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OSTEOPOROSIS PREVENTION AND SCREENING: POTENTIAL ROLE FOR HEALTHCARE PROFESSIONALS?

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Abstract
Long-term inflammation is associated with irreversible destruction of parenchyma and connective tissues. Osteoporosis and periodontitis are examples of chronic inflammatory diseases that cause significant damage to soft and hard tissues, and recent evidence suggests potential links between these diseases. Periodontitis may be an early marker for osteoporosis. It is also possible that osteoporosis increases the risk of development or progression of periodontitis as the result of reduced quantity and quality of alveolar bone. Thus, preventive approaches, especially transdisciplinary interventions involving multiple health professionals, may be particularly important for maintaining oral health in individuals with osteoporosis. The collaborative potential of dental hygienists for implementing practical interventions aimed at controlling and preventing chronic diseases has yet to be fully realized. This article reviews current evidence supporting the association of osteoporosis with the onset and progression of periodontal disease and discusses the implications of 2 pilot projects involving the interaction of dental hygienists with the nursing and medical professions as part of the comprehensive healthcare team. As a primarily prevention-oriented healthcare professional, the dental hygienist may be the ideal primary care provider to initiate educational discussions with female patients at risk of osteoporosis, refer for medical evaluation, and follow-up on subsequent oral health appointments. The nature of the dental hygiene curriculum also facilitates collaborative education and clinical training programs that support transdisciplinary wellness approaches to improving oral-systemic health. These pilot projects may serve as a valuable litmus test for innovative models that integrate healthcare education and training with clinical practice to improve overall patient management.

Citation: Horn J, Iacopino A. Osteoporosis prevention and screening: potential role for oral health professionals? *Grand Rounds Oral-Sys Med.* 2007;2:36-41. (Digital version *Grand Rounds Oral-Sys Med.* 2007;2:36-41a.)
*(A complimentary copy of this article may be downloaded at **www.thesystemiclink.com**.)*

Key Words: Osteoporosis, risk assessment, periodontal disease, transdisciplinary management, screening

Introduction

Risk assessment and prevention will play an increasingly important role in health care as we gain greater understanding of the bidirectional relationships of chronic conditions. The emerging science of oral-systemic medicine seeks to define these associations and implement this knowledge in patient intervention strategies. Compelling research confirms the prevalence and serious risks of oral diseases among Americans, showing how vitally important good oral health is to general health and well-being.[1] This growing body of evidence supporting connections between periodontal disease and chronic disease risk or exacerbation, provides an opportunity for dental hygienists to engage in transdisciplinary practice with their nurse counterparts.[2-10]

Two recent pilot projects illustrate the potential benefits of this model in the ongoing management of patients with osteoporosis. The *Dental Hygienists' Osteoporosis Educational Intervention* study affiliated with the Pennsylvania Dental Hygienists' Association (J. Gleber, electronic communication to J. Horn, Feb 2007) and the *Oral-Systemic Risk Assessment*

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Rounds pilot clinical training rotations project, developed by the University of New Mexico's Division of Dental Hygiene Graduate Program (J. Horn and A. Scott, 2005), are demonstrating increased efficiency and improved patient care through the integration of various educational, training, and practice activities. Despite the increased awareness of the potential of medical-dental collaboration and calls for demonstration projects that show the utility of dental hygienist–nurse models of care, there continues to be a lack of acceptance and a reluctance to change traditional healthcare models. This is not unusual for the healthcare industry, which is an industry characterized by resistance to innovation.[11-13] This notorious lack of flexibility threatens to delay important current health promotion initiatives arising out of oral-systemic medicine, including the use of dental hygienist-nurse screening programs and early intervention strategies to reduce risks and mitigate systemic disease outcomes.

Chronic conditions are health problems which require ongoing management over a period of years or decades and constitute the major cause of death and disability worldwide. Intervention of these chronic diseases dramatically impacts the demands for healthcare.[14,15] Some of the diseases in the noncommunicable category, such as obesity, diabetes, and cardiovascular disease, overlap, share modifiable risk factors, and have bidirectional relationships linked by the common denominator of chronic inflammation or frustrated repair. Periodontitis has been associated with a number of these systemic conditions, and there are data to suggest that there is also a relationship between periodontitis and osteoporosis.[1,16-19] Our greater understanding of the complexity of caring for patients with these interrelated diseases and conditions and associated comorbidity challenges the roles and responsibilities of individual clinicians, medical groups, insurers, and public health departments.[20,21] Indeed, the evolving body of evidence that supports the plausibility of interrelationships between periodontal diseases and systemic diseases and conditions provides a strong rationale for including the diagnosis and treatment of oral infections as an integral part of comprehensive disease management. Erecting barriers to this type of innovative practice obstructs the use of the available science and evidence base and affects every aspect of healthcare delivery.

The disease of osteoporosis presents an opportunity for medical-dental collaboration. The compelling rationale for collaboration between nurses and dental hygienists in screening for osteoporosis and oral diseases focuses on 3 clusters of influence that correlate with how quickly change will occur: perceptions of an innovation, characteristics of the people who adopt the innovation or fail to do so, and contextual factors involving communication, incentives, leadership, and management.[11,12] Our current system of delivery of care that is overly focused on acute, episodic care begs disruption of the status quo.[12,13]

Osteoporosis and periodontitis

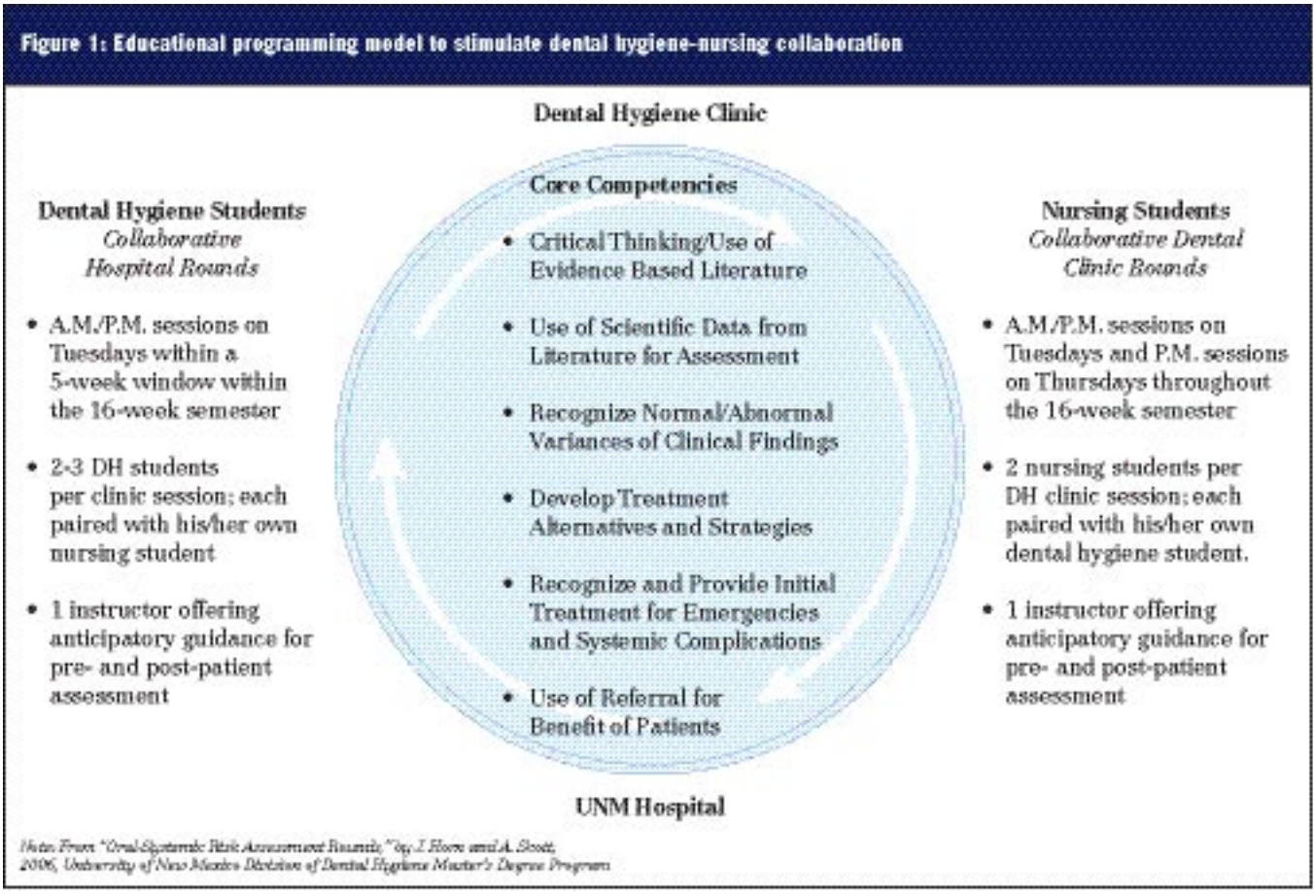
Osteoporosis increases in incidence with advancing age and affects more than 200 million persons worldwide.[22] In the United States (U.S.) alone, 34 million persons are at risk and 10 million already have the disease; 80% of the affected individuals are women. Osteoporosis is characterized by decreased bone mass and poor bone quality, which leads to increased numbers of hip, spine, and wrist fractures.[22] Bone density is expressed as grams of mineral per area or volume and, in any given individual, is determined by peak bone mass and amount of bone loss.[23] Bone quality refers to architecture, turnover, damage accumulation (e.g., microfractures), and mineralization.[24] The acute and long-term medical expenses associated with fracture are estimated to be $10-$18 billion.[25,26] The prevalence of osteoporosis and osteoporotic-related fractures is projected to increase significantly unless the underlying bone health status of Americans is significantly improved.[20] By 2010, roughly 12 million people over the age of 50 are expected to have osteoporosis and another 40 million to have low bone mass.[27] By 2020, those figures are expected to jump to 14 million cases of osteoporosis and more than 47 million cases of low bone mass.[27]

The American Academy of Orthopedic Surgeons and the National Osteoporosis Foundation's joint position paper[22] supports the belief that patient and health profession educational programs are essential for reducing osteoporotic fractures. These educational programs should include information about:

- *Associated risk factors, including insufficient calcium intake, sedentary lifestyle, smoking, excessive alcohol consumption, family history of fractures, small or slender body frame, fair skin, and white or Asian background*
- *Early diagnosis of osteoporosis, which is usually made by using a combination of a complete medical history/physical examination, skeletal radiographs, bone densitometry, and bone turnover tests*
- *The importance of adequate dietary intake of calcium, vitamin D, and other nutrients at an early age, especially in young girls*
- *The efficacy and safety of estrogen and estrogen antagonists, bisphosphonates, calcitonin, and evolving hormone therapies to prevent and treat osteoporosis*
- *Sufficient exercise and activity*
- *Fall prevention strategies*

Periodontitis affects 75% of the American public and is currently defined as an infection-mediated destruction of the supporting structures of the tooth, alveolar bone,

Figure 1: Educational programming model to stimulate dental hygiene-nursing collaboration



Note: From "Oral-Systemic Risk Assessment Rounds," by J. Horn and A. Scott, 2006, University of New Mexico Division of Dental Hygiene Master's Degree Program

periodontal ligament, and gingival tissues.[28] Periodontitis is responsible for most of the tooth loss in adult populations, which usually begins before the age of 20. The primary etiological bacteria which have been implicated include *Porphyromonas gingivalis*, *Prevotella intermedia*, *Bacteroides forsythus*, and *Actinobacillus actinomycetemcomitans*.[29] Periodontal disease is characterized by a host response elicited by bacteria and bacterial biproducts that diffuse through the epithelium and initiate an inflammatory response.[30,31] Studies[16,17] indicate that this oral disease has more than a casual relation with serum lipids and proinflammatory cytokines, inducing negative effects on systemic health. Potential mechanisms by which host factors may directly or indirectly influence the onset and progression of periodontal disease in patients with osteopenia include low bone density in the oral cavity, bone loss as an inflammatory response to infection, genetic susceptibility, and shared exposure to risk factors.[18,32] The risk factors for periodontal disease that can be used by nurses and other healthcare professionals in screening are listed in Table 2 entitled *Assessment of Risk Factors for Periodontal Disease*,[33] which may be accessed and downloaded from the *Clinical Decision-Making Tools* section at www.thesystemiclink.com.

Epidemiologic studies suggest a reciprocal influence of osteoporosis and periodontal disease.[19] Both diseases are chronic, multifactorial diseases that share common risk factors and bone tissue damage characteristics. Some studies[20] have shown that periodontitis could be an independent risk factor for several systemic diseases and conditions, including osteoporosis. Several recent studies[29] have attempted to define the relation between osteoporosis and periodontitis by using clinical attachment level, alveolar crestal height, tooth loss, and mandibular bone density as assessment criteria. Periodontitis and oral bone loss evaluations include radiographic measures of alveolar bone height and residual ridge resorption, probing depths to measure clinical attachment loss, and documentation of tooth loss. Oral bone density studies measure absolute bone density with techniques such as dual photon absorptiometry, quantitative computed tomography, and radiographic absorptiometry. Studies also approximate change in bone density over time with computer-assisted densitometric image analysis. Studies have generally supported a positive association between periodontitis and osteoporosis; however, several factors, such as small sample sizes, variable methods, and lack of standardized techniques, prevent definitive conclusions.[21]

Table 1
Red flags that warrant further assessment for osteoporosis or other bone diseases

- History of fractures related to mild or moderate trauma
- Family history of bone disease
- Low body weight
- Weight loss of more than 1% per year in the elderly
- Late onset of sexual development
- Unusual cessation of menstrual periods
- Anorexia nervosa
- Athletic amenorrhea syndrome
- Patients being treated with drugs that affect bone metabolism (e.g., glucocorticoids)
- Patients with diseases linked to secondary osteoporosis
- High levels of serum calcium or alkaline phosphatase in otherwise healthy patients
- Hyperparathyroidism, hyperthyroidism, or treatment with high doses of thyroid hormone
- Height loss or progressive spinal curvature

Note: From *Bone Health and Osteoporosis: A Report of the Surgeon General* (Chapter 8), by R.H. Carmona, 2004, U.S. Department of Health and Human Services.

Time for a new model for chronic disease management — transdisciplinary care

According to the World Health Organization, current systems of healthcare share similar characteristics regarding chronic, noncommunicable diseases: they are organized to provide acute illness care, the patient's role in management is not emphasized, follow-up is sporadic, community services tend to be ignored, and preventive interventions are underutilized.[15] The importance of identifying novel and improved approaches to meet the healthcare needs of all Americans is emphasized in the 2004 U.S. Surgeon General's report[20] on bone health and osteoporosis. This report not only reflects the burden to society and individuals, but also addresses the obstacles healthcare providers face when attempting to change practice patterns through transdisciplinary models of healthcare delivery.

Examples of transdisciplinary dental hygiene models for education and patient care

Dental Hygienists Osteoporosis Educational Intervention Study

A pilot study entitled *Dental Hygienists' Osteoporosis Educational Intervention*, initiated through an educational grant to the Pennsylvania Dental Hygienists' Association, began in November 2005 with 75 dental hygiene students from the 3 academic programs in Pennsylvania (J. Gleber, electronic communication to J. Horn, Feb 2007). The pilot study seeks to validate that dental hygienists can play an active role in the education and screening of patients at increased risk for osteoporosis. Dental hygiene students received 4 hours of education from physicians related to the incidence, etiology, progression, and prevention of osteoporosis. Additionally, the dental hygiene students received training on patient communication. The goal of this part of the project is to enable the dental hygiene students to improve their understanding of the risk factors associated with osteoporosis and which bone-healthy behaviors can be adopted to maintain or improve bone health. This information is being communicated to the students' female patients as part of a comprehensive healthcare model.

To test the validity of this model, these dental hygiene students are using osteoporosis screening and education protocols in their clinics. Women above the age of 50 are asked to complete a pre-osteoporosis intervention questionnaire for baseline assessment of their knowledge of osteoporosis and self-management of the disease. These patients are then provided a tri-fold educational brochure with a risk factor screening questionnaire which they are also asked to complete. Dental hygiene students review this information with patients during subsequent visits at which time patients are also provided specific information on adopting healthy bone behaviors, such as increased calcium intake and weight-bearing exercises. Patients who are determined to be at high risk are referred to physicians. Health history findings that trigger the need for further assessment for osteoporosis or other bone diseases are listed in Table 1. Patients are telephoned approximately 3 months after their dental hygiene visit for a follow-up phone interview which lasts 5-6 minutes, during which time the patients are asked about any changes in bone health or lifestyle and whether they followed through with recommended evaluation for osteoporosis with their physicians.

Oral-Systemic Risk Assessment Rounds pilot project

The Division of Dental Hygiene, College of Nursing, and the University of New Mexico Hospital at the University of New Mexico are currently participating in a pilot project called *Oral-Systemic Risk Assessment Rounds* which is designed to enhance direct patient care while educating nursing and dental hygiene students on how to take a collaborative approach to wellness promotion (J. Horn, written communication, April 2006). An overview of the entire oral-systemic risk assessment training program is given in Figure 1. Recognizing the lack of interaction between dental hygienists and nurses, the pilot's foremost goal is to raise awareness of the importance of oral health.

Through dual learning and problem-solving strategies, interdisciplinary initiatives which utilize oral-systemic risk assessment evaluation, and bilateral point-of-care extramural rotations, the pilot project seeks to promote interdisciplinary training and develop protocols for improving oral-systemic health.

The Division of Dental Hygiene is organizationally housed within the Department of Surgery, School of Medicine at the University of New Mexico. It is unique in that it is the only dental hygiene program in the U.S. housed within a medical school. This creates many opportunities for interdisciplinary education and practice. The nature of the dental hygiene curriculum also facilitates collaborative education and clinical training programs that support transdisciplinary wellness approaches that improve oral-systemic health. The diversified education and training experiences facilitate face-to-face interaction and transdisciplinary learning and practice. This pilot program may serve as a valuable litmus test for innovative models that integrate healthcare education and training with clinical practice to improve overall patient management.

Conclusion

Age-related, chronic degenerative diseases are widespread shifting the burden of care toward chronic disease management. Comprehensive healthcare plans have evolved to meet this demand. Usually requiring long-term management, both osteoporosis and periodontitis impose devastating effects on quality of life resulting in tooth loss, reduced facial esthetics, disability, deformity, pain and fractures. Osteoporosis and periodontitis remain under-recognized and under-treated. This significant public health issue demands a transdisciplinary approach which enlists all healthcare providers in screening for periodontal disease and all dental providers screening for osteoporosis.

Clinicians deal with the concept of risk on a daily basis in terms of assessment of oral-systemic diseases, outcomes and therapies. Critical clinical decisions hinge on our interpretation of these risks. To realize quality care, every component of the patient's health must be considered in assessment, prevention, and treatment. In contrast with the primary care provider centered model, a transdisciplinary approach allows for interventions which recognize the inflammatory links which appear to underpin a relationship between periodontal diseases and systemic injury. Continuing cross-disciplinary education and introducing the concept for shared responsibility for whole body wellness will be a catalyst for change.

Osteoporosis is often a silent disease in women after menopause and may be developing in women who appear to be in good health. As a primarily prevention-oriented healthcare professional, the dental hygienist may be the ideal primary care provider to introduce and maintain educational discussions with female patients at risk for osteoporosis, to refer for medical evaluation, and follow-up on subsequent oral health appointments. Regular 6-month appointments with the dental hygienist for preventive oral health care would be a logical time to implement an osteoporosis educational and screening intervention. Through a focus on partnering, the previously described pilot programs illustrate transdisciplinary communication and interaction between health professionals that will contribute greater collaboration between dental hygienists, nurses, physicians, and patients. Transdisciplinary approaches may fill the gaps in health care; especially for potentially related diseases/conditions such as osteoporosis and periodontitis.

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