages are based on the severity of the disease as established by the loss of the interdental clinical attachment, radiographic loss of bone, and/or loss of teeth, difficulty of management, and extent or dissemination of disease measured.

- **Power toothbrushes** – Many power toothbrush technologies can provide more effective plaque removal than manual brushes. Certain power toothbrush models have compliance-enhancing features such as timers and multiple brushing modes. Power brush technologies available today include rotating, counter-rotational, sonic, ultrasonic, and oscillating-rotating. Results from an independent systematic review by the **Cochrane Collaboration** showed power toothbrushes with oscillating-rotating action removed plaque and reduced gingivitis more effectively than manual

toothbrushes. No other power designs were as consistently superior to manual toothbrushes.<sup>74,75</sup> In addition, there are now products in clinical trials, soon to be available, that are fully automated with individualized mouth pieces. One cleans the upper and lower arch in 7 seconds simultaneously,<sup>76</sup> and the other cleans one full arch at a time with pressure driven cycles and perfectly placed nylon bristles, about 45 seconds each.<sup>77</sup>

- Interdental cleaning must be individualized in order to ensure compliance with our suggestions. Methods include: floss; a rubber tip; an interdental brush; an oral irrigator; or wooden sticks. Compliance with regular flossing has been far less than ideal. The routine use of dental floss has been shown to be in a range of daily use among adults ranging from 10% to as high as 30%.<sup>78</sup> A 2015 study concluded that inter-dental cleaning with interdental brushes is the most effective method for inter-dental plaque removal.<sup>79</sup> The majority of available studies in this meta-review did not demonstrate that flossing is generally effective in plaque removal.

A Cochrane Database of Systematic Reviews recently summarized the research on interdental biofilm control devices for self-care that impact periodontal disease and caries. The authors warned there were weaknesses in most studies and found that generalizing to all populations challenging.<sup>80</sup> The general conclusion was that the use of dental floss or interdental brushes, in addition to toothbrushing, may reduce gingivitis or plaque, or both, more than toothbrushing alone.

#### ***Chemotherapeutic Inhibition of Plaque Biofilm***

- Chemotherapeutic dentifrices, containing either stannous fluoride or triclosan, are used to inhibit plaque regrowth between brushings and to reduce gingival inflammation and bleeding. However, only stannous fluoride also offers protection from sensitivity<sup>81,82</sup> – a common condition reported to be even more prevalent among older patients and those with periodontal disease<sup>83</sup> – in addition to its caries and

gingival health benefits.<sup>84</sup> The latest stannous fluoride dentifrice technology (Crest® Pro-Health™) contains stabilized stannous fluoride and a whitening, anticalculus agent.

- Chemotherapeutic rinses are another important home care product often recommended in either prescription or over-the-counter versions.<sup>85</sup> Dental professionals generally view chlorhexidine — now available in alcohol and alcohol-free forms — as the gold standard due to its efficacy and substantivity. However, its use is often limited to short-term use due to extrinsic stain and compliance challenges with taste. Other safe and effective options for long-term maintenance are over-the-counter chemotherapeutic rinses Cetylpyridinium chloride (CPC) is a broad spectrum antimicrobial available in an alcohol-free formulation. The alcohol-free form may provide a more pleasurable rinsing experience for patients with soft tissue sensitive to alcohol. Essential oils rinses containing alcohol are also available over-the-counter. Research demonstrates significant reductions in plaque and gingivitis for CPC and essential oils rinses when formulated appropriately.<sup>86,87</sup>

### **Dry Mouth Aids and Fluorides**

#### ***Aids for Xerostomia***

It is estimated that 30% of the population 65+ is likely to suffer with xerostomia and salivary gland hypofunction. Systemic conditions as well as local factors have been reported to impact xerostomic patients, placing them at a higher risk for plaque and caries due to a lower oral pH.<sup>88</sup> Other complications of decreased salivary flow include persistent sore throat, difficulty speaking, hoarseness, and oral candidiasis. Various forms of salivary stimulants, including sugar-free chewing gum and candy, may help stimulate saliva if glands function properly. Specialized rinses, dentifrices, and liquid moisturizers are marketed to relieve symptoms and protect against xerostomic conditions.

#### ***Fluoride Treatments***

Root caries is a growing concern among aging patients. In-office or take-home fluoride treatments often containing acidulated

phosphate fluoride, neutral sodium fluoride, or stannous fluoride can be useful for these patients. Forms include gels, varnishes, pastes, rinses, or foaming solutions. Dental professionals may choose to treat high risk patients with a combination of in-office and at-home treatments.

### Staying Informed

The plethora of literature on the oral-systemic connection challenges dental professionals to differentiate fact from fiction. Further complicating the issue, patients can obtain information as rapidly as dental professionals with the speed of the digital information highway. Table 4 lists several resources to help

dental and medical professionals stay current with valid, credible research related to oral and systemic health. There are unprecedented opportunities for dental professionals to provide individualized care when addressing patient's oral care needs. All patients, female and aging alike have unique health needs indicative of specialized care. With numerous research findings revealed each day, our role as a dental professional is exciting and challenging as we continue to understand oral discoveries and systemic relationships. We as professionals will continue to evolve to best assist our patients in achieving optimal oral health and overall well-being.

**Table 4. Web Sites Related to Oral and Systemic Health.**

- [www.heart.org](http://www.heart.org), Cardiovascular disease
- [www.diabetes.org](http://www.diabetes.org), Diabetes
- [www.americanbonehealth.org](http://www.americanbonehealth.org), Osteoporosis
- [www.nof.org](http://www.nof.org), Osteoporosis
- [www.asbmr.org](http://www.asbmr.org)
- [www.womenshealth.gov](http://www.womenshealth.gov)
- [www.globalhealth.gov/worldhealthstatistics.shtml](http://www.globalhealth.gov/worldhealthstatistics.shtml)
- [www.who.int/whosis/en](http://www.who.int/whosis/en)
- [www.acl.gov](http://www.acl.gov)
- [www.cochrane.org](http://www.cochrane.org)
- [www.dentalcare.com](http://www.dentalcare.com)

## Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: [www.dentalcare.com/en-us/professional-education/ce-courses/ce302/test](http://www.dentalcare.com/en-us/professional-education/ce-courses/ce302/test)

1. **In 2019, the ACC/AHA issued a “Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.”) The most important way to prevent cardiovascular disease is:**
  - A. Take small-dose aspirin twice a day
  - B. Take a low-dose statin daily
  - C. Promote a healthy lifestyle throughout life
  - D. Limiting the amount of exercise daily
2. **All of the following are symptoms of cardiovascular disease typically observed in women EXCEPT:**
  - A. High blood pressure
  - B. Shortness of breath
  - C. Unusual fatigue
  - D. Chest pain characterized as crushing
3. **All of the following are oral manifestations associated from medication usage in treating cardiovascular disease EXCEPT:**
  - A. Xerostomia
  - B. Gingival enlargement/hyperplasia
  - C. Excessive salivation and/or drooling
  - D. Taste impairment
4. **Heart attack and stroke share similar risk factors EXCEPT:**
  - A. Low triglyceride levels
  - B. Diabetes
  - C. Obesity
  - D. Physical inactivity
5. **Cardiovascular disease in men has overshadowed some sex and gender differences related mainly to its diagnosis, presentation and treatment.**
  - A. True
  - B. False
6. **It is believed the inflammatory process in periodontal disease and the specific bacteria destroying gingival tissues is what triggers host responses to rupture atherosclerotic plaques thus worsening the level of CVD in a heart patient.**
  - A. True
  - B. False
7. **The important hormone used to regulate blood sugar is \_\_\_\_\_.**
  - A. Thyroxin
  - B. Micronase
  - C. Vasotec
  - D. Insulin



8. **Pregnant women experience a type of diabetes that is typically diagnosed through prenatal screenings rather than symptoms being reported is known as \_\_\_\_\_.**  
A. Type 1 diabetes  
B. Type 2 diabetes  
C. Hypoglycemia  
D. Gestational diabetes
9. **Women with diabetes can experience a two-to-four times higher risk of heart health concerns than women without a diabetic diagnosis.**  
A. True  
B. False
10. **Of the following systemic diseases, which one predisposes a patient to oral infections and in turn worsens the existing disease?**  
A. High blood pressure  
B. Osteoporosis  
C. Hyperthyroidism  
D. Diabetes
11. **Commonly recognized oral conditions associated with diabetes can include \_\_\_\_\_.**  
A. pink, stippled tissues  
B. acute gingival and/or periodontal abscesses  
C. viral infections  
D. excessive saliva
12. **Osteoporosis is characterized by a loss of bone density, making the bones rigid, and less likely for fracture eliminating the chance for any disability or walking impairment.**  
A. True  
B. False
13. **Risk factors for osteoporosis include all of the following EXCEPT:**  
A. Estrogen deficiency  
B. Caucasian or Asian ethnicity  
C. Certain medications  
D. Weight bearing exercises
14. **The National Osteoporosis Foundation guidelines indicate BMD testing for all of the following EXCEPT:**  
A. Estrogen-deficient women at clinical risk  
B. Postmenopausal women who present with fractures  
C. All women irrespective of age  
D. Those patients being monitored to assess an approved osteoporosis medication
15. **The active ingredient available in an alcohol-free over-the-counter rinse formulation for the treatment of plaque-induced gingivitis is \_\_\_\_\_.**  
A. Xylitol  
B. Iodine  
C. Baking soda  
D. Cetylpyridinium chloride

- 16. Dental professionals should use protocols to improve oral health and whole body health for all patients with emphasis placed on \_\_\_\_\_.**
- A. scaling and root planing
  - B. prophylaxis
  - C. tailored treatment planning/product recommendations
  - D. monitoring blood pressure throughout appointments
- 17. A Cochrane Database of Systematic Reviews recently summarized the research on interdental biofilm control devices for self-care that impact periodontal disease and caries. Which of the following is correct?**
- A. The studies used were robust.
  - B. The study results were easily generalized to all populations.
  - C. Toothbrushing alone is adequate to maintain oral health.
  - D. The use of an interdental cleaning device is suggested.
- 18. Which of the following is a TRUE statement?**
- A. Osteoporosis always indicates an underlying health problem.
  - B. The most common sites for osteoporotic fractures are the long bones.
  - C. Thin African American women are at the highest risk for osteoporosis.
  - D. An osteoporotic fracture indicates a high risk of death.
- 19. Which of the following is a TRUE statement?**
- A. Women with diabetes do not have a higher risk for heart disease.
  - B. A low dose of daily aspirin has not been recommended for patients with cardiovascular risk factors.
  - C. Vasotec is an angiotensin-converting enzyme inhibitor used to reduce the risk of cardiovascular disease.
  - D. Zocor and Lipitor and Glyburide are statin drugs used to reduce cholesterol.
- 20. The leading cause of death among women is \_\_\_\_\_.**
- A. Breast cancer
  - B. Lung cancer
  - C. Diabetes
  - D. Cardiovascular disease including high blood pressure, stroke and coronary heart disease

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## Additional Resources

- No Additional Resources Available.

## About the Authors

### Pam Hughes, RDH, MS



*The P&G team wishes to express its sadness over the loss of our colleague and friend, Ms. Pam Hughes, on December 14, 2017. She was a dedicated, passionate dental hygiene educator and clinician who touched so many lives through her teaching and patient care. We will miss her.*

Pam was a recognized speaker throughout the United States on advances in therapeutic oral care products, women's aging complexities, oral risk assessment and improving patient care with evidence-based decision making. She was a past President of the California Dental Hygiene Educators' Association and the California Dental Hygienists' Association.

Pam was clinically active in a general practice with over 37 years of experience and held a faculty position in the BSDH and MSDH graduate program at the Ostrow School of Dentistry of University of Southern California in the Division of Periodontology, Diagnostic Sciences and Dental Hygiene. Pam was the recipient of the 2016 Most Outstanding Part-time Faculty award and the 2017 Excellence in Teaching Award.

### Maria Goldie, RDH, MS



Maria graduated from the University of Pennsylvania, School of Dental Hygiene & is the recipient of the 1999 University of Pennsylvania Dental Hygiene Alumni Achievement Award. She is also a 2003 winner of the Pfizer/ADHA Award for Excellence in Dental Hygiene and the 2011 Alfred C. Fones Award. She was awarded the first ever "2016 Distinction in Service Award" from the International Federation of Dental Hygienists in June, 2016 Presidential Citation in 2018 from ADHA. She earned her BA in Health Services Administration from Saint Mary's College and a MS in Health Science from San Francisco State University. Maria is a graduate of the 2004-2006 fellowship of the California Health Care Foundation's (CHCF) Health Care Leadership Program, administered by the Center for Health Professions at the University of California, San Francisco, a two-year program. She is the owner of Seminars for Women's Health and Sex Based Medicine, whose goal is to educate professionals about the differences in health and disease between men and women, communication styles, and the link between oral and general health.

As a noted researcher, author, and speaker, Maria has presented seminars nationally and internationally on topics such as Women's Health and Wellness, Cancers and Oral Care for the Cancer Patient, Oral Cancer, Enamel Therapy, and Immunology and Periodontal Disease. Maria was a member of the National Advisory Committee for the Robert Wood Johnson Foundation's Smoking Cessation Leadership Center. She conducted research with the late Dr. Margaret Walsh on smokeless tobacco at the University of California, San Francisco.

Maria is co-editor of the textbook: Dental Hygiene – Applications to Clinical Practice. Maria is co-founder of the International Dental Hygiene Educator's Forum (IDHEF), the fifth meeting to be held in Australia in 2019. Maria served as the 1997-98 President of the American Dental Hygienists' Association (ADHA), served on an advisory panel to develop "The Future of Dental Hygiene Report", and was the President of the International Federation of Dental Hygienists (IFDH) 2010-2013.

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