

STRATEGIES FOR DENTAL HYGIENIST AND NURSE COLLABORATION IN TARGETING PERIODONTAL AND CARDIOVASCULAR DISEASES

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Abstract

This article presents the background and rationale for proposing a novel model for health care specifically targeting periodontal and cardiovascular disease (CVD) by using dental hygienists and nurses as point-of-care screeners. It is estimated that nearly 60% of total mortality in the United States is related to CVD¹, and it can be projected that at least 60 million adults (18 years or older) have periodontal disease of moderate to advanced severity.² Research reported during the last five years implicates the potential role of periodontal infection in increasing the risk for atherosclerosis which predisposes individuals to CVD. Although the relationships between the exposure of periodontal infection and cardiovascular outcomes are uncertain at this time, what has become apparent is that the periodontal bacteria/host interaction and its relationship to systemic conditions, such as smoking, diabetes, obesity, and hypertension, are highly complex.

However complicated and poorly understood these interrelationships may be, recent research suggests there is a clustering of variables (i.e., classic risk factors for CVD, different levels of periodontal pathogens, antibodies to those pathogens, and cardiovascular outcomes) that may represent the presence of specific syndromes and may more appropriately describe the link between periodontal disease and CVDs.³ The perspective that periodontitis and CVD may be part of a clustering of interrelated variables is unique and intriguing. It also provides a clear direction for the kind of future research necessary to illuminate a more certain profile of individuals at risk for CVD, which deserves the attention of all medical and dental professionals in formulating new CVD management strategies.

This article proposes that nurses and dental hygienists are very well positioned to work in transdisciplinary collaboration to perform *bilateral point-of-care screening* to intercept patients at risk for periodontal and CVD. Examples of intervention opportunities are provided and readers are challenged to consider what may be possible if traditional professional boundaries are abandoned in favor of transdisciplinary care.

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With more than 2,600 Americans dying of CVD each day,¹ at a rate of one death every 34 seconds,¹ medical practitioners and policymakers are currently facing statistics on CVD that are daunting. This comes at a time when both public and private sectors are calling for health care promotion and primary prevention strategies that will preempt the incidence and severity of chronic diseases and conditions. Indeed, wellness instead of health repair has become the battle cry in public health arenas and at the center of consumer demands. However, instead of primary prevention to preempt the beginning of disease, the best option we currently have is secondary prevention aimed at minimizing the loss or disability resulting from chronic diseases. The widespread adoption of progressive disease management strategies that incorporate health wellness models and primary prevention still seems

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far away.

Our capacity to provide even secondary preventive care is challenged beyond the capacity of our current health-care delivery system. Unfortunately, the outlook for the future may be even more dismal. As a group, the massive population of baby boomers are living longer, but living with multifactorial diseases like hypertension and diabetes which already tax the health-care system. In addition, the explosive increase in the prevalence of obesity and type 2 diabetes and their related complications, such as hypertension, hyperlipidemia, and atherosclerosis, and an alarming increase in unattended risk factors in younger populations will fuel the CVD epidemic for many years to come.¹ Given the projections of the incidence of CVD expected during the next 20 years,¹ the present way of delivering health care may soon be incapable of treating patients with already diagnosed CVD, and primary prevention aimed at intercepting patients at risk for CVD, our nation's number one killer, is a real long shot. The development of effective and efficient intervention strategies that address the multifactorial risk associated with chronic diseases and conditions like CVD is overdue. It is time to think beyond traditional models of care. At the heart of this health-care campaign may very well be one of the most powerful models of care ever mobilized — bilateral point-of-care screening, which relies on collaboration between dental hygienists and nurses in identifying and triaging patients at risk for systemic inflammation and chronic diseases, such as periodontitis and CVD.

CVD Statistics Going the Wrong Way

More than 70 million Americans have CVD,¹ which translates into one in four people with some form of CVD, including 7 million people with coronary heart disease (CHD) (myocardial infarction, angina pectoris), and more than 5 million people with stroke.¹ Table 1 chronicles a series of alarming statistics related to the prevalence, incidence, and mortality of CHD and stroke.¹ Even more frightening are the statistics related to the failure to assess CVD risk and to diagnose CVD. As an example, research indicates that for 50% of men and 64% of women who died suddenly of CHD, there was no previous recognition of the disease.⁴ Furthermore, it was found that a significant proportion of the population with identified risk factors for CVD were not diagnosed with CVD and include individuals who are not being treated for CVD adequately.⁴ Other studies have found that among insured people, 29% of adults with hypertension and 51% of adults with high cholesterol had undiagnosed CVD.⁴ For the uninsured, projections of CVD prevalence were even more pronounced, with 41% of uninsured people having undiagnosed hypertension and 71% having undiagnosed hypercholesterolemia,⁴ both highly recognized major risk factors for CVD.

There is a new twist to the etiology of CVD — about half of the patients presenting with myocardial infarctions (MI) do not have classic risk

Table 1
Alarming Statistics on the
Prevalence, Incidence, and
Mortality of Coronary Heart
Disease and Stroke.¹

Coronary Heart Disease:

- At current rates, an estimated 700,000 Americans will have a new coronary event, and 500,000 will have a recurrent event each year.
- The estimated number of years of life lost because of a heart attack is 11.5.
- 25% of men and 38% of women will die within 1 year after having an initial recognized MI.
- Individuals who survive the acute stage of a heart attack have a chance of illness and death that is 1.5 to 15 times higher than that of the general population.
- Within 6 years after a recognized heart attack:
 - 18% of men and 35% of women will have another heart attack.
 - 7% of men and 6% of women will experience sudden death.
 - 22% of men and 46% of women will be disabled with heart failure.
 - 8% of men and 11% of women will have a stroke.
- This year the estimated direct and indirect cost of CVD is \$393.5 billion.

Stroke:

- On average, someone in the United States has a stroke every 45 seconds and every 3 minutes someone dies of a stroke.
- Stroke accounted for more than 1 of every 15 deaths in the United States in 2002.
- Each year, about 500,000 people experience their first stroke and 200,000 experience recurrent strokes.
- 14% of people who survive a first stroke or transient ischemic attack will have another within 1 year.
- 22% of men and 25% of women who have an initial stroke die within one year.
- 8% to 12% of ischemic strokes and 37% to 38% of hemorrhagic strokes result in death within 30 days.
- The estimated direct and indirect cost of stroke is \$56.8 billion in year 2005.

factors for CVD.⁵ And contrary to the long-held belief that CVD is primarily induced by hypercholesterolemia, high cholesterol is relevant in only 50% of patients with coronary artery disease (CAD).⁶ As a result, researchers are aggressively pursuing other biological mechanisms that may implicate less obvious, more novel risk factors for CVD.

In Search of Novel Risk Factors for CVD

One of the biological mechanisms under investigation is the role periodontal infection may play in increasing the risk for CVD. During the last 20 years, many case-control and cross-sectional studies have shown have association between periodontal disease severity and CVD.⁷ It has been known for some time that there is a biological gradient between periodontal infection and the incidence of CHD and a dose relationship between various levels of bone loss and the cumulative incidence of angina and MI.⁸

Although many research findings point to intriguing evidence of a relationship between periodontal disease and CVD, a cause-and-effect relationship has yet to be proven. Experts at the 2003 American Academy of Periodontology (AAP) Workshop on Contemporary Science in Clinical Periodontics concluded that although there was a moderate level of evidence to suggest that periodontal disease is associated with CVD, additional large-scale longitudinal epidemiological and intervention studies are necessary to validate the association.⁹ What still remains a mystery is whether the association is causative or because of etiological factors common to both disease processes.⁹ The consensus opinion of the 2003 workshop stated there was insufficient evidence to support advising patients that periodontal treatment could prevent the onset or progression of atherosclerosis-induced diseases like CVD and stroke.⁹

Since the consensus findings of the 2003 AAP workshop, mounting evidence reported in dental and medical journals seems to strengthen the supposition that periodontal bacterial pathogens and the resulting host immune response are directly implicated in the development of atherosclerosis and in the increased risk for cardio- and cerebrovascular events.¹⁰⁻¹⁵ The Oral Infections and Vascular Disease Epidemiology Studies (INVEST) published within the last few years have provided more substantial evidence that periodontal disease may actually accelerate the development of atherosclerosis-related diseases (i.e. CVD and stroke).¹⁶ The INVEST studies also reported that

patients with significant periodontal bacterial burden had increased carotid intima-media thickness (IMT),¹⁶ which is an indicator of subclinical (undetected) atherosclerosis and a precursor to CVD.

One of the most reliable markers of systemic inflammation is high sensitivity C-reactive protein (hsCRP), which is one of the acute phase proteins that is produced by the liver in response to ischemia, trauma, burns, infections, and other inflammatory conditions.⁷ C-reactive protein (CRP) is an independent risk factor for CVD.¹⁷ The growing consensus is that testing CRP levels in the blood with high sensitivity assay (hsCRP), which is now widely available, can consistently predict new coronary events in patients with unstable angina and acute MI.¹⁸ It has also been suggested that increased hsCRP will elevate an individual at intermediate risk for CVD within 10 years to a higher risk category.¹⁸ Recent research indicates that there may be a gradient effect between the extent and severity of periodontal disease and elevated levels of hsCRP¹⁹ and that the presence of CVD seems to be highest in those individuals in whom periodontal disease co-exists with elevated hsCRP.²⁰ Patients with periodontitis have increased systemic levels of hsCRP and fibrinogen, both of which affect coagulation, platelet activation, and aggregation contributing to atheroma formation, thereby increasing the risk for CVD.^{21,22}

It is true that randomized controlled clinical trials to demonstrate the potential cardiovascular benefits of periodontal treatment are needed before sweeping changes in health-care policy can be established. Some of this research, in fact, may be on the way. The National Institute of Dental and Craniofacial Research (NIDCR) has just completed but not yet reported the findings of a study of 400 participants called PACE (Periodontitis and Cardiovascular Events) to determine if treating periodontal infections will lead to fewer MIs, cardiac revascularization, fatal coronary disease, unstable angina and hospitalized ischemic stroke.²³ This pilot clinical trial, involving investigations at five university treatment facilities, will provide supporting data for the development of a larger randomized clinical trial that will include about 4,000 participants from 15 academic centers across the United States.²³

Another study that is especially intriguing is being conducted at Boston University. Also sponsored by NIDCR, this study is designed to determine whether effective treatment of periodontal disease improves endothelial

function and reduces inflammation.²⁴The term being used to describe this kind of approach to therapy is *reversible atherosclerosis* (S. Amar, oral communication, Nov 2005). The investigators are halfway into clinical trials, with results expected in 2009.

The overwhelming statistics related to the prevalence, incidence, and mortality of CVD, in combination with the emerging body of evidence implicating periodontal infection as a potential risk correlate for CVD, provides an unprecedented opportunity for dental and medical collaboration. This includes prevention, early identification and progressive treatment of CVD, and recognition of novel risk factors related to systemic inflammation arising from chronic infections like periodontitis. Dental hygienists and nurses have a major role to play in bringing about this level of action. Although well-supported recommendations for preventing heart disease and stroke have been available for more than 50 years, these guidelines have not been well implemented by physicians and patient compliance is poor.²⁵ For example, the American Heart Association (AHA) recommends that adults 40 years of age or older with no history of CVD be assessed for their risk for CHD every five years.⁴ Unfortunately, research among primary care physicians found that such an assessment has not been widely implemented.⁴ Mobilizing point-of-care providers such as dental hygienists and nurses to perform risk assessment for periodontal disease and CVD may net the greatest gains in progressive prevention and detection of these diseases.

Perhaps one of the most compelling statistics to support ramping up dental hygienist and nurse collaboration in integrating risk assessment protocols is that 250,000 sudden deaths from CHD occur each year without hospitalization or in the absence of any previous history of CHD.²⁶ For these victims, there was no opportunity for treatment because no one identified their risk for CVD. In effect, death became the first sign of CVD. Collectively, the CVD statistics and emerging evidence of a relationship between periodontal disease and CVD provides a strong justification for using dental hygienists and nurses to provide progressive point-of-care intervention strategies.

Robust Reduction of Risk for CVD

It has been said that, "No matter what advances there are in high-technology medicine, the fundamental message is that any major reduction in deaths and disability from CVD will come from prevention and not cure. This

must involve robust reduction of risk factors."²⁷ Because atherosclerosis is associated with the majority of cases of CVD, robust reduction of risk factors for CVD necessarily begins with reducing the risk for atherosclerosis.

The development of an atherosclerotic lesion, which is implicated in the majority of CVD cases,⁹ is thought to be a multifactorial and complex process.⁶ Atherosclerosis is an inflammatory sequela, arising from injury, leading to dysfunction of the endothelial cells lining the lumen of an artery.⁶ The degree of endothelial dysfunction depends on the cumulative burden and severity of cardiovascular risk factors, including the cumulative burden of infections⁶ like periodontitis. Several causes of endothelial dysfunction that lead to atherosclerosis and, therefore, increased risk for CVD include, but are not limited to, elevated low-density lipoprotein, cigarette smoking, diabetes mellitus, and hypertension.⁶ Beck and Offenbacher recently wrote that, "The problem regarding CVD management is that since it requires decades to initiate and propagate, it also requires sustained intervention to prevent or treat."³ So true, yet without developing and sustaining primary prevention and health promotion intervention strategies that address all risk factors including those implicated in systemic inflammation, we will continue to see increasing numbers of people with CVD risk factors, increasing numbers of first and recurrent heart attack and stroke victims, and increasing numbers of people who die from CVD.²⁸

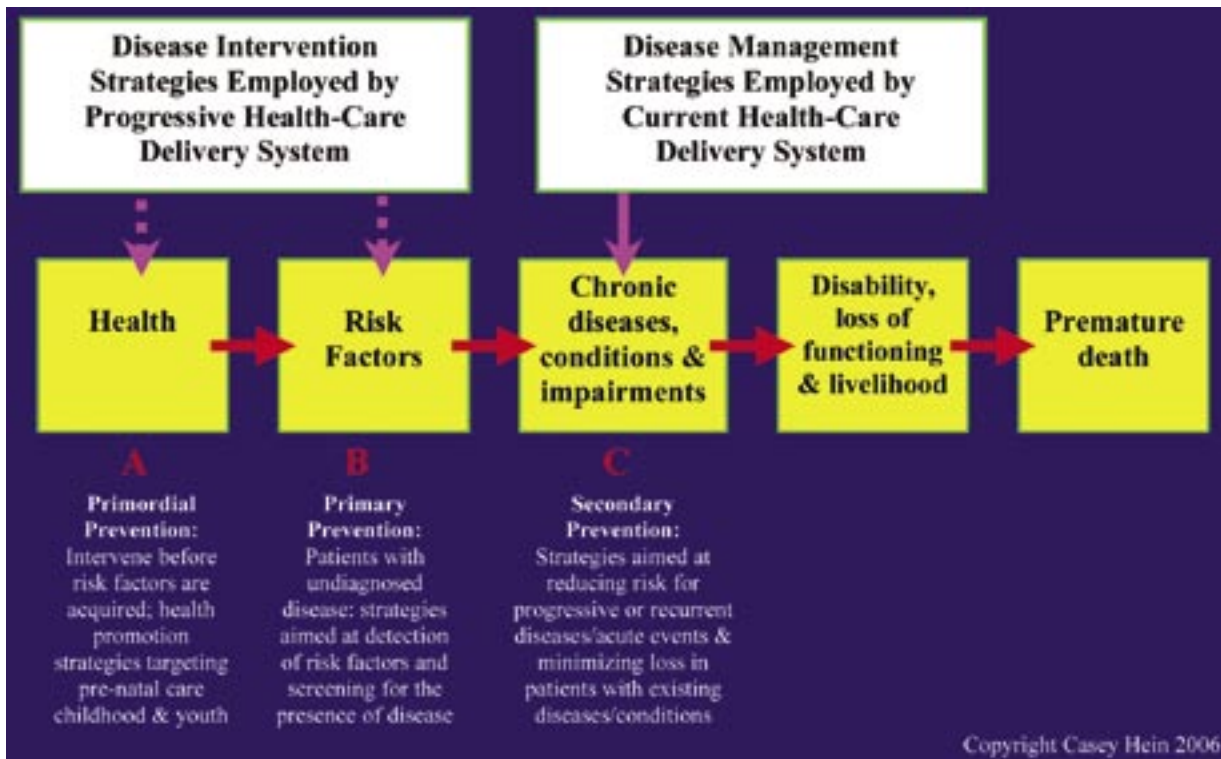
When *Healthy People 2010* was published in 2000, the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) shared joint responsibility for moving the nation toward achieving the goals set forth in the report and periodically reporting the progress over the course of the decade.²⁸ The *Healthy People 2010 Heart and Stroke Partnership* set into place four goals based on different intervention approaches for prevention, detection, and treatment of risk factors related to CVD:²⁵

- Prevention of risk factors
- Detection and treatment of risk factors
- Early identification and treatment of heart attacks and strokes
- Prevention of recurrent cardiovascular disease

Recommendations in the form of clinical practice guidelines for detecting and treating risk factors and preventing heart disease and stroke have been published

Figure 1

Points of intervention opportunities in targeting periodontal and cardiovascular disease



by the AHA/American Stroke Association (ASA), the American College of Cardiology (ACC), and the National Heart, Lung, and Blood Institute (NHLBI).²⁵ These recommendations embody three points of intervention of CVD (see Figure 1):

- Primordial prevention of CVD, Point A, includes the promotion of a combination of favorable health habits and conditions that protect against the development of CVD.²⁵ Cardiovascular health promotion targets individuals at any age who have not yet developed risk factors because the intervention occurred before the risk factors began to incite changes in the vasculature that lead to CVD.²⁵ Such interventions should start in childhood — some would argue even during gestation — and continue throughout adulthood to prevent risk factors from ever developing.²⁵
- Primary prevention, Point B, is intended to prevent a first heart attack or stroke by detecting and treating risk factors of individuals with CVD risk factors but no clinical manifestations of CVD.²⁵
- Secondary prevention, Point C, aims to reduce the risk for recurrent heart attacks or strokes by treating CVD

and the risk factors of individuals with established CVD, including survivors of CVD events.²⁵

The probability of achieving the risk prevention, reduction, and treatment goals contained in Healthy People 2010 and implementing the clinical practice guidelines set forth by the AHA/ASA, the ACC, and the NHLBI may be significantly increased with a collaborative model of care that aligns dental hygienists and nurses in the integration of clinical protocols and bilateral screening for CVD and periodontitis.

Mobilizing Dental Hygienists in Collaboration with Nurses

In fiscal year 2005, Congress appropriated \$45 million for the Heart Disease and Stroke Prevention Program.²⁹ The CDC, which has advocated for the adoption of a long-term national health-care policy that includes primary prevention of premature atherosclerosis,²⁹ currently funds risk reduction programs in 32 states and the District of Columbia.²⁹ The priorities of these programs include control of high blood pressure and high cholesterol.²⁹ What seems to be missing in these funding priorities are

strategies for reducing systemic inflammation, which is becoming increasingly recognized as a serious threat to cardiovascular wellness. Although the CDC acknowledges that collaboration in bringing about cardiovascular health is key, there is no reference to dental-medical collaboration or dental hygienist-nurse collaboration. This may represent a departure from the Surgeon General's recommendations for interdisciplinary care among dental and nondental care providers embodied in the *Oral Health in America* report published in 2000.³⁰ Bypassing this collaborative model of care may forfeit the potential of a valuable alliance in providing primary prevention in daily patient care.

Health-care usage patterns indicate that individuals tend to seek routine and preventive oral health care on a more frequent and regular basis than routine and preventive medical care.⁴ Glick and Greenberg⁴ recently reported a national probability sample that estimated that among people aged 40 to 85, about 25% reported having no history of CHD, heart attack, stroke, or angina, and no previous diagnosis of hypertension or high cholesterol levels. A number of these people with unidentified risk factors had not seen a physician within the previous 12-month period; however, they had seen a dentist within that same time period.⁴ When the researchers applied the Framingham-based risk calculation to this sample group, 18.3% of men were found to be at increased risk for a first CVD event.⁴ The findings from this study substantiate that dental-care providers are uniquely positioned to intercept CVD in patients who are unaware of their increased risk. Unfortunately for many people with undiagnosed CVD, it is hospitalization for an acute coronary event that provides the "teachable moment" for secondary prevention of a recurrence. The dental practice setting could provide the "teachable moment" for interception of those individuals with unidentified risk factors for CVD, a primary prevention strategy that is easily integrated into daily patient care.

Assessing the Risk of Periodontal Disease as an Exposure for Systemic Injury

Unfortunately, many practitioners still hold the view that periodontal disease is the clinical outcome of interest rather than a potential contributor to a greater disease process within the human body. This philosophy of practice may prevent clinicians from taking responsibility and becoming accountable for periodontal-systemic outcomes.

If the strength of evidence from epidemiological studies and intervention trials net the results that many researchers have speculated, it seems inevitable that the classification of inflammatory periodontal disease will have to be modified to reflect the level of risk it may pose for a potential exposure event for atherosclerosis-related systemic diseases such as CVD. Along those lines, various researchers have already developed concepts that attempt to quantify the risk of systemic consequences of periodontal infection. One of the most notable is the Periodontal Index for Risk of Infectiousness (PIRI).^{31,32}

The PIRI computes the amount of ulcerated subgingival space exposed to the infection burden and the potential systemic threat that the bacterial challenge poses to patients with periodontal disease.³² Using the PIRI to determine a patient's level of risk for periodontal-systemic consequences, individual patients are assigned penalty points. By taking into account the probing depths of the deepest periodontal lesions and their number per patient, this methodology gives a quick, gross estimation of the surface area of the interface between the subgingival biofilm and the epithelial walls of the periodontal niches.³² This provides a relative value for the level of individuals' risk for the release of proinflammatory mediators from the periodontium.^{31,32} When researchers used the PIRI to quantify the level of risk that periodontal infection posed to cardiovascular health, they found a significant dose response relationship between increasing PIRI scores and the presence of CAD; specifically that subjects who had the highest PIRI scores had a 13.8 times greater risk of having CAD than patients with the lowest scores.³²

The theory that periodontal infections predispose certain individuals to accelerated progression of carotid atherosclerosis (and therefore increased risk for stroke), MI and CVD may no longer be a stretch. To that end, it seems entirely appropriate for nondental practitioners to begin to categorize infection from periodontal origin as a risk correlate for CVD. It also seems right that nondental care providers start to recognize novel risk factors like elevated hsCRP, which is implicated in both CVD and periodontitis. Elevated levels of hsCRP have been shown to predict future coronary events and may add predictive value to testing for cholesterol levels.³³ In the future, medical and dental practices may screen patients to quantify certain markers of systemic inflammation implicated in diseases like CVD and periodontitis. Analyzers designed to monitor hsCRP and HbA1c are now available to use in-office or chairside, which can provide the mechanism for onsite

screening for markers of systemic injury of patients in dental and medical practices. These technologies place into the hands of medical and dental practitioners tools for both primary and secondary prevention of cardiovascular events, which are easily incorporated into patient care.

Should future events dictate that periodontal treatment is medically necessary to decrease the risk for systemic complications, such as CVD and ischemic stroke, it seems likely that the demand for periodontal services will increase. This, in turn, will prompt significant changes in insurance and reimbursement mechanisms. Assessing risk properly and triaging patients to appropriate health-care providers is pivotal in bringing about elimination and reduction of patients' risk for both periodontal and cardiovascular diseases and will require highly integrated dental-medical care. The actual implementation of periodontal medicine most appropriately falls to dental hygienists and nurses who are uniquely well positioned to play a key protective role by preventing the initiation, escalation, and/or acceleration of systemic events via bilateral point-of-care screening.

Building the Case for Dental Hygienist and Nurse Bilateral Point-of-Care Screening

Screening for individuals at risk for CVD and integrating the research findings associated with the theorized link between periodontal disease and CVD exceeds the capacity of any one profession. Indeed, it will take practitioners from both the medical and dental side, at all levels, to implement scientifically justified prevention strategies. It will also require targeted interventions that are multidisciplinary for a sustained period of time to change the risk profile of an individual who has identified risk factors for CVD and more extensive and sustained interventions for those who have already suffered a coronary event. Accordingly, there needs to be a purposeful shift from prevention and treatment of two distinct diseases (i.e., dental practitioners' sole focus on periodontal disease and medical practitioners' exclusive focus on CVD) to a transdisciplinary model of care. These overlapping boundaries of care are centered around prevention and treatment of a cluster of interrelated clinical signs and symptoms of chronic inflammation, with CVD, ischemic stroke, and periodontal disease being part of this cluster. Hypertension and diabetes (or insulin resistance), when present, may also be part of this cluster of interrelated signs and symptoms of chronic inflammation. New research may actually add validity to the assertion that health-care providers may need to

start thinking of CVD and periodontal disease as part of a cluster of interrelated variables.³

Beck and Offenbacher³ recently published a study that was designed to determine which CVD outcomes are affected by oral diseases and under what related circumstances individuals may be at greater risk for CVD.³ Using a statistical technique called principal component analysis, the researchers explored the relationship and the strength of correlation between traditional risk factors for CVD (i.e., smoking, hypertension, obesity, and age), periodontal pathogen exposure levels (low to high), antibody levels to those pathogens (low to high) and cardiovascular outcomes. The authors noted four distinct biofilm microorganism-host response patterns and speculated that there is a clustering of variables (i.e., traditional risk factors for CVD, levels of periodontal pathogens and antibody levels) within those biofilm patterns that correspond to CVD outcomes.³ In evaluating an individual's CVD health in comparison with the level of periodontal microorganisms and their antibody levels, the researchers found that IMT is more closely associated with antibody levels, and that stroke and CHD are more influenced by the level of periodontal microorganisms, especially when antibody levels are high.³ Of particular interest was the finding that individuals with early periodontitis, low levels of periodontal microorganisms and high antibodies are more likely to have CHD and stroke than individuals with severe periodontitis, high levels of organisms, and high antibodies.³ Elevated antibodies appeared to be associated with periodontal disease and chronic systemic conditions (i.e., CHD and diabetes). In conclusion, the researchers noted the importance of understanding the underlying relationships between oral infection and CVD and the implication of this in enabling better diagnosis, treatment, and management of CVD.³ This research presents a unique perspective and an intriguing concept that should be considered by both medical and dental professionals in moving toward transdisciplinary prevention and management of CVD. The clustering of interrelated variables also represents a domain of periodontal medicine that must be shared and equally understood by point-of-care providers like nurses and dental hygienists. Both medical and dental professionals are responsible for implementing this information into clinical practice.

Ideas for Implementing Bilateral Point-of-Care Screening by Dental Hygienists and Nurses

Recognizing the points at which clinicians have an

opportunity to alter the course of disease is the key to the implementation of successful intervention strategies. Figure 1 illustrates various points of intervention and valuable therapeutic opportunities for dental hygienists and nurses.

Intervention Point A represents *primordial preventive* measures, including health promotion (therapeutic seeding) directed toward lifestyle changes that emphasize exercise, weight loss or control, and knowledge of risk factors in healthy patients. Examples of therapeutic seeding include novel patient education strategies aimed at preventing obesity, smoking, sedentary behavior, and chemical addictions. In addition, education of certain ethnic populations known to be at greater risk for chronic diseases and patients with suspected genetic predisposition to periodontal disease is vital. Primordial prevention also includes proactive educational campaigns targeting such things as healthy nutrition and physical activity. Calibration of these messages between the nursing and dental hygiene professions would reinforce the same important patient information.

Intervention Point B corresponds to *primary prevention* and includes screening for the presence of an undiagnosed disease like diabetes and risk for CVD and ischemic stroke. Screening tools such as the Framingham global risk assessment, in-office hsCRP and HbA1c testing, the use of body mass index (BMI) tracking, and diabetic profiling, fall into this prevention category. This level of care has the potential to significantly impact chronic disease trends, but only if integrated screening can be incorporated into dental and medical practices. This transdisciplinary model of care adds significant value to the positions of both dental hygienists and nurses as preventive specialists.

Intervention Point C is *secondary prevention* and includes the treatment of chronic conditions in an attempt to minimize disability and/or the loss of function in individuals with already diagnosed diseases. Among other things, secondary prevention includes treatment of periodontal disease, metabolic control of diabetes, and management of hyperlipidemia and hypercholesterolemia with the goal of reducing disability or increasing compromised function.

With consumer demand for wellness and newly emerging philosophies of care that embrace the wellness model over the repair model, we can expect to see a push toward developing primary and secondary prevention strategies that pre-empt the incidence and severity of

chronic disease. The implementation of bilateral point-of-care screening by dental hygienists and nurses provides a potential clinical pathway that may have a profound effect on disease prevention or, possibly, disease reversal. Ideas relative to implementation of bilateral point of care screening by dental hygienists and nurses are as follows:

- *It has been observed that the risk for CVD is highest in individuals with periodontitis, elevated hsCRP concentrations, and serum antibody levels to periodontal pathogens.²⁰ This observation suggests that periodontitis increases CVD risk, primarily in those individuals who react to periodontal infections with a profound systemic inflammatory and immune response.²⁰ Interestingly, it has also been suggested that patients exhibiting both periodontitis and elevated hsCRP levels are not necessarily those with the most severe periodontal disease.²⁰ Regardless, researchers have reported that treating periodontitis in patients with elevated hsCRP results in decreased levels and may, therefore, translate into decreased risk for CHD.³⁴*

This information, in addition to other evidence concerning the relationship between hsCRP and periodontal disease, provides a compelling rationale for hsCRP testing by dental hygienists. These rationales include:

1. The use of hsCRP testing in dental offices may detect those individuals who present with less severe periodontal disease but react to periodontal infection with more profound systemic inflammation and immune response.
 2. The use of hsCRP testing in dental offices may increase the detection of individuals at high risk for CVD and ischemic stroke beyond that of lipid testing (cholesterol) alone.³³
 3. The use of hsCRP testing in dental offices may allow improved identification of individuals who would benefit from statin therapy (cholesterol-lowering drugs).³³
 4. The use of hsCRP testing in dental offices may increase the rate of identification of those cardiac patients who are at greater risk for an acute coronary syndrome.³³
- *Extensive periodontal disease and BMI were found to be commonly associated with increased hsCRP levels in otherwise healthy middle-aged adults, suggesting the need for both medical and dental diagnoses when looking for the sources of acute phase response in*

*some patients.*³⁵

Nurses screening otherwise healthy middle-aged adults for elevated hsCRP and obesity as determined by BMI may identify those patients at high risk for periodontal disease. Conversely, dental hygienists screening for those periodontal patients who are obese may identify patients at risk for increased hsCRP levels. Both of these strategies represent secondary prevention.

- *Obesity is associated with multiple-risk factor syndromes, such as hypertension, hyperlipidemia, type 2 diabetes, periodontal disease, and atherosclerosis.*³⁶ Among adults aged 18 and older, the prevalence of two or more risk factors increased from 23.6% in 1991 to 27.9% in 1999.¹ It is important to note that multiple risk factor syndromes increased for both men and women and across all race, ethnic, age, and education groups.¹ Among those with two risk factors in 1999, the most common combination was hypertension and high cholesterol (23.9%).¹ Among those with three risk factors, the most common combination was hypertension, high cholesterol, and obesity (32.5%).¹

Recognition by both nurses and dental hygienists of the interrelationships of the multiple-risk factor syndromes stated above allows for significantly greater bilateral interception of at-risk individuals, and the opportunity to triage, in both directions, those cases that require more aggressive care. Less than 12% of people say that a health-care provider has talked to them about the need for weight loss over the past year.³⁷ To that end, those practitioners who are reluctant to start dialogues with patients about weight control need to overcome their discomfort and begin to educate patients about the risks imposed by obesity.

- *Researchers found that, on average, adults who have experienced a coronary event had been small at birth and thin at 2 years of age, but then rapidly gained weight thereafter — a pattern of growth associated with insulin resistance in later life.*³⁸ The researchers concluded the risk for coronary events is more strongly associated with the rate of childhood gain of BMI than to BMI attained in adulthood.³⁸

Dental hygienists and nurses who incorporate aggressive therapeutic seeding related to prevention of childhood obesity into pedodontics and pediatrics may have the most significant influence on risk for future adult coronary events. Nurses also need to recognize that the incidence

of periodontal disease starting in youth is projected to increase parallel to childhood obesity trends.³⁹ The current epidemiologic trend indicates that this younger population subset may also become predisposed to chronic inflammatory diseases at a much younger age than their older cohorts,³⁹ which is significant for dental hygienists to consider when designing health promotion programs, including screening protocols.

- *With increasing severity of periodontitis, there is a progressive increase in left ventricular mass (a known independent predictor of CVD) in patients with essential hypertension. Researchers concluded that periodontal evaluation might contribute to refining cardiovascular risk assessment in patients with high blood pressure.*⁴⁰

A valuable addition to the assessment of individual patients would be a nurse's recognition that hypertensive patients with increases in left ventricular mass might also be at increased risk for periodontal disease. Triage of such at-risk patients to dental care providers constitutes an excellent opportunity for collaboration with the dental profession. On the other hand, a dental practitioner's measurement of blood pressure can identify the presence of hypertension and/or level of the patient's hypertension control,⁴¹ both of which represent cases that should be triaged to a medical practitioner.

- *Patients with diabetes are 2 to 5 times more likely, smokers are 3 to 7 times more likely, patients who report that parents or siblings lost their teeth at a young age may be 3 to 5 times more likely, and those with suspected genetic predisposition and who also smoke are 8 to 10 times more likely to develop periodontal disease.*⁴²

These are the very individuals who are at significantly higher risk for periodontal disease and when seen by medical practitioners should be triaged to dental practitioners. It is fairly simple to include known risk factors (i.e., smoking, diabetes, and genetic predisposition) for periodontal disease that do not require intraoral examination as part of nurses' assessment of their patients.

- *Some investigators have found gingival inflammation may be considered a more significant risk factor for CVD than clinical attachment loss.*⁴³

If nurses used a screening tool as simple as a wooden toothpick to check for gingival inflammation and bleeding of gingival margins or interproximal papillae, it seems reasonable that cases of gingivitis could be identified in medical settings. Treatment intervention at this point may decrease patients' risk for CVD and ischemic stroke. Conversely, it should be noted that dental hygienists' recognition that periodontal disease and gingivitis may increase a patient's risk for CVD or ischemic stroke is important if patient wellness is the outcome of interest.

- *Porphyromonas gingivalis* has been implicated in several steps in the development of the atherosclerotic lesion.^{44,45} In addition, hsCRP levels are highest in patients who are infected with periodontal pathogens.⁴⁶

Another opportunity, albeit rather unconventional, for intervention would be the incorporation of DNA probe and sensitivity testing to screen for *P. gingivalis* and other periodontal pathogens in medical practices. Taking a sample of subgingival plaque is performed by placing a paper point subgingivally and although this is an intraoral procedure, taking the sample is relatively noninvasive and may be easily taught to nondental care providers.

- Recent research has found that radiographic evidence of severe periodontal bone loss was independently associated with nearly a four-fold increase in risk for the presence of carotid artery plaque.⁴⁷

This has considerable significance for the dental community. Patients with radiographical evidence of periodontal bone loss may be excellent candidates for referral to the medical side; the addition of hsCRP testing might add further validity to the need for referral. Conversely, patients with diagnosed atherosclerosis represent those who medical care providers should triage for periodontal evaluation and treatment.

Conclusion

Central to all these point-of-care intervention strategies is the assumption that dental hygienists and nurses have a keen awareness of the systemic affects of cumulative infection and the systemic inflammatory burden implicated in atherosclerosis formation. Bilateral point-of-care screening for periodontal disease and cardiovascular risk also supposes that health-care providers on both sides understand the contribution of periodontal infection to systemic inflammation and that prevention or treatment of

periodontal disease will reduce the cumulative pathogen and inflammatory burden. As a result, these types of intervention strategies may decrease the morbidity associated with chronic diseases. These strategies also assume that dental hygienists and nurses are intensely aware of how chronic disease states jeopardize patients' oral health status.

No doubt screening and diagnostic technologies will some day soon make targeting those at risk a much more concrete science. Currently in development is a self-contained saliva test that would allow detection of periodontal and cardiovascular disease in dental offices, estimated to take no longer than 15 minutes to perform.⁴⁸ Until these types of non-invasive, efficient, and affordable tests of biological markers of chronic disease states are developed and commercialized, we must rely on traditional risk assessment of periodontal disease and CVD.

There is a significant body of evidence to support the concept of a cluster of interrelated signs and symptoms of chronic inflammation that includes periodontal disease and atherosclerosis-related diseases. To address this cluster of maladies, nurses and dental hygienists are uniquely positioned to deploy progressive disease intervention strategies within a collaborative framework that includes wellness promotion and primary prevention. Neither of these points of intervention are currently practiced in mainstream health care. Moving to a transdisciplinary model of care will no doubt be challenging. Proactive initiatives of the nursing and dental hygiene professions to achieve this goal should be a major focus of contemporary dental hygiene and nursing practice. Until there is reform of dental hygiene and nursing education that includes a strong oral-systemic component in the curriculum, the forerunners of this transdisciplinary model of care will most likely be individual dental hygienists and nurses who independently forge alliances to foster collaboration. These alliances will be comprised of practitioners who are committed to pursuing a wellness model of care, who are willing to abandon traditional professional boundaries, and who are willing to risk doing something yet uncharted to provide extraordinary patient care. For millions of people who are destined to lose their lives on their first encounter with CVD, mobilizing dental hygienists in collaboration with nurses to perform bilateral point-of-care screenings may significantly reduce premature death.

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