Editorial

ADHA and Research: Coming together with the World

By Rebecca S. Wilder, RDH, BS, MS

I recently attended two amazing conferences in Washington, D.C. The first was the North American Dental Hygiene Research Conference and the other was the American Dental Hygienists' Association (ADHA) Annual Session/Center for Lifelong Learning. Even in these economic times, both meetings were jam packed. One might ask why this is, when so many people are out of work and depressed about the economy. Well, I did not see depressed people at these conferences – both meetings were full of energetic, dynamic, courageous and ambitious individuals who are trying to make a difference for their profession, their patients and for the people of the world.

The North American Dental Hygiene Research Conference was planned and implemented through the leadership of Dr. Jane Forrest and Dr. Ann Eshenaur Spolarich, along with a steering committee of seven members from the United States and Canada. The conference sold out weeks before it started. Many countries were represented at the 3-day conference. On the first day, the meetings were held at the National Institutes of Health with the Director of the National Institute of Dental and Craniofacial research (NIDCR) providing welcoming comments. We learned about the NIDCR's strategic plan for the coming years and heard from other leaders in Canada and the U.S. that recognize the important role dental hygienists currently have, and should have, in the promotion of oral and overall health for all people. Other topics at the conference dealt with emerging technologies, cultural considerations for practice, linking dental hygiene and systemic health, the changing climate of research, preparing competitive grants, and assessing the efficacy of alternative dental hygiene models of care delivery in meeting community needs. In addition, over 30 poster presentations occurred at the conference as well as 20 Lunch and Learn sessions on everything from "How to Write and Publish" to "Dental Stem Cell Research." Even though the conference was packed with fabulous information and ideas, the most exciting part was the enthusiasm and sense of connection that came from dental hygienists from Canada, the US, Sweden, England, Scotland, Italy and other corners of the world. We all have a common goal - to promote the very best oral health across the globe.

The ADHA Annual Session/Center for Lifelong Learning was also a first in many aspects. I would like to commend DENTSPLY Professional for recognizing the value of dental hygiene research produced through the graduate dental hygiene programs in the United States. This year, DENTSPLY and ADHA announced the DENTSPLY/ADHA Graduate Dental Hygiene Research Program. Through a partnership between the ADHA and DENTSPLY, each graduate dental hygiene program was invited to nominate one outstanding graduate student project, based on criteria determined by the program, to represent them at the ADHA CLL at Annual Session. Qualifying research could include clinical or basic science research, which supports the research priorities identified in the National Dental Hygiene Research Agenda and contributes to the dental hygiene knowledge base.

There were 15 outstanding entries in the competition. The winning projects are listed below, although I think all 15 are winners. These students

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DENTSPLY/ADHA Graduate Dental Hygiene Research Award Winners

1st Place	2nd Place	3rd Place
Jane C. Cotter, RDH, BS	Cherri L. Kading, RDH, BS, MS	Amy E. Coplen, BSDH
Baylor College of Dentistry	University of North Carolina, Chapel Hill	University of Michigan
Factors Affecting the Performance of Oral Cancer Screenings by Texas Dental Hygienists	*Factors Affecting North Carolina Dental Hygienists' Confidence in Providing Obesity Education and Counseling*	*Current Status of Dental Hygiene Faculty and Perceptions' of Important Qualifications In Future Faculty*

are our future and we must keep the scholarly activity moving forward. Congratulations to the three dental hygienists listed below who won the Inaugural DENTSPLY/ADHA Graduate Dental Hygiene Research Award.

Be on the lookout for the next issue of the Journal of Dental Hygiene. The entire issue will be the publication of the Proceedings of the North American Dental Hygiene Research Conference held in June, 2009. You will not want to miss it.

Have a great summer!

Sincerely,

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Editor in Chief: Journal of Dental Hygiene

Finding Solutions:
Implementation of the ADHP Model

Jacquelyn L. Fried, RDH, MS

Introduction

The Advanced Dental Hygiene Practitioner (ADHP) model for health care delivery in the U.S. champions the provision of accessible quality care to the underserved, the promotion of healthy lifestyles and quality of life, and the belief that oral health care must be integrated into the delivery of comprehensive health care services. The first *Surgeon General's Report on Oral Health*,[1] *Healthy People 2010*,[2] and a *National Call to Action to Promote Oral Health*[3] are 3 federal documents that illuminate health disparities within our society, chart a course for increasing the quality and years of healthy life for American citizens, and acknowledge that attainment of oral health is essential to achieving total well-being. The purpose of this paper is to demonstrate how the role and dimensions of the ADHP are congruent with the philosophies, objectives, and strategies set forth in these documents.

The first *Surgeon General's Report on Oral Health* provides a broad description of oral health and highlights the relationship between oral health and general health (i.e., the oral-systemic link). Inequities in the provision of oral health care services to many disadvantaged populations within the U.S. are emphasized. Prevention is viewed as the measure to halt the "silent epidemic of oral disease" and the main strategy for reducing unnecessary pain and suffering associated with compromised oral health.[1] Philosophically, the ADHP concept and the *Surgeon General's Report* share 3 salient similarities: both recognize that meeting oral health needs must be brought to the forefront, prevention is paramount in disease eradication, and oral health is an integral component of total well-being. The key themes of the *Surgeon General's Report* are: 1) oral health means much more than healthy teeth, 2) oral health is integral to general health, 3) safe and effective disease prevention measures exist that everyone can adopt to improve oral health and prevent disease, and 4) general health risk factors, such as tobacco use and poor dietary practices, also affect oral and craniofacial health.[1] The essence of the ADHP derives from these themes. Themes 1 and 2 are realized by the ADHP's holistic approach to oral health and overall well-being and the concomitant belief that oral health is a lynchpin for systemic health. As promulgated by the ADHP, healthy teeth enable proper nutrition and have the potential to increase self-esteem and general health. Recognition of the oral-systemic link is integral to comprehensive patient assessment, treatment planning, and case management. Multi-disciplinary collaboration, an important aspect of the ADHP's role, highlights the inextricable relationship between oral health and total well-being.

In relationship to theme 3, the ADHP is a proponent of disease prevention and health promotion, and realizes that the delivery of individualized, culturally sensitive educational messages can help people adopt effective disease prevention behaviors. By working with families and community groups, the ADHP can help create coalitions that convey these key preventive messages to their constituencies. As professionals who integrate current research into their practices, ADHPs employ cost-effective prevention strategies, and can adapt those strategies to meet community needs.

Regarding theme 4 of the *Surgeon General's Report*,[1] the ADHP would target deleterious habits that threaten oral and systemic health, such as tobacco use and improper diet. For example, when educating and treating pregnant women, the ADHP will address and monitor tobacco use and discuss associated hazards posed to both mother and developing fetus. In their efforts to stem oral and craniofacial disease, ADHPs will identify high risk individuals and groups and plan interventions based on sound assessment data. Coalitions formed with community groups (e.g., American Cancer Society, American Heart Association, Head Start, WIC) can raise awareness of the association between craniofacial anomalies, oral disease, tobacco use, and poor dietary practices. Philosophically, the ADHP is aligned consistently with the *Surgeon General's Report*.[1]

Healthy People 2010 addresses both oral and systemic health through its inclusion of 28 health arenas, one of which is oral health. The oral health goal for *Healthy People* is "to prevent and control oral and craniofacial diseases, conditions and injuries, and to improve access to related services."[2] The 17 oral health objectives which emanate from this goal are broad-based and cover a gamut of oral health issues,

policy matters, and population-specific oral health concerns, ranging from sealant placement to early detection of oral cancers (Table 1). The ADHP has direct relevance to each of these objectives. In addition, *Healthy People 2010* includes many other health categories to which the ADHP can contribute. The ADHP can make positive contributions to arenas that include access to quality health services, cancer reduction, diabetes prevention, educational and community based programs, health communication, tobacco use, substance abuse, health insurance, injury and violence prevention, and maternal, infant, and child health. In essence, the ADHP could aid in the attainment of the majority of *Healthy People 2010's* goals and objectives. Table 2 exhibits the congruence of the ADHP competencies with the *Healthy People 2010's* oral health objectives. These relationships will be discussed later in this report.

Table 1 - Objectives for Oral Health, adapted from Healthy People 2012

Goal	
Prevent and control oral and craniofacial diseases, conditions, and injuries and improve access to related services.	
Number	**Objective**
1	Reduce dental caries experience among adolescents and children in primary and permanent teeth
2	Reduce untreated dental decay among children, adolescents, adults
3	Reduce permanent tooth loss
4	Reduce complete tooth loss
5	Reduce periodontal disease
6	Increase rate of early detection of oral and pharyngeal cancers
7	Increase annual examinations for detection of oral and pharyngeal cancers
8	Increase dental sealant placement in children's molars
9	Increase availability of fluoridated community water
10	Increase child and adult use of oral health care system
11	Increase use of oral health care system by residents in long-term care facilities
12	Increase receipt of preventive dental services by low-income children and adolescents
13	Increase numbers of school-based health centers with oral health component
14	Increase numbers of community health centers with oral health service components
15	Increase number of U.S. jurisdictions that systematically record and refer children with craniofacial abnormalities to rehabilitative teams
16	Increase number of U.S. jurisdictions that have an oral and craniofacial surveillance system
17	Increase number of effective tribal, state, and local dental programs directed by dental professionals with public health training

A National Call to Action to Promote Oral Health,[3] which emanated from the first *Surgeon General's Report on Oral Health*, proposes 3 major goals: 1) promote oral health, 2) improve quality of life, and 3) eliminate oral health disparities. The report urges that oral health promotion, disease prevention, and oral health care be visible in all health policy agendas, set at all levels of government. For this to occur, the report emphasizes that all stakeholders must recognize that oral health is integral to general health, and that "the oral health community must be ready to act in efforts to address the nation's overall health agenda." The 5 actions set forth by the *Call to Action* (CTA) are: 1) change perceptions of oral health, 2) overcome barriers by replicating effective programs and proven efforts, 3) build the science base and accelerate science transfer, 4) increase oral health workforce diversity, capacity and flexibility, and 5) increase collaborations. These strategies demonstrate a high degree of congruence with the ADHP framework and mission.[4] Further, since CTA emphasizes implementation, a close scrutiny of the ADHP's competencies in relationship to these action plans is important.

The aspirations expressed in the first *Surgeon General's Report*,[1] *Healthy People*,[2] and the CTA[3] necessitate action. The belief that oral health is essential to the general health and well-being of all Americans resonates throughout these documents. Yet establishing measures to address their stated goals and objectives is challenging. It is clear that cost-effective preventive measures are available to the American public[1] – the issue is to provide the underserved with access to these services. The number of dentists available to the population is declining,[5] emphasizing the need for other well-educated and skilled providers to deliver oral health care services. In addition, research reveals that non-dentist providers with the requisite levels of education and practical experience possess the skills, judgment, and attitudes needed to deliver

Table 2. Congruence between ADHP and Healthy People 2010

	HEALTHY PEOPLE 2010 OBJECTIVES FOR ORAL HEALTH															
ADHP COMPETENCIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Health Promotion/Disease Prevention	x	x	x	x	x	x	x	x	x		x	x	x				
2. Provision of Primary Care	x	x	x	x	x	x	x	x			x	x	x				
3. Case Management	x	x	x	x	x	x	x	x		x	x	x					
4. Multi-disciplinary Collaboration	x	x	x	x	x	x	x	x		x	x	x	x				
5. Health Care Policy	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
6. Advocacy	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
7. Practice Management	x									x			x	x	x	x	x
8. Quality Assurance	x	x	x	x	x	x	x	x		x					x	x	
9. Fiscal Management													x				x
10. Evidence-based Practice	x	x	x	x	x	x	x	x									
11. Clinical Scholarship	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
12. Ethics and Professional Behavior	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→
13. Lifelong Learning	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→

Table 3. Congruence between ADHP Competencies and CTA Actions

	A NATIONAL CALL TO ACTION: FIVE ACTIONS				
ADHP COMPETENCIES	Action 1	Action 2	Action 3	Action 4	Action 5
Health Promotion & Disease Prevention	x	x		x	x
Provision of Primary Care	x	x		x	x
Case Management	x	x		x	x
Multi-disciplinary Collaboration	x	x	x	x	x
Health Care Policy	x	x		x	x
Advocacy	x	x		x	x
Practice Management	x	x		x	
Quality Assurance	x	x		x	
Fiscal Management	x	x		x	x
Evidence-based Practice	x	x	x		
Clinical Scholarship	x	x	x		x
Ethics and Professional Behavior	x	x	x	x	x
Lifelong Learning	x	x	x		

high quality preventive and primary care dental services.[6-9] Models similar to the ADHP have been integral to oral health care delivery systems in numerous countries for decades, and their impact has reaped positive benefits.[10-13] To appreciate the congruence of the ADHP with *Healthy People*[2] and the CTA,[3] an overview of the ADHP's competencies are provided in the next section.

Competencies for the ADHP[4]

Within the document, *Competencies for the Advanced Dental Hygiene Practitioner*, 5 key themes, known as domains, are established: Provision of Primary Oral Health Care, Health Care Policy and Advocacy, Management of Oral Care Delivery, Translational Research, and Professionalism. From these domains, 13 broad competencies are derived (Tables 2 and 3). These broad competency areas directly address the oral health objectives as presented in *Healthy People 2010*[2] and the 5 strategies outlined in the CTA[3]. The competency-driven education designed for the ADHP provides the foundation and framework for the successful delivery of cost-effective, accessible, affordable, high quality, holistic care

to underserved populations in non-traditional settings.

Congruence of the ADHP Competencies with *Healthy People 2010*[2] Objectives

When examining the relationships between the *Healthy People*[2] objectives and the ADHP competencies, many parallels are obvious. As Table 2 indicates, Competencies 5, 6, 11, 12, and 13 cut across all of the oral health objectives. These competencies represent inherent characteristics and capabilities of the ADHP that would be present regardless of the role assumption or the activity in which the ADHP is engaged. A more specific analysis of all competencies and the oral health objectives follows.

Health promotion, disease prevention, and the provision of primary care (Competency 1, 2) have direct relevance to Objectives 1-8 (Table 1). Objectives 1-4 address the need for reductions in the proportion of children and adolescents who have dental caries experience, the proportions of untreated decay in children, adolescents, and adults, and the proportion of adult extractions. Objectives 5-8 are directed at increasing detection rates and the number of annual examinations for head and neck cancers, the placement of sealants in children's molars, and the reduction of periodontal disease. Through health promotion and disease prevention (Competency 1), the ADHP conducts risk assessments to identify an individual's susceptibility to caries, periodontal disease, and oral cancer. Clients are provided with the tools to adopt preventive oral hygiene and healthy lifestyle habits that have the potential to reduce the incidence of oral disease. The community-based family approach fostered in the ADHP provides a foundation for family reinforcement of a child's habits and the opportunity to raise awareness of oral health and disease prevention within the community. Competency 2 states that through the provision of primary oral health care, the ADHP utilizes health education, counseling, and health promotion theory to achieve positive health behaviors, recognizes health conditions, and provides interventions that prevent disease and promote healthy lifestyles. This competency meets the objectives to reduce the proportion of untreated decay, unnecessary tooth loss, and periodontal disease, since the ADHP will design "care plans that include the delivery of primary care dental services when appropriate." These include providing restorative services that treat infection, relieving pain, promoting function and oral health, delivering non-surgical periodontal therapy, and prescribing pharmacologic adjuncts that can reduce periodontal infection. It is logical that preventive interventions that reduce caries and periodontal disease will ultimately reduce tooth loss. Other primary care services the ADHP delivers include screening for early detection of oral and pharyngeal cancers.

ADHP case management (Competency 3) utilizes assessment data to create appropriate care plans that reduce risk, promote health, and foster patient partnerships that enhance informed decision-making, positive lifestyle change, and appropriate self-care. All of these endeavors will help reduce caries, unnecessary tooth loss, and periodontal disease. In addition, they will help increase sealant placement in children's molars and augment the detection of oral and pharyngeal cancers. The ADHP will create care plans to reduce risk for all types of oral disease - a key step in prevention.

Multi-disciplinary collaboration (Competency 4) is the foundation for comprehensive and individualized patient care. When warranted, patients will be referred to other providers. The ADHP will dialogue with health professional colleagues to ensure the delivery of individualized, culturally competent, and appropriate patient care.

The health care policy and advocacy roles (Competency 5, 6) of the ADHP specifically address Objective 9 of *Healthy People 2010*,[2] which is to "increase the proportion of the U.S. population served by community water systems with optimally fluoridated water."[2] However, the ADHP's commitment to health promotion, disease prevention, and the provision of primary care are the basis for this advocacy.

Objectives 10 and 11 aspire to increase the proportion of children, adults, and residents in long-term care who use the oral health care system. These objectives speak directly to availability and access to care. The creation of a new cadre of oral health professionals who can fill the gap left by decreasing numbers of practicing dentists offers a partial solution to the access problem. The mission of the ADHP[4] is to improve the public health of the underserved by providing "access to early interventions, quality preventive oral health care, and referrals to dentists and other health care providers." With the continuing growth of long-term care residents, creating options for meeting their oral health needs is mandatory. To date, most long-term care facilities cannot afford hiring a staff dentist. The ADHP could provide services to residents on-site or work with facility administrators to provide transportation to a community facility where the ADHP is employed. Skills in practice and fiscal management (Competencies 7, 9) could facilitate establishment of on-site programs. Through the provision of primary care, the delivery of health promotion and disease prevention messages, and health policy advocacy (Competencies 1, 2, 5, 6), ADHPs can work toward extending primary care to disadvantaged and remote populations not receiving care in traditional settings.

Objective 12 hopes "to increase the proportion of low income children and adolescents who receive

preventive care."[2] ADHPs will position themselves to provide preventive and primary care services to these population groups. By working with community leaders, other health professionals and families, the ADHP will develop and implement appropriate health care interventions that are culturally specific and consistent. Through the ADHP's efforts in advocating for the underserved and promoting the role of the ADHP, community leaders will be able to direct those in need to new care sources (Competencies 1-6).

Objectives 13 and 14 address the need to increase the proportion of school, local, and community based health centers (including migrant and homeless health centers) that have an oral health component. Professionalism (Domain 5, Competency 12) states that the ADHP will "develop strategic relations with community stakeholders to optimize resources."[5] As advocates and policy-makers with strong community roots, the ADHP will actively engage in efforts that promote oral health as a necessary component of health centers (Competencies 5, 6).

ADHPs will contribute to the attainment of objectives 15, 16, and 17 if they are employees of the health agencies whose infrastructure is cited in the objective. However, skills in establishing partnerships, collaborative relationships, quality assurance, practice, and fiscal management would enhance ADHP contributions to existing programs (Competencies 4, 7, 8, 9). A major portion of the ADHP curriculum addresses public health and community issues. Further, examples of ADHP practice settings include community health centers, federally qualified health centers (FQHC's), and the Indian Health Service.

The desire to collaborate with other health care providers (Competency 4) is integral to all aspects of the ADHP's role and therefore related to each of the oral health objectives. Similarly, commitments to lifelong learning, clinical scholarship, and evidence-based practice are ingrained characteristics of the ADHP. The advocacy and health policy roles of the ADHP (Competencies 5, 6) universally apply to all 17 of the oral health objectives. Through advocacy, the ADHP will be engaged in efforts to promote the delivery of accessible, affordable, and quality oral health care to the underserved. Working with policy makers to endorse water fluoridation, sealant placement, the creation of oral health programs, and the provision of care to those outside the traditional delivery system contribute to the attainment of objectives 8-17. Finally, all initiatives instituted by the ADHP will be predicated on quality assurance, sound fiscal management, and evidence-based practice (Competencies 8, 9, 10, 12). Adherence to these principles will ensure high quality and judicious clinical outcomes, viable continuity of care, and the provision of state-of-the-art services. Through a commitment to lifelong learning and scholarship, ADHPs will subscribe to self-assessment and continually seek to improve themselves and the publics they serve (Competencies 11, 13).

Congruence of the ADHP Competencies with the *National Call to Action to Promote Oral Health*

In the *National Call to Action to Promote Oral Health*,[3] the first action calls for a change in the perceptions of oral health among policy makers, health care providers, and the public. All 13 ADHP competencies are essential to achieving a change in the perceptions of oral health. To effect genuine change within these groups, ADHPs will lead by example and embrace their diverse roles as preventive health educators, community advocates, and providers of primary oral health care services. ADHPs will educate clients, communities, and other health care professionals about oral health and share information about associations between oral and systemic health, thereby illuminating the importance of oral health. Utilizing sound practice and fiscal management and providing high quality care will draw positive attention to the ADHP. Through advocacy, the ADHP will put oral health care on the political agenda. As well-educated, ethical practitioners who employ evidence–based decision making and value clinical scholarship and lifelong learning, ADHPs will improve the public's perception of oral health.

Action 2 talks about replicating effective programs and proven efforts to overcome barriers to care. Knowledge of health promotion, disease prevention, and the ability to provide primary care (Competencies 1, 2) contribute to the development of effective programs. As a health professional that adheres to evidence-based decision making, the ADHP has a strong knowledge of what is effective and what is not (Competency 10). When case managing clients, the ADHP will confer with colleagues to overcome immediate barriers and seek out best practices that can serve as models for replication (Competencies 3, 4). Staying up to date with current literature and practice is the hallmark of the ethical professional, a defining characteristic of the ADHP (Competencies 10-13). Knowledge of insurances and a high level of cultural competence are 2 other emphases of the ADHP curriculum (Competency 9). Practice management (Competency 7) and an eye for a strict surveillance will allow the ADHP to track populations that lack access, a key barrier to service delivery, and utilization. The mere existence of the ADHP will improve access to care in that a high-level provider can be positioned in communities where no other oral health care professionals are located. Lastly, ADHPs will promote health literacy through edu-

cation and advocacy.

The ADHP can contribute to Action 3, to "build the science base and accelerate science transfer." An entire domain of the ADHP curriculum is devoted to translational research. In this domain, clinical scholarship and the contribution to the development of best practices are highlighted (Competencies 10, 11). ADHPs, in their quest to remain state-of-the-art, will utilize scientifically sound technologies during assessment, planning, delivery, and evaluation of care. They will have the capabilities to employ tele-dentistry to access immediate information, evaluate research studies, and analyze and interpret information to make decisions and problem solve effectively. Through their commitments to professionalism and lifelong learning (Competencies12, 13), ADHPs are dedicated to building the science base and accelerating science transfer. In their provision of primary care, preventive education, and patient case management (Competencies 1-3), ADHPs will document the effectiveness of approaches, treatments, and outcomes, generating data to build the science base. Collaborations with colleagues from other disciplines may inspire research (Competency 4).

By definition, the ADHP will "increase oral health workforce diversity, capacity, and flexibility" (Action 4). ADHPs are intended to be indigenous community members who can relate to and empathize with the publics they serve. If not a member of the immediate community, the ADHP possesses a strong educational background in cultural competence, public health, and communication; in addition, the ADHP curriculum requires that a student complete a minimum of 12 semester hours "in the field." As is often the case, field work may occur in the community where the ADHP ultimately is employed. Didactic coursework that highlights establishing community relationships, coalition building, legislative skills, and advocacy will support the ADHP's comfort in the community.

The ADHP model borrows from the well-established nurse practitioner (NP) role. Like NPs, ADHPs receive the requisite didactic and experiential learning that will enable the delivery of high quality health care services, specifically in oral health. The dentist workforce capacity is decreasing while that of the dental hygienist is increasing exponentially.[5] Students entering the ADHP program must already have baccalaureate degrees and practice experience in dental hygiene. Almost 300 dental hygiene programs are in existence in the U.S.[14]; dental hygienists are an untapped resource that can "grow" the capacity of high quality providers in areas where oral health care services are inaccessible and/or costly.

An accredited standardized curriculum will allow the ADHP to provide oral health care services across the nation that currently are not allowable in many U.S. jurisdictions. For example, in the state of Washington, dental hygienists place restorations.[15] If the ADHP could legally offer this type of service nationally, more care could be delivered and more untreated decay could be resolved, particularly in community centers and facilities that often reach the disadvantaged and underserved. Given the Bureau of Labor Statistics data,[5] it is sensible to promote the education of an already growing cadre of oral health care providers (i.e., dental hygienists) who are licensed health care professionals possessing foundational knowledge. This seems a logical option when the numbers of prospective dentists are declining.

The ADHP offers flexibility for other reasons. This provider has an understanding of macro community needs while also appreciating the need for individualized care (Competencies 3-6). The ADHP works in the context of the total health care system, but also provides primary preventive oral health care services to individual patients. Further, the ADHP serves as a triage and referral source when warranted. Sound judgment that derives from comprehensive education, experiential learning, and the ADHP's professional attitude allows flexibility in terms of patient case management and the appropriate delivery of holistic care. By definition, and through participation in a formal program, the ADHP will participate "in state-funded programs for reducing disparities, serve in community clinics or in health care shortage areas, assist in community-based surveillance and health assessment activities, participate in school-based disease prevention efforts, and volunteer in health-promotion and disease-prevention efforts such as tobacco cessation programs."3

The ADHP addresses Action 5 to increase collaborations through many avenues. In their advocacy roles, ADHPs work to form partnerships to advance the attainment of oral health within both public and private sectors of the community (Competency 6). Exposure to curriculum that builds skills in sound practice and fiscal management will enhance the ADHP's potential to create lasting and effective partnerships (Competencies 7, 9). A key component of the ADHP role is to plan, design, monitor, and evaluate oral health programs. Programs designed for social service, health care, and educational entities will be established. The potential for coalition building, a key goal for the ADHP, will be encouraged. Partnerships with dental industry and community oral health professional associations will be fostered.

The oral systemic link serves as an excellent basis for collaborative activities (Competency 4). The ADHP's involvement in health promotion and disease prevention naturally fits with diet counseling, mouth guard protection, and tobacco cessation. On a larger scale, community-wide programs that address these

issues will be implemented by the ADHP in concert with other groups. The suggested oral connection to heart disease and pre-term low birth weight babies establishes commonalities with organizations such as WIC, women's health groups, and the American Heart Association. Improper nutrition can affect oral health by heightening risks for caries and periodontal diseases. The inclusion of oral health education for school nurses and for curriculum planners in pre-kindergarten and elementary/lower schools is critical. Similarly, large scale dental screenings for school children is essential. Uncontrolled diabetes and periodontal disease exacerbate each other. The American Diabetic Association, nutrition, and endocrinology groups could forge coalitions related to diabetes and oral health. A comprehensive approach to oral and systemic health is a hallmark of the ADHP.

Conclusion

It is apparent that the ADHP can be a key force in implementing the action plans set forth in the CTA and in meeting the objectives articulated in *Healthy People 2010*. The congruence in philosophy between the *Surgeon General's Report on Oral Health* and the ADHP is apparent. There is well-substantiated need for the ADHP[4] - a provider who can help fill the growing gap in disparities by addressing the oral health care needs of the underserved in the U.S.

Competencies for the Advanced Dental Hygiene Practitioner,[4] in addition to providing sound rationale for the creation and implementation of the ADHP's role, presents a well-delineated educational plan and sample curriculum for role preparation. The competencies reflect the thought, rigor, and thoroughness that went into their development. Recognizing the size of looming challenges, the framework as presented shows a concerted, meticulous, and elaborate plan for creating the ADHP. The document demonstrates that the pieces are in place to begin implementation of action plans. As the U.S. moves forward to meet the oral health care needs of the underserved, quality initiatives are needed. The role of the ADHP promises hope for bringing accessible care to the underserved and for promulgating the tenet that oral well being is a reflection of overall systemic health.

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Research

Use of the Cross-Cultural Adaptability Inventory to Measure Cultural Competence in a Dental Hygiene Program

Janice P. DeWald BSDH, DDS, MS and Eric S. Solomon DDS, MA

Abstract

Purpose: The purpose of this study was to determine changes in students' cross-cultural effectiveness using the Cross-Cultural Adaptability Inventory (CCAI™). The inventory assessed strengths and weaknesses in 4 skill areas: Emotional Resilience, Flexibility/Openness, Perceptual Acuity, and Personal Autonomy.

Methods: The CCAI™ was administered to 30 dental hygiene students during Orientation. Age and dental assisting experience were recorded to determine if those variables affected skill areas. The inventory was re-administered at the end of the first and second years of the program. Data from the 3 time periods were analyzed using t-tests (α=0.05) for the 4 skill areas. These scores were totaled and used to determine differences due to dental assisting experience or age.

Results: T-tests found no significant differences (α=0.05) for the 4 skill areas and for total scores between administrations of the inventory. Age and dental assisting experience did not affect results.

Conclusions: No significant improvement in students' cross-cultural effectiveness over the course of the 2-year curriculum was determined using the CCAI™. Results of each student's performance, however, were not shared until graduation. Sharing results earlier would have allowed students to identify strengths and weaknesses in their cross-cultural effectiveness. This knowledge may have motivated them to improve their skills when exposed to patient experiences and curricular content promoting cross-cultural effectiveness. Programs which decide to use this inventory may want to consider using a strategy of surveying and sharing results at appropriate points during the curriculum.

Key Words: cultural competence, diversity, dental hygiene

Introduction

The American Dental Education Association (ADEA) resolution 12H-2000 states that "All dental education institutions should include cultural and linguistic concepts as an integral component of their curricula to facilitate the provision of oral health services."[1] The American Dental Association's 2001 *Future of Dentistry* report supports this concept with its Education Recommendation 13: "The education community should enhance undergraduate exposure to the ethics of dental practice while also providing cultural competency that provides information and training on delivering care to all segments of the population."[2] The report of the Surgeon General points to the need for a culturally competent dental workforce to increase access to care and enhance oral health.[3] All of these recommendations are in response to the changing demographics in the United States, where current minority populations are projected to increase to near half the population in 2050.[4]

The educational community has responded by incorporating effective communication with individuals from diverse backgrounds into their competencies for dentists and dental hygienists.[5,6] A position paper by the ADEA addresses the important role dental and allied dental educational programs have in not only producing a workforce but producing a "diverse and culturally competent workforce … to meet the oral health needs of the nation."[7] Specifically, institutions are urged to prepare their graduates to address the needs of an "aging population, a racially and ethnically diverse population, and individuals with special needs."

Review of the Literature

A 2004 survey of pre-doctoral dental schools found that 80% had increased the amount of cross-cultural teaching in the 5 years prior to the survey.[8] Hours devoted to teaching ranged from under 5 to over 40. The survey also found that 90% reported diverse patient population as the reason for teaching cross-cultural issues. Recommendations to the educational community included sharing teaching and evalu-

ation methods used by schools. A separate study using ADEA survey data collected from 52 responding schools concluded that the majority of graduating dental students were prepared to treat a diverse population of patients, but 25% felt more time should be devoted to this subject.[9]

A variety of techniques can be used to assess cultural competency. A study regarding the teaching and evaluation of dental students' interpersonal and cultural sensitivity skills found the use of instructors to simulate a patient's illness/condition effective in teaching interpersonal communication. Likewise, providing education and evaluations of students' interviewing skills increased effectiveness in interpersonal communication.[10]

Other means to evaluate cultural sensitivity and interpersonal skills include the use of surveys and inventories. A recent review of a dental program's development and cultural competency curriculum used a survey developed at their institution for D1 and D2 classes. The survey was administered before and after exposure to cultural competency content to determine knowledge acquisition.[11] Other instruments used to measure multicultural competence are commercially available. The Multicultural Counseling Awareness Scale, Multicultural Awareness-Knowledge-and-Skills Survey, and the Graduate Students' Experience with Diversity have been evaluated for reliability and validity.[12] The instrument for graduate students was found to be appropriate for that population while the Multicultural Counseling Awareness Scale was recommended for general use.

Dental hygiene has embraced the need for integrating cultural competency into the dental hygiene process of care,[13-15] and a commercially available instrument, the Cross-Cultural Adaptability Inventory (CCAI™),[16] has been used by dental hygiene researchers.[17,18] This inventory evaluates cultural adaptability (ability to adapt to living in another culture and to interact effectively with people of other cultures) by measuring Emotional Resilience, Flexibility/Openness, Perceptual Acuity, and Personal Autonomy. A 6-point scale ranging from 'definitely true' to 'definitely not true' was used when responding to the 50 statements that make up the inventory. In one study, the CCAI™ was used to determine the cultural adaptability of faculty in 4 health science disciplines: dental hygiene, medical laboratory science, nursing, and physical therapy.[17] The premise was that if faculty members are expected to teach cultural competency to their students, they should know something about their own cross-cultural adaptability. Although no significant differences were found in their overall scores, some differences were found between health science disciplines. However, the total mean scores of the entire faculty were found to be higher than the CCAI™'s normative sample (a group with high educational levels and experience living abroad). In a separate study, the CCAI™ was used to determine cross-cultural adaptability of dental hygiene students attending culturally diverse and non-culturally diverse programs and to make comparisons between them within the 4 skill areas.[18] Although overall cross-cultural adaptability scores were not found to be significantly different, the culturally diverse group scored significantly higher in Emotional Resilience while the non-culturally diverse students scored higher in Flexibility/Openness and Perceptual Acuity (empathy, attentiveness to interpersonal relations). Overall, total CCAI™ scores for all dental hygiene students surveyed were found to be lower than the CCAI™ normative sample. In order to be successful in a multicultural society, this study's authors recommended dental hygiene curricula to include "educational strategies, training, and personal encounters with people of diverse cultures" and encouraged "using the CCAI™ as a pre- and post-test to determine if cross-cultural training and education increases dental hygiene students' cross-cultural adaptability."

While the focus in the last decade has been to increase diversity and cultural training in dental hygiene programs, little is known on how effective these initiatives are in improving or changing dental hygiene students' cultural sensitivity. Studies have examined cross-cultural adaptability at a single point in time, but no study has used the CCAI™ to determine changes over time. The purpose of this study was to determine changes in dental hygiene students' cross-cultural effectiveness using the CCAI™ before, during, and after dental hygiene instruction, which included didactic and clinical encounters with diverse populations.

Methodology

The CCAI™ developed by Kelley and Meyers was used in this study. The inventory was designed to meet a variety of needs, which included increasing self-awareness of qualities that affect cross-cultural effectiveness and using the results to improve interaction skills with people of other cultures. The inventory assessed strengths and weaknesses in 4 skill areas: Emotional Resilience, Flexibility/Openness, Perceptual Acuity, and Personal Autonomy:

- Emotional Resilience: ability to cope, react positively to new experiences, and deal effectively with feelings of culture shock
- Flexibility and Openness: acceptance of others who are different and comfortable with all kinds of people
- Perceptual Acuity: reflects empathy, attentiveness to interpersonal relations, and verbal and nonverbal behavior
- Personal Autonomy: respect for others while feeling secure with

own identity

The inventory is considered to have face validity (apparent what the instrument is designed to do), content validity (covers the subject matter in question), construct validity (extent to which the instrument measures a trait), and an overall reliability of 0.90.[16]

The inventory was administered 3 different times during the students' 2-year program. Students were asked to supply a 6-digit code and the name of a teacher or pet only they would know in case they lost the code during administrations of the survey. This was also done so the inventories could be returned to each student upon graduation. In addition, students were asked to record their age and whether they had been a dental assistant. Inventories were collected in such a way as to protect students' identities. Each inventory was then scored according to the CCAI™ directions and a total for each of the 4 areas was determined.

The first administration of the inventory was given to 30 students entering their first year at the Caruth School of Dental Hygiene during Orientation (fall 2005), but before a diversity workshop provided later that week. The Caruth School of Dental Hygiene has relied on a 4 hour diversity workshop, "Building Bridges for Better Health Care," during Orientation week to initiate cultural competency instruction. The workshop focuses on stereotypes, experiences with discrimination, and verbal and nonverbal communication and relates these topics to the delivery of care to diverse groups. During the second semester, while students are seeing patients in Clinical Dental Hygiene I, a 2-hour lecture on cultural competence in the Health Education and Behavioral Science was offered. The inventory was re-administered at the end of the first year of the program. However, 3 surveys were not able to be used. Two students changed to the part-time program (increasing the length of their program by 1 year) and responses on 1 survey made it unusable for making comparisons. Paired t-tests (α=0.05) were used to determine if significant differences in the 4 areas occurred between the first and second administrations of the inventory and to determine if differences were due to the age or dental assisting experience of the students.

During the second year of the program, students participated in a variety of rotations aimed at exposing them to various ethnic, socioeconomic, and special needs populations. They also received a 90 minute cultural competence lecture with class participation in the Public and Community Health course (students investigated different populations and developed reports on how those differences could impact care). Courses such as Gerontology, Pediatric Dentistry, and Theory of Dental Hygiene, which address patients with special needs, also support the students' knowledge of these different populations during the second year. Students completed the third administration of the CCAI™ at the end of the second year of the program (spring 2007) and were asked again to use their secret code for tracking purposes. One student did not complete the second year, which brought the sample size to 26. Paired t-tests (α=0.05) were used to determine if significant differences in the 4 areas assessed by this inventory occurred between the first and third administrations and to determine if any differences were due to the age or dental assisting experience of the students.

Results

No significant differences were found in the 4 skill areas between administrations of the inventory for the 26 students completing all 3 inventories (Table 1). The total score for the 4 skill areas also showed no significant change. Three of the 4 skill areas showed some improvement, with Perceptual Acuity exhibiting the most change. One skill area, Emotional Resilience, showed no improvement in the average score between any administrations of the inventory. Age and dental assisting experience did not significantly affect students' skills in the 4 areas measured. For comparative purposes, normative sample scores reported by the authors of the CCAI™ Manual are included in Table 1.[16]

Discussion

Emotional Resilience and Personal Autonomy were expected to be high at the baseline with little possible increase. This was due to students already maturing during their first 2 years of college before entering into the program. Perceptual Acuity, the area that increased the most, would seem to be the most likely affected, due to a program's curricular impact. In this program, students begin seeing each other as 'patients' during the first semester and observe the second-year class in clinic. They also receive lecture material on cultural competency and on communication skills, stress, and coping. Perceptual Acuity was expected to further increase due to additional didactic instruction and clinical experiences that brought students in contact with a variety of patient populations during their second year. It was also anticipated that Personal Autonomy would increase due to a growing sense of achievement students might feel as they near graduation, Emotional Resilience would increase due to a sense of accomplishment and ability to cope as they completed the curriculum, and Flexibility and Openness would increase because of the many experiences students had encountering different patient populations. While it was expected that there would be a significant increase in the students' cross-cultural capacity, as measured by the CCAI™

Table 1. CCAI™ Scores for 4 skill areas and normative sample analyzed with a t-test for paired samples

Four Skill Areas	Administration 1 (Baseline)	Administration 2 (end of first year)	Administration 3 (end of second year)	Normative Sample (N=653 CCAI™)
Emotional Resilience	82.8 ± 7.5	82.2 ± 8.0	82.8 ± 7.7	79.6 ± 8.3
Flexibility/ Openness	67.1 ± 6.9	66.7 ± 6.9	67.4 ± 5.7	66.9 ± 7.7
Perceptual Acuity	45.3 ± 5.4	47.0± 5.0	47.1 ± 4.4	46.5 ± 5.0
Personal Autonomy	34.9 ± 3.5	34.7± 34.7	35.7 ± 2.9	32.9 ± 3.8
Total	230.2 ± 18.3	230.5 ± 17.4	233.0 ± 16.0	225.9 ± 19.6

between the first and third administrations of the survey, no significant differences were found.

One explanation could be that scores were already high when students entered the program due to the number of high achievers entering the dental hygiene class, their selection of a totally new environment, and their desire to help people. Considering this possibility, the inventory may not have been sensitive enough to determine slight changes in attitudes. As seen in Table 1, baseline scores for Emotional Resilience, Personal Autonomy, and the total overall score for the dental hygiene sample were higher than the normative sample reported by the CCAI™ manual. These results differ from the results of other researchers who made comparisons among CCAI™ normative sample scores and scores from diverse (4-5 ethnicities represented by ≥40% of enrollment) and non-diverse (only 1 ethnic category) dental hygiene programs.[18] Only the Perceptual Acuity score in the study for non-culturally diverse groups was found to be higher than the normative sample. Reasons for differences in how students' scores compared to the normative sample could be due to differences in program types, geographic location, and lack of diversity. The present study's class diversity did not meet the diversity criteria for either category used by previous researchers.

Another explanation for a lack of significant change is more directly related to how the inventory was used. The CCAI™ is an instrument designed to assess skills and make the person aware of weaknesses through feedback. Awareness of weaknesses can motivate people to improve in those areas and plan for self-improvement. In this study, students were not given that opportunity. Inventories were held until the end of the study and students were not aware of their weaknesses. Therefore, they could not develop a plan for self-improvement.

Sample size could also be a reason for a lack of significant results. Since this study followed only 1 class of students, it is limited in its application of findings. Curriculum changes during the course of this longitudinal study prevented assessment of additional classes. Finally, the lack of any statistical significance may be due to the program's curricular content simply not being effective enough to affect change in student attitudes.

Conclusion

The CCAI™ is an instrument designed to increase self-awareness of a person's potential for cross-cultural effectiveness. The inventory was used to determine if a dental hygiene program's curriculum affected improvement in the students' cross-cultural effectiveness. No significant improvement was found. Inventory results and scoring, however, were not shared with students until graduation. An approach wherein sharing results as each inventory is completed would allow students to identify strengths and weaknesses in the 4 skill areas. It is recommended that programs that decide to use this inventory strongly consider sharing the results during the program. In this way, students could use the information and experiences provided by the curriculum to improve their skills in any weak areas identified by the inventory.

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are our future and we must keep the scholarly activity moving forward. Congratulations to the three dental hygienists listed below who won the Inaugural DENTSPLY/ADHA Graduate Dental Hygiene Research Award.

Be on the lookout for the next issue of the Journal of Dental Hygiene. The entire issue will be the publication of the Proceedings of the North American Dental Hygiene Research Conference held in June, 2009. You will not want to miss it.

Have a great summer!

Sincerely,

Rebecca Wilder, RDH, BS, MS
Editor in Chief: Journal of Dental Hygiene

Research

The Effect of Brushing Time and Dentifrice on Dental Plaque Removal *in vivo*

Andrew Gallagher, DMD; Joseph Sowinski, DDS; James Bowman, MS; Kathy Barrett; Shirley Lowe; Kartik Patel, PhD; Mary Lynn Bosma, DDS; Jonathan E Creeth, PhD

Abstract

Purpose: Routine toothbrushing is the principal method by which individuals remove plaque and control plaque-related diseases, such as periodontitis and caries. Oral health care professionals generally recommend at least 2 minutes brushing with an appropriate technique, and yet the average brushing time in the general population is closer to 45 seconds. Our understanding of the relationship between brushing time and plaque removal, in an untutored general population using a conventional manual toothbrush and dentifrice, is limited. The role of dentifrice in plaque removal is also unclear.

Methods: This study was undertaken to measure plaque removal during untutored brushing over timed periods between 30 and 180 seconds with 1.5g dentifrice, using an Aquafresh Flex® brush and Aquafresh Advanced® dentifrice. Plaque removal after brushing without dentifrice was also determined (at the 60 second time point only). Forty-seven subjects participated in the study, in which plaque level was assessed using the Quigley-Hein (Turesky-modification) Index.

Results: Plaque removal increased with brushing time across the range studied, tending towards a maximum at longer brushing times. At the extremes, brushing for 180 seconds removed 55% more plaque than brushing for 30 seconds. Brushing for 120 seconds removed 26% more plaque than brushing for 45 seconds. The use of dentifrice did not increase plaque removal during 60 seconds of brushing.

Conclusions: Oral health care professionals should reinforce efforts to persuade patients to brush for longer periods of time, as increasing brushing time to the consensus minimum of 2 minutes from a more typical 45 seconds increases plaque removal to an extent likely to provide clinically significant oral health benefits.

Key Words: toothbrush, dentifrice, plaque, brushing, duration

Introduction

Routine toothbrushing is perhaps the single most important step an individual can take to reduce plaque accumulation and the consequent risk of plaque-associated diseases, such as periodontitis and caries.[1-9] Studies of the relationship between time spent brushing and oral hygiene have been inconsistent.[10-13] However, when the effect of brushing time on plaque removal has been studied on a within-subject basis, a significant effect on plaque removal has been observed.[14-19]

There have been several studies on the effects of plaque removal concerning the type of brush, brushing technique, and frequency of brushing.[20-25] However, the authors could find no existing study on the effects time spent brushing had on plaque removal in the general population – that is, when subjects are untutored in brushing technique and are not linked to the oral health profession. Yet this represents the most common situation, and brushing time is important to cleaning the teeth properly and the consequent oral health benefits. Brushing time is the most easily controlled parameter of effective everyday brushing.

The general consensus amongst oral health care professionals is that individuals should spend at least 2 minutes brushing their teeth with an effective technique at least twice a day, though specific recommendations from national dental associations are frequently lacking. However, most estimates of actual brushing time vary between just over 30 seconds to just over 60 seconds.[10,16,17,26-32] Some caution regarding these estimates should be exercised as the act of measuring brushing time has been shown to affect brushing behavior.[30] The recent study of Beals et al[33] determined an average of 46 seconds from a home-use study involving 173 U.S. adults. It is clear that the average time spent brushing is considerably shorter than 2 minutes, and a value of about 45 seconds would seem a useful estimate.

Therefore, the aim of this study was to determine whether brushing time is an important determinant of plaque removal during conventional toothbrushing. A sample representa-

tive of the general population using their normal brushing technique was tested. Differences in plaque removal could then be related to the possible impact on overall oral health. A specific objective was to compare the effect of brushing for 2 minutes with brushing for 45 seconds, representing a comparison of the plaque removal benefits of brushing for the consensus minimum time with brushing for the estimated average time. This should assist oral health professionals in encouraging their patients into a more effective oral hygiene routine.

Methodology

The study design consisted of a randomized, single-center, single-product, multi-use, 6-way crossover. This design allowed treatment comparisons on a within-subject basis, to maximize the ability to detect treatment differences. The plaque index used in this study was the Turesky modification[34] of the original index of Quigley and Hein,[35] as modified subsequently by Lobene et al[36] to include 6 sites per tooth (the 'Turesky Index'). The study was designed to ensure at least 40 subjects completed all treatments. This size was calculated to provide a 90% chance of detecting a difference in Turesky Index of 0.16 as significant at the 5% level. Such a fine level of resolution was desired due to the relatively small intervals between brushing times. This calculation assumed a within-subject standard deviation of 0.3, which was the value determined in a pilot study of plaque removal after 2 minutes brushing with dentifrice (data on file, GSK). Forty-seven subjects were recruited by Hill-Top Research, Cincinnati, from the local population. Recruitment to the panel pre-screening was achieved by advertisements in local media and via the Hill-Top Research Web site, without any restrictions beyond being adult. The subjects (37 female, 10 male), ages 18-63 years, who qualified with a minimum plaque score of 2.0 using the above index were randomized, and 46 returned for at least 1 evaluation (the intent-to-treat population). Subjects were screened to ensure that at least 20 gradable teeth were present and that subjects were in good general physical and oral health with no pathoses.

The subjects brushed with an Aquafresh Flex® flat-trim soft toothbrush and Aquafresh Advanced® (1100 ppm fluoride as sodium fluoride) dentifrice for different defined times, using 1.5g or no dentifrice, in a randomized order. Subjects brushed their teeth at the study site (Hill Top Research, Cincinnati) under supervision on a total of 6 occasions. Brushing times were 30 seconds, 45 seconds, 60 seconds, 120 seconds, and 180 seconds. For the 30-, 45-, 120-, and 180-second brushing, 1.5g (weighed to within +0.05g) of paste was used for each treatment arm. For the 60-second brushing time, there were 2 treatment arms, one using 1.5g dentifrice and the other brushing without dentifrice. Brushing times were assigned in a randomized order over a 3-week period. A minimum washout period of 72 hours was observed between treatments with subjects refraining from brushing for approximately 24 hours prior to each treatment visit.

The study aimed to measure plaque removal achieved by subjects via manual tooth brushing for different brushing times. Dental plaque on the subject's teeth before brushing was disclosed using Butler Red Cote® disclosing solution and the level of plaque was evaluated and recorded using the Turesky Index. The appropriate amount of dentifrice was dispensed by the study technician onto a new toothbrush. Subjects were informed immediately in advance of each brushing occasion how long they were to brush, and the brushing time was divided evenly between the 4 dental quadrants. Brushing time was measured by the technician using a count-down timer. No other modification to the subject's brushing style was made. Dental plaque remaining on the subject's teeth after brushing was re-disclosed and the level evaluated and recorded as before. The amount of plaque removed by brushing was calculated by difference. At each visit, a single examiner conducted an oral soft tissue exam to monitor adverse events.

Data Analysis

Plaque was assessed at 6 sites for each individual tooth. A whole-mouth average score was calculated by summing the individual scores across all teeth and dividing by the number of gradable sites using all non-missing values. The intent-to-treat study population, defined as all subjects who were randomized, treated at least once, and provided at least 1 plaque removal measure, was used for all data analysis. Missing data was not included in the statistical data analysis.

An analysis of covariance model was used to analyze the change from pre-brushing Turesky Index scores. The model included fixed factors for study period and treatment and the random factor subject. The pre-brushing Turesky Index score measured at the start of each study period was included in the model as a covariate. All statistical tests of hypothesis employed a level of significance of 0.05.

Results

Figure 1 shows the change in mean Turesky Index score from pre- to post-brushing as a function of brushing time for the subjects using dentifrice in this crossover study.

A clear dose-response relationship between plaque removal and brushing time was observed. The profile was broadly hyperbolic in form, ie the amount of plaque removed was highly dependent on brushing time at shorter times, but tended towards a maximum at longer times. Howev-

er, even after 3 minutes of brushing, some plaque removal still appeared to be occurring.

The longest brushing time (180 seconds) removed 55% more plaque than the shortest (30 seconds, $p<0.0001$). A brushing time of 2 minutes removed 26% more plaque than a time of 45 seconds ($p=0.0002$). Table 1 gives the details of the statistics for brushing time and dose comparisons.

Table 2 shows the actual amounts of plaque present (Turesky Index score) before and after brushing, from which the Table 1 data was calculated. This table indicates that even after the longest brushing times, considerable amounts of plaque remain (3 minutes brushing reduces the mean Turesky Index score from 3.0 to 2.0).

The tables further show there was no statistically significant difference in mean plaque removed between brushing with 1.5g of dentifrice compared to brushing without dentifrice, when brushing time was 60 seconds (0.82 and 0.84 mean Turesky model adjusted units of plaque removed, respectively; $p=0.5675$).

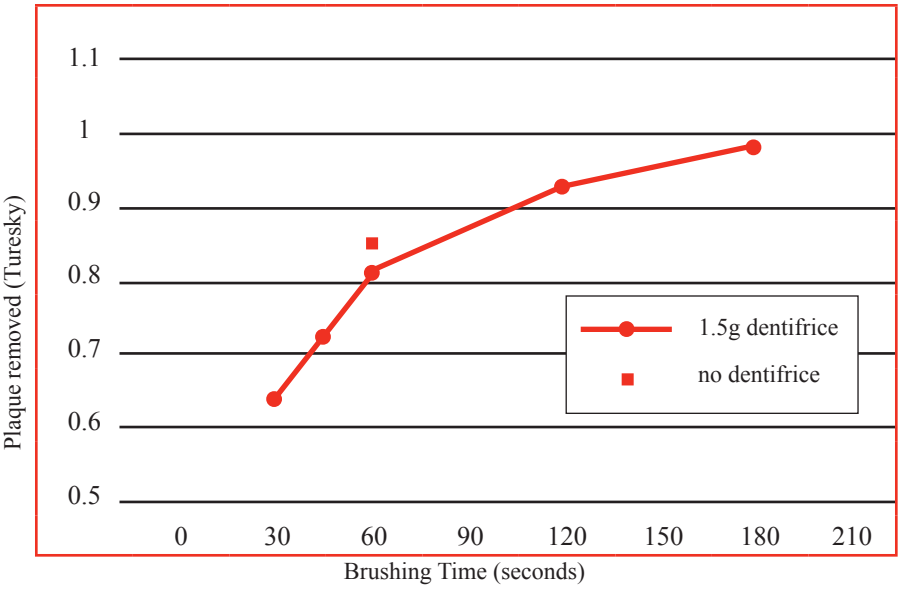

Figure 1. The effect of brushing time and presence of dentifrice on plaque removal, mean ± between subject s.e. (note the 'no dentifrice-60 seconds' value is slightly displaced on the x-axis for clarity).

Table 1. Pair-wise comparisons between treatment groups of change in plaque level during brushing.

Treatment Groups Compared		Adjusted Means (Group 1 - Group 2)[a]		Significance of difference (p-value)
Group 1	Group 2	Difference[b]	95% Conf. Int.[b]	
30 Sec. – 1.5g	45 Sec. – 1.5g	-0.09	[-0.19, 0.01]	0.0838
30 Sec. – 1.5g	60 Sec. – 1.5g	-0.18	[-0.28, -0.08]	0.0005
30 Sec. – 1.5g	120 Sec. – 1.5g	-0.28	[-0.38, -0.18]	<.0001
30 Sec. – 1.5g	180 Sec. – 1.5g	-0.35	[-0.45, -0.25]	<.0001
45 Sec. – 1.5g	60 Sec. – 1.5g	-0.09	[-0.19, 0.01]	0.0721
45 Sec. – 1.5g	120 Sec. – 1.5g	-0.19	[-0.29, -0.09]	0.0002
45 Sec. – 1.5g	180 Sec. – 1.5g	-0.26	[-0.36, -0.16]	<.0001
60 Sec. – 1.5g	120 Sec. – 1.5g	-0.10	[-0.20, -0.00]	0.0454
60 Sec. – 1.5g	180 Sec. – 1.5g	-0.17	[-0.27, -0.07]	0.0008
120 Sec. – 1.5g	180 Sec. – 1.5g	-0.07	[-0.17, 0.03]	0.1715
60 Sec. – 1.5g	60 Sec. – 0.0g	-0.03	[-0.13, 0.07]	0.5675

[a] Least squares means from analysis of covariance with treatment and period as fixed effect, subject as random effect and pre-brushing Turesky index score as a covariate as predictor terms.

[b] Difference in adjusted means; negative values favor the second treatment group.

Discussion

In this study, subjects were enrolled from the general population local to the study site. Subjects used a flat-trim, soft, manual brush and sodium fluoride-silica dentifrice, and were asked to use their normal brushing technique. The choice of brushing times was intended to span the range employed by the large majority of the population, and to include evenly spaced intermediate times to allow for a more complete understanding of the influence of brushing time on plaque removal. Subjects were also told in advance how long they were to brush, were able to adapt their rate of tooth surface coverage accordingly, and were prompted when to change quadrants. The aim of this approach was to model as closely as possible subjects' likely brushing technique, were they actually to brush for the different lengths of time in their normal routine. At the same time, this approach allowed precise control of brushing time and measurement of plaque levels. The design of the study did not include any measures (beyond brushing time) of the brushing procedure used by the individual subjects, so no comment may be made on the effects of brush-

ing technique on plaque removal. A crossover design was used to allow treatment comparisons on a within-subject basis, to minimize the impact of the subjects' different brushing techniques on the ability to detect treatment differences. The analysis was performed on the intent-to-treat population, to represent the real-world situation more closely than a per-protocol analysis.

There were no recruitment restrictions on subjects beyond age, general/oral health, and presence of a sufficient number of gradable teeth with a sufficiently high total plaque score. The population was necessarily restricted by the demographics of the locality, and having the time to attend the clinics. It was clearly biased towards females. The absence of other restrictions leads the authors to believe the population was representative of the locality, and the results relevant to Western developed countries in general.

Given these considerations, the results show brushing time is likely to be an important determinant of plaque removal in the general population. The degree of plaque reduction was related to brushing time across the examined 30-second to 3-minute time period. Plaque removal was dependent on brushing time at shorter times, but tended towards a maximum at extended times. This hyperbolic profile is consistent with a situation in which a proportion of the plaque is relatively easily accessible on the tooth and remaining plaque is progressively less accessible. In this situation, the easily accessible proportion is removed efficiently and quickly. However, the less-accessible remaining plaque is removed at a slower rate. Therefore, a given plaque removal increment will take progressively longer to achieve as brushing proceeds. At extended brushing times, it is also likely that subjects will re-trace the path of previous brushing strokes and remove no further plaque.[14]

The difference between immediately adjacent brushing times up to 2 minutes was of borderline statistical significance. A larger population would likely be required to determine dependency of plaque removal on brushing time to such a high precision.

The central aim of the study was to understand the overall effect of brushing time on plaque removal. Within this broad aim, a key comparison was the effect of brushing for 45 seconds, an estimate of the average brushing time employed by individuals,[33] with the effect of brushing for 2 minutes, a consensus minimum brushing time recommended by oral health professionals. The results showed that 2 minutes brushing removed 26% more plaque than brushing for 45 seconds (p=0.0002).

The profile of plaque removal as a function of time reported here is consistent with that reported by Hawkins et al[15] for dental student subjects trained in the Bass technique, and by McCracken et al[19] for power brush users. In contrast, Klukowska et al[37] showed no evidence of increased plaque removal beyond 1 minute, though in this study, participants did not know until they were stopped how long they had to brush. Hodges et al,[14] in a study performed on children, also saw no benefit of brushing for longer than 1 minute.

Table 2 shows the actual Turesky Index plaque scores before and after brushing for all treatment groups. This indicates that even when brushing for the longest period of the study (3 minutes), subjects left plaque remaining. The mean Turesky Index score after this brushing time was 2.0. As an individual reading, this corresponds to a thin continuous band of plaque around the cervical margin. Other studies of supervised manual brushing have also found that plaque removal is far from complete during 1 brushing session.[13,38-40]

Table 2. Actual Turesky Index plaque scores before and after brushing as a function of brushing time and presence of dentifrice.

Brushing time	30 Sec.	45 Sec.	60 Sec.	120 Sec.	180 Sec.	60 Sec.
Weight of dentifrice	1.5g	1.5g	1.5g	1.5g	1.5g	0.0g
N	42	43	44	42	42	43
Pre-brushing plaque score (mean ± s.d.)	2.95 ± 0.51	2.98 ± 0.49	2.95 ± 0.49	2.98 ± 0.47	3.00 ± 0.46	2.98 ± 0.53
Post-brushing plaque score (mean ± s.d.)	2.31 ± 0.60	2.26 ± 0.58	2.14 ± 0.57	2.06 ± 0.54	2.01 ± 0.63	2.13 ± 0.60

The presence of dentifrice during brushing made no difference to the amount of plaque removed by brushing (Figure 1). The benefit of toothpaste in removing plaque during brushing has been controversial. Reports of improved plaque removal when toothpaste is present[41] have been balanced by reports of no effect,[42] but these reports now contrast with recent work by Paraskevas and coworkers[40,43] which indicate a slight negative effect of the presence of toothpaste. The present study supports the view that the effectiveness of plaque removal during toothbrushing with dentifrice is essentially a function of access of brush bristles rather than dentifrice abrasive.

This study examined plaque removal from a single brushing. It did not examine the effects of brushing for different times or with different dentifrice doses over a period of time, during which cumulative

benefits may become apparent. The study did not address gingivitis, the next stage in dental plaque-related disease. Of particular interest would be to study the hypothesis that maintaining a longer brushing time for an extended period (weeks or months) would result in larger differences in plaque levels than were observed in the present, single-use study. The time-scale of such a study would also allow study of the effect of brushing time and dentifrice dose on gingivitis development.

Conclusion

Plaque removal during toothbrushing, by untutored subjects recruited from the general population local to the study site, was strongly dependent on brushing time. Increasing brushing time increased plaque removal across the period 30 seconds to 3 minutes. Plaque removal was, however, not influenced by the presence of dentifrice (over 60 seconds brushing), indicating that dentifrice constituents, such as abrasive and surfactant, do not meaningfully assist the action of the brush. A key finding in this study was that brushing for 2 minutes gave a 26% improvement in plaque removal compared to brushing for 45 seconds. This represents the plaque removal benefit individuals should expect when increasing their brushing time from the average 45 seconds[33] to the consensus minimum of 2 minutes. Though lower plaque levels as a result of more effective brushing may not always lead to a reduction in gingivitis,[5,44-47] this degree of improvement is potentially of clinical significance in reducing the risk of gingival disease. These results reinforce the view that oral health professionals, while coaching their patients in brushing technique, should recommend brushing for at least 2 minutes.

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Research

Practicing Dental Hygienists' Attitudes toward the Proposed Advanced Dental Hygiene Practitioner: A Pilot Study

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Abstract

Purpose: The purpose of this pilot study was to assess the attitudes of active registered dental hygienists toward the proposed Advanced Dental Hygiene Practitioner (ADHP). Factors of support/interest in the ADHP concept, level of practice, and socio-demographics were examined.

Methods: In 2007, a self-administered questionnaire was mailed to 1,562 active registered dental hygienists in Colorado, Kentucky, and North Carolina, states with diverse practice acts. The quantitative analysis included descriptive statistics, Mantel Haenszel for Likert-scaled responses, and chi-square to compare nominal responses. All of the survey questions were qualitatively reviewed.

Results: The response rate was 29% (n = 442), with 45% (n=196) of respondents indicating they had not heard of the proposed ADHP prior to receiving this survey. Overall level of support for the proposed ADHP as indicated by both very supportive and somewhat supportive responses was 87% (n=129) in Colorado, 82% (n=64) in Kentucky, and 92% (n=196) in North Carolina. Overall level of interest for the proposed ADHP as indicated by both very interested and somewhat interested responses was 74% (n=109) in Colorado, 71% (n=55) in Kentucky, and 81% (n=170) in North Carolina. A significant difference was found among respondents interested in becoming an ADHP and those not interested ($p<0.05$).

Conclusions: Among the 3 states, a higher overall level of support for the proposed ADHP was indicated compared to the overall level of interest. Although the state practice acts vary, these findings suggest that the level of support/interest in the proposed ADHP does not differ among respondents.

Key Words: advanced dental hygiene practitioner, advanced mid-level oral health care providers, mid-level health professions, dental hygienists

Introduction

Oral Health in America: A Report of the Surgeon General, which described oral health disparities among certain populations, stressed the important relationship between oral health and the overall general health of all Americans. Although the majority of Americans have benefited from "the safe and effective means of maintaining oral health, many still experience needless pain and suffering, complications that devastate overall health and well-being, and financial and social costs that diminish the quality of life and burden American society."[1] The *Report* described "'a silent epidemic' of oral diseases that is affecting the most vulnerable citizens including poor children, the elderly, and many members of racial and ethnic minority groups," and suggested that many Americans are unable to achieve optimal oral health due to barriers including lack of access to care.[1] Following the *Report*, the *National Call to Action to Promote Oral Health (Call to Action)* described 5 principal actions and implementation strategies "to promote oral health and prevent disease, especially to reduce the health disparities that affect members of racial and ethnic groups, poor people, many who are geographically isolated, and others who are vulnerable because of special oral health care needs."[2] "The goals of the *Call to Action* reflected those of *Healthy People 2010* that included: to promote oral health, to improve quality of life, and to eliminate oral health disparities."[2]

To help address these disparities, the American Dental Hygienists' Association (ADHA) began an initiative in 2004 to develop a curriculum for an Advanced Dental Hygiene Practitioner (ADHP). Comparable to the nurse practitioner model, the ADHP was proposed as a cost-effective response to help address the

lack of access to dental care of many Americans. The proposed clinical responsibilities of an ADHP include advanced preventive therapies, diagnosis, restorative procedures, and referrals. Working in a variety of settings, this professional would be part of a multi-disciplinary team that would offer a well-rounded approach to oral health care service. The education of a practicing ADHP would be at the master's level following completion of a baccalaureate degree in dental hygiene or related field.

In creating a new allied health position, a significant part of the assessment involves identifying potential applicants who would be willing to obtain this new credential. Currently, no data exists that examines pre-admission characteristics and attitudes of potential candidates for the proposed ADHP.

After developing the questionnaire and initiating the study, a design limitation was discovered that precluded the authors from conducting a follow-up with non-respondents. Therefore, given the relatively low response rate and concern about possible non-response bias, the study was recharacterized as a pilot, and the specific aims and associated analyses were modified. The purpose of this pilot study was to assess the attitudes of a random sample of active registered dental hygienists toward the proposed ADHP, to determine the prevalence of support/interest of the ADHP model, and to examine factors associated with support/interest of the ADHP model including level of training, practice, and sociodemographic characteristics.

Review of the Literature

Advocacy Efforts to Address Oral Health Care Disparities

The ADHA started to advocate at the federal level to seek support for a pilot project for the ADHP. The United States Senate Appropriations Committee report in December 2005 indicated that new ways of bringing oral health care to rural and underserved populations were needed.[3] "The Committee encouraged the Human Resources and Service Administration (HRSA) to explore alternative methods of delivering preventive and restorative oral health services in rural America, specifically to explore development of an advanced dental hygiene practitioner."

The first state to consider legislation for creation of the ADHP was Minnesota in February 2008. An omnibus health care appropriations bill contained wording supporting an ADHP pilot project and changing the name of the ADHP to Oral Health Practitioner (OHP). Subsequently, in April 2008, "the Minnesota State Senate passed an amended Omnibus Higher Education Bill that contained a provision to put language in the statute that creates the OHP and convenes a workgroup to make recommendations and proposed legislation to define the scope, supervision, and education of the provider by January 2009."[4]

In 2004, the ADA House of Delegates created a task force to study relevant issues with access to oral health care and the dental workforce. Two years later, the ADA House of Delegates approved the task force report, which resulted in the creation of an Oral Preventive Assistant (OPA) and Community Dental Health Coordinator (CDHC).[5] The OPA model would include competencies similar to those of a dental assistant, but would add scaling for Periodontal Type 1 (gingivitis) patients. The competencies of the CDHC model parallel the current scope of practice of dental hygienists, but the CDHC would be trained under a new academic program. Under dentist supervision, a CDHC "would be employed by federally qualified community health centers, the Indian Health Service, state or county public health clinics, or private practitioners serving dentally underserved areas."[5]

The Proposed ADHP Curriculum

The ADHA Council on Education recommended a task force to develop the ADHP curriculum. Phase I consisted of a preliminary ADHP curriculum framework that was completed in June 2005. The curriculum included 10 course titles: Issues in Health Care Delivery; Professional Development and Leadership; Practice Management; Populations with Special Needs; Pain Management; Restorative and Uncomplicated Extractions; Advanced Diagnosis and Medicine; Research and Grantsmanship; Community Planning and Externships; and Health Promotion, Disease Prevention, and Epidemiology.[6] Examples of course content and objectives were outlined for each course title. One year later, Phase II of a revised curriculum draft described 5 general themes (domains) and specific behaviors (competencies). The 5 domains, representing general professional roles and skills, were Provision of Primary Oral Health Care, Health Care Policy and Advocacy, Management of Oral Care Delivery, Transitional Research, and Professionalism and Ethics.[7] Each domain was supported by several competencies that described expected knowledge and skills of an ADHP. An important aspect of Phase II involved the wording that this curriculum was designed for a master's level education. In June 2007, Phase III included a sample curriculum and course guidelines, listing didactic courses (21 credits) and advanced practice clinical courses (16 credits). The educational competencies for the ADHP were adopted by the ADHA Board of Trustees in March 2008.

Studies Examining Existing Midlevel Oral Health Care Practitioners

In a study by Ross and colleagues, the authors investigated the educational needs and employment

status of registered dental hygienists in Scotland.[8] The questionnaire was mailed to 381 dental hygienists resulting in a 76% response rate (n=290) after 2 mailings. The majority of respondents were female who had received 12-17 months of training. Approximately 70% of respondents completed their training over 10 years ago prior to the study. Regarding training for extended duties, the majority indicated they had received formal training in the administration of local anesthesia and many had completed training in the placement of temporary restorations. Over half of the respondents indicated they would be interested in additional training to become qualified as dental therapists. The authors concluded that additional training in dental therapy would allow these individuals "to join forces with dentists in addressing the unacceptable levels of oral disease in many parts of the U.K."

One of the educational recommendations stated in the 2005 ADHA report, *Dental Hygiene: Focus on Advancing the Profession*, was to implement the baccalaureate degree as the entry point for dental hygiene practice within 5 years.[9] Shortly after, a research study by Monson and Engeswick included a specific aim "to assess and analyze associate degree dental hygiene students' interest in baccalaureate degree completion."[10] A 55-item, self-administered questionnaire was distributed to first- and second-year dental hygiene students by faculty at 8 associate degree-granting institutions in Minnesota. Seven schools participated, yielding a 69% response rate (n=204): 94 first year students and 110 second year students. Sixty-six percent of students identified they were currently interested in completing a Bachelor of Science degree in dental hygiene. Of those interested, 58% intended to take 2 classes per semester, 27% intended to take 3-4 classes per semester and almost 40% were willing to commit as many years as needed to achieve their degree. Thirty two percent were willing to commit 2 years. Of the students interested in degree completion, 50% were very interested in evening classes held in off-site locations near their home communities, 36% were very interested in online-only coursework, 29% were very interested in a mixture of face-to-face and online coursework, and 13% were very interested in completing coursework during traditional daytime hours at Minnesota State University. The authors referenced a 2002 Canadian research study by Cobban and Clovis that listed the need for flexibility in scheduling, family, and work obligations as barriers for dental hygienists to complete their baccalaureate degree.[11] In conclusion, the authors suggested that degree-completion programs need to recognize these barriers and enable students to enroll part time.

The ADHP concept parallels other mid-level health professions

In nursing, certifications for nurse midwife, nurse practitioner, clinical nurse specialist, and registered nurse anesthetist have been established. In the mid 1990s, the apparent shortage of primary care physicians resulted in an increase of nurse practitioners (NP) and physician assistants (PA), which helped address access to care issues. This suggests that NPs and PAs are providing services (especially primary care) to populations that otherwise would be managed by a physician or would not receive services.[12]

Saint Louis University School of Nursing began an accelerated baccalaureate nursing (BSN) program in 1971. "The program's objective was to increase the supply of baccalaureate-prepared nurses by recruiting individuals with non-nursing baccalaureate or higher degrees into a nursing program requiring less time to complete than a traditional baccalaureate program."[13] Although many programs have started since 1971, Meyer and colleagues found little reported research on the students who enter these programs. They reported 3 published studies, Diers,[14] Feldman and Jordet,[15] and Wu and Connelly[16] that described the type of students who enrolled in accelerated BSN programs during the 1980s. These studies reported a mean age of 27-30 for students. Wu and Connelly reported that students returned to school within 3-7 years after earning their first college degree. Students' reasons for entering the accelerated BSN programs included employment opportunities, the length of the program, opportunity for upward mobility, and the desire to be part of a caring profession.

Methodology

A 23-item questionnaire was designed using 3 domains: support/interest in the ADHP, practice demographics, and socio-demographics and level of training. These questions were derived from the literature review and from pilot test suggestions using a convenience sample of registered dental hygienists in North Carolina. After several revisions, the final questionnaire contained 22 closed-ended questions using the formats of completion, Likert-scale, multiple choice, and 1 open-ended question. Upon the premise that unique differences in state dental laws, such as duty regulations and supervision levels, would be a predictor of support/interest, the states of Colorado (unsupervised practice permitted for most services in any setting), Kentucky (general and direct supervision), and North Carolina (direct supervision) were selected.[17]

Mailing lists were obtained from the dental boards of each state. A systematic sample yielded 555 from Colorado, 305 from Kentucky, and 702 from North Carolina. After approval from the University of North Carolina's Institutional Review

Board, the cover letter, questionnaire, and a postage-paid business reply envelope were mailed in June 2007. The participants were asked to return the completed surveys approximately 1 week after the survey was mailed.

The quantitative analysis to compare the responses from the three states included descriptive statistics, Mantel Haenszel for Likert-scaled responses, and chi-square to compare nominal responses. Level of significance was set at 0.05.

Results

The returned surveys yielded an overall 29% response rate (n=442). Although 7% (n=30) of respondents did not complete page 2 (questions #8-17), these surveys were included in the descriptive data. Over 96% of respondents in all 3 states were female. White non-Hispanics comprised 91% (n=135) in Colorado, 96% (n=77) in Kentucky, and 92% (n=196) in North Carolina (Table 1). The mean age in years of the respondents was 44 in Colorado, 41 in Kentucky, and 43 in North Carolina (Table 2). General practice was the most selected as the primary practice setting for each state; in contrast, hospital practice was the least. The distribution of respondents who indicated their highest degree as an associate degree in dental hygiene was 54% (n=80) in Colorado, 66% (n=53) in Kentucky, and 72% (n=155) in North Carolina (Table 3).

Forty-five percent (n=196) of respondents indicated they had not heard of the proposed ADHP prior to receiving this survey. Table 4 compares the level of support of the 5 general themes and overall opinion of the ADHP. The statistical analysis revealed no significant differences. For all 3 states, Theme V (Professionalism and Ethics) received the most support, whereas Theme I (Provision of Primary Oral Health Care) was least supported. Overall level of support for the proposed ADHP as indicated by both very supportive and somewhat supportive responses was 87% (n=129) in Colorado, 82% (n=64) in Kentucky, and 92% (n=196) in North Carolina.

Comparison by level of interest of the 5 general themes and overall opinion of the ADHP is shown in Table 5. Theme II (Health Care Policy and Advocacy) revealed the only significant difference (p=0.02) among the 3 states. Theme V (Professionalism and Ethics) received the most interest; in contrast, Themes I (Provision of Primary Oral Health Care) and III (Management of Oral Care Delivery) received the least interest. Overall level of interest for the proposed ADHP as indicated by both very interested and somewhat interested responses was 74% (n=109) in Colorado, 71% (n=55) in Kentucky, and 81% (n=170) in North Carolina.

Pursuit of the proposed ADHP degree with formal education indicated that 302 respondents were interested and 106 were not interested (Table 6). There was a significant differ-

Table 1. Frequency by state of gender, ethnicity, current primary practice setting, and geographic setting of primary practice

N = 442	Colorado		Kentucky		N. Carolina	
Variable	N	%	N	%	N	%
Gender						
• Female	130	96.30	78	98.73	193	97.47
• Male	5	3.70	1	1.27	5	2.53
Ethnicity						
• White, non-Hispanics	135	91.22	77	96.25	196	92.02
• Others	13	8.78	3	3.75	17	7.98
Practice Setting						
• General practice	112	82.96	61	77.22	145	73.23
• Specialty practice	8	5.93	10	12.66	18	9.09
• Hospital practice	0	0	0	0	3	1.52
• Public practice	3	2.22	3	3.80	12	6.06
• Education	2	1.48	1	1.27	6	3.03
• Other	10	7.41	4	5.06	14	7.07
Geographic Setting						
• Rural	17	12.59	29	37.18	47	23.98
• Suburban	75	55.56	26	33.33	74	37.76
• Urban	38	28.15	21	26.92	59	30.10
• Other	5	3.70	2	2.56	16	8.16

Frequency missing excludes the 30 respondents who did not complete questions 8-17: ethnicity (1), geographic setting (3)

Table 2. Comparison by state of years of active practice, hours/week in providing patient care, and age

N = 442	Years of Active Practice			Hours/week of work			Age		
State	N	Mean	SD	N	Mean	SD	N	Mean	SD
Colorado	147	16.72	10.12	130	27.94	9.90	135	43.84	10.19
Kentucky	80	16.48	10.87	77	27.62	10.44	79	41.33	10.15
N. Carolina	213	18.02	10.79	191	27.09	10.93	198	43.47	10.54

Frequency missing excludes the 30 respondents who did not complete page 2 (q #8-17): years of active practice (2), hours/week of work (14)

ence (p=0.04) among the interested respondents by state, with 80% in North Carolina, 70% in Colorado, and 68% in Kentucky. Of the 302 respondents, a majority indicated that they would be willing to spend 2 years or less of additional education to earn this degree (Table 5). The interested respondents suggested that they would be most willing to enroll as a part-time student and take courses online (Table 7). The most appealing teaching format was in class lectures supplemented with online material followed by online/internet with instructor available on campus (p=0.04). In comparison to respondents in Kentucky and North Carolina, 27% (n=25) of Colorado respondents indicated interest in the online/Internet with the instructor off campus format. The distribution of respondents selecting finances and family obligations as the main challenge in becoming an ADHP was fairly consistent among the 3 states except for finances among Kentucky respondents (22%). Thirty percent (n=26) of Colorado respondents chose interest in practicing in a suburban dental clinic, 32% (n=16) in Kentucky chose practicing in a rural dental clinic, and 31% (n=45) in North Carolina chose interest in a public health setting.

Discussion

Colorado, Kentucky, and North Carolina were chosen based on unique differences in the state practice acts and levels of supervision. It was proposed that these differences might be a factor in determining the overall level of support/interest of the ADHP. The low response rate (29%) was inadequate to support any significant differences among the 3 states and limited any generalizations of the population. However, the descriptive data yielded points of interest in comparing responses among these states.

The percentage of female respondents (over 96%) was proportionate to the total random sample and reflects the gender distribution of the profession. The majority of the respondents for all 3 states were white, non-Hispanic. The ethnicity distribution should be considered as ADHP programs are proposed. Recruitment measures should include strategies to increase student diversity. Action 4 of the *National Call to Action to Promote Oral Health* states that increased diversity in the oral health workforce would help meet the patient and community needs.[2] The recruitment process in dental hygiene has been described as self-recruiting and as recruitment by reputation. Recruitment for ADHP programs may be different. Trends in success rates when new advanced degrees were started in other health professions need to be evaluated with attention to gender and minorities.

The mean age in years (43) and the mean years of active practice (17) were similar among the 3 states. Studies have shown trends where individuals will work a number of years in their chosen profession and then decide to seek additional education. Rasmussen and colleagues conducted a pilot study on nurses' interest in the neonatal nurse practitioner (NNP) role. Their study revealed that 36% indicated interest in becoming an NNP and the mean time since graduation from a nursing program was 16 years for the entire sample.[18] Completion programs, or RN-to-BSN, have served as a solution to prepare more nurses with a baccalaureate degree. "The RNs who enroll in these programs are adult learners who also bring to the academic arena a repertoire of clinical knowledge and skills, a structured background of educational preparation, and employment experiences."[19] This experienced cohort is interested in seeking advanced degrees and should be part of the applicant pool as nontraditional students.

Sixty-five percent of respondents held an associate degree in dental hygiene, whereas 30% held a bachelors degree. These percentages varied from the 2001 workforce profile of dental hygienists in all states that reported 49% with a baccalaureate degree, 44% with an associate degree, and 7% with a certificate.[5] The respondents with an associate degree in dental hygiene who are interested in obtaining the proposed ADHP credential need to first com-

Table 3. Frequency by state of highest educational degree, year of graduation, and type of institution

N = 442	Colorado		Kentucky		N. Carolina	
Level of training	N	%	N	%	N	%
Highest educational degree						
• Associate in Dental Hygiene	80	54.05	53	66.25	155	72.43
• Certificate in Dental Hygiene	3	2.03	3	3.75	2	0.93
• Bachelors degree	61	41.22	21	26.25	52	24.30
• Master's degree and above; others	4	2.71	3	3.75	5	2.34
Year of graduation						
• 1958-1970	5	3.62	1	1.35	13	6.28
• 1971-1980	37	26.81	17	22.97	52	25.12
• 1981-1990	30	21.74	17	22.97	55	26.57
• 1991-2000	42	30.43	19	25.68	49	23.67
• 2001-2007	24	17.39	20	27.03	38	18.36
Type of Institution						
• Comm/tech college	81	54.73	30	37.50	159	74.30
• College/univ. without dental school	22	14.86	20	25.00	14	6.54
• College/univ. with dental school	45	30.41	30	37.50	41	19.16

Frequency missing: year of graduation (23)t

plete a Bachelors Degree. ADHA's 2007 report, Dental Hygiene: Focus on Advancing the Profession,[9] states the goal of advancing the baccalaureate degree as entry-level for dental hygiene in the next 5 years is to prepare graduates for alternative career opportunities in education, administration, public health, and research.[10] Pursuit of this goal would provide support for successful implementation of the ADHP with qualified applicants. As stated in the nursing literature, "the pipeline of future nurse practitioners is dependent primarily on graduates from baccalaureate nursing programs."[12] As supportive measures, community/technical colleges could increase opportunities for more graduates to pursue a baccalaureate degree. In addition, articulation agreements between community/technical colleges offering associate degrees in dental hygiene and universities offering degree completion programs could be revised. Dental hygiene degree completion programs need to modify their recruitment efforts to include recent graduates and non-traditional students. These programs could consider changes with course scheduling and online teaching methods to accommodate the various needs of students. In 2006, 56 dental hygiene degree completion programs existed with 7 programs offering 100% course content online.10 An increase in the number of programs offering online courses would correlate to possible increases in enrollment.

Table 4. Frequency by state of level of support of the five general themes describing the proposed professional responsibilities, knowledge, and skills of an ADHP and of the overall opinion of the ADHP

N = 442	Very Supportive		Somewhat Supportive		Neutral		Not Supportive		Strongly Against		p-value
Outcomes	N	%	N	%	N	%	N	%	N	%	
Theme I											
•Colorado	82	55.41	41	27.70	11	7.43	5	3.38	9	6.08	0.40
•Kentucky	43	54.43	13	16.46	10	12.66	7	8.86	6	7.59	
•N. Carolina	114	53.77	45	21.23	26	12.26	18	8.49	9	4.25	
Theme II											
•Colorado	102	68.92	30	20.27	14	9.46	1	0.68	1	0.68	0.46
•Kentucky	53	67.09	17	21.52	7	8.86	1	1.27	1	1.27	
•N. Carolina	160	75.47	32	15.09	16	7.55	2	0.94	2	0.94	
Theme III											
•Colorado	78	52.70	38	25.68	28	18.92	1	0.68	3	2.03	0.56
•Kentucky	46	58.23	15	18.99	12	15.19	4	5.06	2	2.53	
•N. Carolina	127	59.62	48	22.54	28	13.15	7	3.29	3	1.41	
Theme IV											
• Colorado	112	75.68	25	16.89	10	6.76	0	0.00	1	0.68	0.16
• Kentucky	53	66.25	16	20.00	8	10.00	2	2.50	1	1.25	
• N. Carolina	163	76.89	29	13.68	13	6.13	6	2.83	1	0.47	
Theme V											
• Colorado	124	83.78	15	10.14	8	5.41	0	0.00	1	0.68	0.27
• Kentucky	65	81.25	8	10.00	6	7.50	1	1.25	0	0.00	
• N. Carolina	189	88.73	16	7.51	6	2.82	0	0.00	2	0.94	
Overall Opinion											
• Colorado	97	65.54	32	21.62	12	8.11	3	2.03	4	2.70	0.26
• Kentucky	51	65.38	13	16.67	9	11.54	4	5.13	1	1.28	
• N. Carolina	147	69.34	49	23.11	10	4.72	1	0.47	5	2.36	

Theme I (Provision of primary oral health care), Theme II (Health care policy and advocacy), Theme III (Management of oral care delivery), Theme IV (Translational research), Theme V (Professionalism and ethics); Frequency missing < (4); Mantel-Haenszel (row mean scores differ)

Theme V (Professionalism and Ethics) received the highest level of support and interest among the 3 states. This was expected, as these behaviors are familiar principles to current dental hygienists. The least level of support was found for Theme I (Provision of Primary Oral Health Care). The percentages of combined "very supportive" and "somewhat supportive" responses were 83% in Colorado, 71% in Kentucky and 75% in North Carolina. In addition, Colorado showed the highest level of interest at 67%. This level could correlate to the duties currently allowed. Both Colorado and Kentucky shared similar expanded duties; however, Colorado is the only state with unsupervised practice permitted for most services. The least level of interest was revealed in Theme III (Management of Oral Care Delivery). Combined responses of "very interested" and "somewhat interested" were the lowest in Colorado (44%), followed by Kentucky (50%), and North Carolina (58%). Dental hygienists in Colorado may be more familiar with business management skills due to the unsupervised dental hygiene practice for most services and optional independent practice. The lower level of interest could reflect dislike for this part of dental hygiene practice. A significant difference was determined only for level of interest for Theme II (Health Care Policy and

Table 5. Frequency by state of level of interest of the five general themes describing the proposed professional responsibilities, knowledge, and skills of an ADHP and of the overall opinion of the ADHP

N = 442	Very Interested		Somewhat Interested		Neutral		Slightly Interested		Not Interested		p-value
Outcomes	N	%	N	%	N	%	N	%	N	%	
Theme I											
• Colorado	65	43.92	34	22.97	21	14.19	10	6.76	18	12.16	0.56
• Kentucky	31	38.75	17	21.25	15	18.75	5	6.25	12	15.00	
• N. Carolina	99	46.92	31	14.69	26	12.32	16	7.58	39	18.48	
Theme II											
• Colorado	61	41.22	34	22.97	29	19.59	12	8.11	12	8.11	0.02
• Kentucky	35	43.75	18	22.50	16	20.00	4	5.00	7	8.75	
• N. Carolina	117	55.45	39	18.48	36	17.06	8	3.79	11	5.21	
Theme III											
• Colorado	36	24.32	29	19.59	46	31.08	12	8.11	25	16.89	0.06
• Kentucky	24	30.00	16	20.00	18	22.50	10	12.50	12	15.00	
• N. Carolina	82	38.68	40	18.87	46	21.70	14	6.60	30	14.15	
Theme IV											
• Colorado	89	60.14	24	16.22	22	14.86	4	2.70	9	6.08	0.44
• Kentucky	43	53.75	13	16.25	13	16.25	5	6.25	6	7.50	
• N. Carolina	128	60.66	35	16.59	25	11.85	11	5.21	12	5.69	
Theme V											
• Colorado	103	69.59	21	14.19	14	9.46	3	2.03	7	4.73	0.31
• Kentucky	58	72.50	10	12.50	8	10.00	0	0.00	4	5.00	
• N. Carolina	165	77.83	25	11.79	11	5.19	2	0.94	9	4.25	
Overall Opinion											
• Colorado	72	48.65	37	25.00	22	14.86	5	3.38	12	8.11	0.56
• Kentucky	38	48.72	17	21.79	15	19.23	4	5.13	4	5.13	
• N. Carolina	116	54.98	54	25.59	16	7.58	8	3.79	17	8.06	

Theme I (Provision of primary oral health care), Theme II (Health care policy and advocacy), Theme III (Management of oral care delivery), Theme IV (Translational research), Theme V (Professionalism and ethics); Frequency missing < (5); Mantel-Haenszel (row mean scores differ)

Advocacy). North Carolina revealed the higher percentages of very supportive (75%) and very interested (55%) for this theme. Access to care and providing oral health care to the underserved are prominent issues in this state. Dental hygienists are restricted in many ways due to the current state practice acts. The combination of these conditions may explain the interests of dental hygienists to advocate for changes in health care policy and legislative changes in North Carolina. In addition, this could contribute to the respondents in North Carolina exhibiting the highest overall level of support and interest for the ADHP.

A significant difference was observed among the states interested in becoming an ADHP and those who were not interested. Of those interested, a majority of respondents (mean 56%) indicated they would be willing to spend 2 years or less to obtain the proposed ADHP credential. The length of a program has been an important factor suggested by students in accelerated BSN programs and master of physical therapy programs.[13,20] Respondents among the 3 states indicated the most interest in returning to school as a part-time student and taking courses online. A significant difference was found in preferred teaching formats with the selection of "in-class lectures supplemented with online/internet material" being the most favored. In contrast, very few respondents indicated an interest to relocate to an area where the college is offering the ADHP curriculum. Studies have shown that many students (nurse practitioner, accelerated BSN, and master of physical therapy) attend schools that are less than 50 miles from home.[13,20,21] Students earning a second degree may be less mobile due to family ties.[13] The main challenges in becoming an ADHP were age, finances, and family obligations. These challenges are consistent themes in that graduate students appear to be more influenced by spouse, family, and work considerations than undergraduates.[20] Despite these challenges, many dental hygienists have flexible schedules and "half of all dental hygienists work part-time (less than 35 hours per week)."[5] Furthermore, very few respondents indicated a reluctance to go back to school. The respondents also showed interest to practice as an ADHP in areas to address the oral health needs of the underserved. These results indicate favorable characteristics that describe a potential pool of interested students.

Assessment of this data could be beneficial to ADHP programs with regards to planning school locations, recruitment efforts, course scheduling, delivery methods, and teaching formats. ADHP programs will need to develop strategies to overcome challenges and best meet the needs of a varied applicant pool of recent

graduates and non-traditional students.

The ADHA House of Delegates adopted the development of the ADHP in June 2004; however, prior to receiving this survey, 45% percent (n=196) of respondents indicated they had not heard of the proposed ADHP. If this same percentage was applied to the total sample (1,562), then one could extrapolate that approximately 700 dental hygienists knew about the ADHP at the time of the survey. The lack of awareness of the ADHP could be a contributing factor to the low response rate and support possible non-response bias. ADHA could develop alternative strategies to improve the flow of communication from the association to all dental hygienists. In proportion to the number of dental hygienists in the United States, membership in ADHA remains low. ADHA could creatively market and promote the advantages of membership. Efforts are being made to encourage the transition of membership from SADHA to ADHA; however, postgraduates with years of practicing experience need to be contacted. Members would hopefully become more engaged in advocacy efforts and legislative issues. Printed and televised news of the recent legislative effort by the ADHA to establish the ADHP in Minnesota has probably increased the general knowledge.

Due to limitations in the study, it cannot be generalized to a larger population. The study was implemented in 2007 and much discussion has occurred about the ADHP since that time. If the study were conducted today, it is likely that more dental hygienists would be familiar with the ADHP proposal. In addition, only 3 states were surveyed, decreasing the ability to generalize results. Although this pilot study is limited with generalizations to the population, the information learned from the study population may be beneficial to future investigations and also to the progress of the ADHP.

Table 6: Frequency by state of interest in becoming an ADHP and additional years of education to obtain the proposed ADHP degree

N = 442	Colorado		Kentucky		N. Carolina		p-value
Variable	N	%	N	%	N	%	
Becoming an ADHP							
• Interested	94	69.93	52	67.53	156	79.59	0.04
• Not interested	41	30.37	25	32.47	40	20.41	
Education for ADHP							
• 2 years or less	76	56.30	41	53.25	117	59.69	
• 3 years	12	8.89	9	11.69	23	11.73	
• 4 years or more	6	4.44	2	2.60	16	8.16	

Frequency missing excludes the 30 respondents who did not complete questions 8-17

Table 7: Frequency by state of preferences to become an ADHP, most appealing teaching format, main challenge in becoming an ADHP, and most likely practice setting as an ADHP

	Colorado		Kentucky		N. Carolina		p-value
Characteristics	N	%	N	%	N	%	
*Willing to obtain ADHP (N = 306)							
• Relocate to area	11	11.58	2	3.70	18	11.46	0.23
• Take courses online	84	88.42	49	90.74	146	92.99	0.46
• Use student loans	43	45.26	20	37.04	70	44.59	0.57
• Full-time student	21	22.11	9	16.67	28	17.83	0.63
• Part-time student	67	70.53	41	75.93	124	78.98	0.32
+Teaching format (N = 304)							0.04
• In class lectures only	11	11.83	4	7.41	13	8.28	
• In class lectures with online	33	35.48	23	42.59	71	45.22	
• Online/instructor on campus	24	25.81	17	31.48	56	35.67	
• Online/instructor off campus	25	26.88	10	18.52	17	10.83	
+Main challenge (N = 280)							0.46
• Age	20	23.26	13	25.49	32	22.38	
• Finances	28	32.56	11	21.57	44	30.77	
• Family obligations	26	30.23	16	31.37	52	36.36	
• Reluctance return to school	12	13.95	11	21.57	15	10.49	
+Practice setting (N = 285)							0.21
• Hospital	14	16.09	8	15.69	20	13.61	
• Public Health	14	16.09	12	23.53	45	30.61	
• Rural dental clinic	23	26.44	16	31.37	43	29.25	
• Suburban dental clinic	26	29.89	8	15.69	26	17.69	
• Urban dental clinic	10	11.49	7	13.73	13	8.84	

Frequency missing excludes the 30 respondents who did not complete page 2 (q #8-17) and the 106 respondents who were not interested in becoming an ADHP: teaching format (2), main challenge (26), practice setting (21)

*Respondents could select more than one answer

+Responses were mutually exclusive

Conclusion

ADHA proposed the ADHP model as a cost-effective response to help address the lack of access to dental care of many Americans. Development of this model has paralleled features in the nursing profession, with its successful implementation of the nurse practitioner. Among the 3 states, a higher overall level of support for the proposed ADHP was indicated as compared to the overall level of interest. However, the 302 respondents interested in obtaining the proposed ADHP credential indicated specific preferences to support their interest. Utilization of this pilot study may help future researchers find additional trends and characteristics of potential students regarding the ADHP.

At the time of the study, Douglas Lambert was a MS degree candidate in the Dental Hygiene Education Master of Science Degree Program at the University of North Carolina at Chapel Hill School of Dentistry. Alice Curran, DMD, MS, is an Associate Professor, Diagnostic Sciences & General Dentistry; Jessica Lee, DDS, MPH, PhD, is an Associate Professor, Pediatric Dentistry; Daniel Shugars, DDS, MPH, PhD, is a Professor, Operative Dentistry; Mary George, RDH, MEd, is an Associate Professor, Dental Ecology. They all currently work at the University of North Carolina School of Dentistry.

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Research

Career Influences and Perceptions of Pre-Dental Hygiene Students

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Abstract

Purpose: Dental hygiene programs have a responsibility to help potential applicants determine if dental hygiene is the best career choice for them. Good fit of career promotes a satisfied workforce along with retention within the profession. The purposes of this study were to describe students interested in dental hygiene, influential factors on career choice, and how perceptions of the profession were impacted by an introductory career course.

Methods: Pre- and post-course surveys were distributed to 186 students enrolled in "Perspectives in Dental Hygiene" at a state university. An overall response rate of 97% (N=181) was achieved. The average participant was 18-19 years old, female, Caucasian, worked 0-10 hours/week, and reported a GPA of 3.5-4.0.

Results: The most influential people for career choice were dental hygienists, dentists, and mothers. Observing a dental hygienist was the most influential activity. Influential factors impacting career choice favorably were helping people, good career with family, and availability of jobs. Influential negative factors included stress of prerequisite science and dental hygiene coursework. Frequent alternate occupations considered by post-course participants included nursing, dentistry, dental assisting, and education.

Conclusions: Dental hygienists and dentists play a key role in influencing career choice of dental hygienists. Additional potential applicants may be found by providing opportunities for students interested in nursing, education, dentistry, and dental assisting to learn more about the dental hygiene profession.

Key Words: dental hygiene curriculum, dental hygiene applicants, student recruitment, career perceptions, career motivation

Introduction

Career choice is a complex decision influenced by both internal and external factors. The purposes of this study were to describe characteristics of students interested in dental hygiene, influential factors on career choice, and how perceptions of the profession were impacted by an introductory career course. Communicating comprehensive information about the dental hygiene profession to interested students may help promote career fit and ultimately lead to increased retention within the profession.

Review of the Literature

Typically, dental hygienists are Caucasian and female, and enter dental hygiene programs in their twenties.[1,2] In 2002, males represented about 2.5% of dental hygienists, while 20% of dental hygiene graduates were non-Caucasian.[3] Few research articles have gone beyond describing the demographics of dental hygienists to explore why dental hygiene was chosen for their career. This literature review examines 4 previous studies that examined influential factors on career choice of dental hygienists and allied health professions.

Foley utilized an open-ended questionnaire with 169 first and second year Indiana dental hygiene students from 5 Indiana programs and a convenience sample of 70 Indiana dental hygiene graduates to determine influential factors in career choice.[4] Eighty-one percent of students and 86% of graduates identified the dental office as the person or group most responsible for influencing career choice. Within the dental office, the dentist was considered more influential than the dental hygienist or the assistant. Relatives were considered most influential by 33% of students and 16% of graduates, while less than 1% of both groups were influenced by college counselors. The ages 16-20 were listed as the time when decisions were made regarding career choice in dental hygiene for 64% of students. However, 71% of graduates' ages ranged anywhere from 7-35. Chemistry and biology were listed as the most influential high school courses, with chemistry, anatomy/physiology, and speech as the most influential pre-hygiene courses. This study supports the concept that recruitment strategies

should incorporate dental practitioners and should occur during late high school or early post-secondary years of education. Additionally, more information about the program and profession may help guide better career choices and lead to increased satisfaction.

Carr examined factors influencing career choice using a convenience sample of 50 students entering the University of Maryland dental hygiene program over a period of 2 years.[5] Students were divided into 2 groups based on a high or low score using Holland's Vocational Identity scale. Holland's Vocational Identity scale consists of 18 true or false items that investigate individuals' "possession of a clear and stable picture of one's goals, interests, and talents."[6] High scores on the scale indicate a clear sense of identity.[6] While the Vocational Identity group mean score was 13, there was a significant difference between the high (N=17) and low (N=33) group mean scores of 17 and 11 ($p<.001$). The high group listed the dental hygienist as the most influential person in career choice, while the low group listed both the dentist and dental hygienist as equally influential. Observing a dental hygienist was ranked the highest influential activity, while high school and college career activities were least influential in both groups. Influential characteristics for the high group included working with people and availability of jobs. Working in health science and flexible work schedules influenced the low group. This study suggests that involving dental hygiene practitioners in the recruitment of students may increase the effectiveness of recruitment strategies. Satisfaction with career choice was not followed in this study, preventing comparisons of satisfaction determined by high or low Vocational Identity scores.

DeAngelis, Dean, and Pace examined the career choice and perceptions of dental hygiene using a convenience sample of 151 prospective and current dental hygiene students from 2 dental hygiene programs in Arkansas.[1] Students ranked the influence of individuals in guiding their career choice on a scale from 1 to 5, with dental hygienists having the greatest mean score (3.58), followed by dentists (3.49). Similar to the results of Foley, college counselors had little influence on career choice (1.36), while high school counselors had the lowest mean score (1.15). Examination of career motivation influences beyond individuals was ranked using the same system, where helping and working with people had the greatest mean score (4.62), followed by flexibility of work schedule (4.52), good family career (4.54), and good salaries (4.48). The least influential motivation was identified as the desire for dental hygiene as a second choice from dental school (1.72). Contact with people (4.79), a caring profession (4.74), good job security (4.71), and flexible work schedules (4.69) received the highest mean scores of perceptions of the profession. Perceiving dental hygiene as a science-based occupation (4.08) and diverse career opportunities (3.81) were the lower mean scores. No significant differences were found in career perceptions between prospective and current dental hygiene students using a one-way ANOVA. This study supports the concept that social values have more weight in influencing career motivation of dental hygienists than economic factors.

Baldwin and Agho examined the influence of contact sources in career choices of allied health disciplines.[7] A total of 1,809 students participated, selected from a national stratified sample, with 302 students from 7 institutions representing dental hygiene. A dental health professional was the most significant source of information ($p<.01$), followed by high school counselor ($p<.05$), and health professional outside of dentistry ($p<.05$). Influence from the media was an insignificant source of information for dental hygiene. The influence of contact sources on dental hygiene career choice may be further understood by utilizing the Career Beliefs Inventory designed to operationalize Krumboltz's Social Learning Theory.

The Social Learning Theory suggests there are two major types of learning experiences that shape an individual's actions and skills.[8] The first type, instrumental learning experience, occurs through reinforcement or punishment of an action or skill. The second type, associative learning experience, occurs through association of an emotional experience with a previously neutral event. The Social Learning Theory of Career Decision Making (SLTCDM) is based on 4 influential factors: 1) genetic endowment and special abilities, 2) environmental conditions and events, 3) learning experiences, and 4) task approach skills.[8] Based on the general social learning theory of behavior, SLTCDM recognizes that personal qualities such as skill, interests, beliefs, values, and work habits are dynamic and subject to influence by new learning.[9] This learning can be influenced by working with a career counselor who is able to first assess the individual's beginning reference and then promote exploration into elements within a satisfactory life. The Career Beliefs Inventory consists of 25 scales used to identify career beliefs and assumptions that may prevent individuals from pursuing constructive career choices.[10]

Dental hygiene career choice studies have identified dental professionals, particularly dental hygienists and dentists, as the leading persons of influence in choosing dental hygiene as a profession.[1,4,5,7] The age when most students chose dental hygiene as their profession was 16-20, suggesting recruitment strategies should be implemented during this period.[4] Other influences motivating a career choice in dental hygiene included observing a dental hygienist and completing science coursework

in both high school and college.[4,5] Specific common perceptions of the dental hygiene field include working with people and flexible schedules,[1,5] working in a health science field,[5] adequate salaries, and consistency with family obligations.[1]

Career development courses are often used in postsecondary settings to help students with career choice. Folsom and Reardon examined 46 studies that observed the effectiveness of career courses since the 1920s.[11] Of these studies, 83% found positive changes as a result of the career course and 15 (33%) reported positive outcomes such as retention. Reese and Miller compared students enrolled in a career development course to students enrolled in a general psychology course and found those in the career course had increased career decision-making self-efficacy.[12] More recent trends are investigating the effect of career development courses specific to a major. Positive outcomes such as increased career decision making and increased confidence have been reported as a result of career development courses in both psychology and nursing.[13,14]

Methodology

Pre- and post-course surveys were distributed to 186 students enrolled in "Perspectives in Dental Hygiene" at a state university in Minnesota. Subject approval was obtained from the Institutional Review Board, Minnesota State University, Mankato. Informed consent was obtained from all participants. An overall response rate of 97% (N=181) was achieved. The average participant was 18-19 years old, female, and Caucasian; worked 0-10 hours/week; and reported a GPA of 3.5-4.0. This course was designed to meet 13 learning outcomes, including:

1) Identifying a peer group interested in the field of dental hygiene

2) Understanding the goals of the dental hygiene profession

3) Identifying career opportunities with a Bachelor of Science in dental hygiene

4) Identifying workplace fit according to Holland's theory

5) Analyzing basic career interest scores using LiveCareer assessment online

6) Developing a relationship with the study partner interested in the field of dental hygiene

7) Analyzing the learning style (Felder & Silverman) identified using the online questionnaire

8) Understanding what curriculum is offered by the dental hygiene program

9) Understanding the general education requirements of the university

10) Developing a plan of study for required general education and electives with intention of application to the dental hygiene program

11) Experiencing dental appointment in the university dental clinic

12) Developing a mentor relationship with a licensed dental hygienist through job shadow experience

13) Evaluating individual capability and desire to enter the field of dental hygiene

A combination of discussions, PowerPoint presentations, peer interactions, group activities, and assigned reading and writing was used to achieve the learning outcomes.

Permission was obtained from DeAngelis to pattern portions of this survey after the instrument used in her research.[1] The pre-survey included items from the DeAngelis instrument regarding career guidance influences, career motivation influences, and perceptions of the profession. Additional items within career guidance and career motivation influences were added. The pre-survey also included items to measure the influence of activities and negative factors. The post-survey included the identical items from the pre-survey used to measure perceptions of the profession and influential negative factors, along with alternate career options considered by the participants. Neither validity nor reliability testing of the questionnaire was conducted.

Results

Participants in this study ranked the influence of individuals on dental hygiene career choice using a 5-point Likert scale of 1 (Low Influence) to 5 (High Influence). Dental hygienists were identified as most influential on dental hygiene career choice, followed by dentists, mothers, and fathers (Table 1). College teachers and advisors were rated as higher influences than high school teachers and counselors.

Participants ranked the influence of various activities on dental hygiene career choice using the same 5-point Likert scale of 1 (Low Influence) to 5 (High Influence). Observing a dental hygienist was the most influential activity on dental hygiene career choice, followed by reading dental hygiene material (Table 2). College career day activities and working in a dental office were rated as the least influential activities.

Participants ranked the influence of various career motivations on dental hygiene career choice using a 5-point Likert scale of 1 (Low Influence) to 5 (High Influence). The most influential career motivations included: 1) helping and/or working with people, 2) good career with family, and 3) availability of jobs (Table 3). Participants indicated that dental hygiene was not considered as a second choice instead of dental school.

Perceptions of the profession were measured in both the pre- and post-course surveys, asking participants to look over a list of characteristics describing dental hygiene and rate their agreement to those characteristics. The agreement levels ranged on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Prior to course completion, participants agreed most strongly with: 1) contact

Table 1. Mean Influence Levels[a] of People on Participants' Choice of DHYG Career

Person	Mean Level	SD
Dental hygienist	4.28	0.93
Dentist	3.76	1.33
Mother	3.51	1.42
Father	3.09	1.49
Friend	3.02	1.50
Other family member	2.83	1.56
College advisor	2.72	1.48
College teacher	1.93	1.16
High school teacher	1.73	1.08
High school counselor	1.70	1.11

[a]1=Low Influence, 5=High Influence

Table 2. Mean Influence Levels[a] of Activities on Participants' Choice of DHYG Career

Person	Mean Level	SD
Observing dental hygienist	4.14	1.20
Reading dental hygiene material	3.36	1.33
Visiting dental hygiene program	3.25	1.46
High school career day/activities	2.51	1.47
College career day/activities	2.32	1.39
Working in a dental office	2.02	1.51

[a]1=Low Influence, 5=High Influence

with people, 2) career with responsibility, and 3) caring profession (Table 4). After course completion, the top 3 characteristics remained. Wilcoxon-signed ranked tests revealed that perceptions of these characteristics significantly increased for all items except job security (Table 4). Examining the mean differences, the course appeared to have the greatest influence on participants' perceptions of diverse career opportunities and preventive care specialists associated with dental hygiene.

Participants were also asked to identify the influence level of negative factors regarding a dental hygiene career choice in both pre- and post-course surveys. Prior to completing the introductory career course, participants indicated that the stress of prerequisite science and dental hygiene coursework, along with limited benefits depending on employer, were the most influential negative factors. After course completion, the top 3 negative factors remained the highest influencers. Wilcoxon-signed ranked tests revealed that perceptions of these negative factors significantly increased for all items (Table 5). Examining mean differences, the course appeared to have the greatest influence on participants' perceptions of time constraints, production requirements, state licensing issues, positions available, and emotional stress.

Participants were asked to indicate which of the following professions they were currently considering, previously considered, or never considered (Table 6). The percentages of participants currently considering careers were dentist (22.1%), dental assistant (17.7%), educator (16.3%), and nurse (16.2%). The percentages of participants previously considering other careers were nurse (53.8%), educator (47.7%), dental assistant (45.3%), and pharmacist (39.3%). Alternate careers least considered by participants were lawyer or engineer.

Discussion

Influential People

Previous research has found that dental professionals have high influence for those considering a dental hygiene career.[1,4-6] While Foley found that more dental hygiene students were influenced by a dentist than a dental hygienist, this research supports the findings of DeAngelis and Carr that dental hygienists are the most influential persons.[1] This study found dental hygienists to be ranked even more influential (4.28) than in DeAngelis' study, where dental hygienists' mean influence level was ranked 3.58. A greater difference between the influence of the dental hygienist and dentist was also found in this study. Clearly, the dental community has a strong influence on motivating individuals to consider dental careers. Both dental hygienists and dentists could encourage career development by inviting young adults aged 16-20 to job shadow at their place of employment to expose them to the oral health care professions.

Family was found to have the next highest influence, similar to the findings of DeAngelis.[1] However, participants in this study ranked the influence of mothers, fathers, and other family members separately. Of all family members, mothers were found to have the highest influence (3.51). This study did not investigate why mothers were found to be more influential than other family members. DeAngelis found the mean influence of family members in dentistry was 1.6, while family members or friends not in dentistry were 2.79. Accurate knowledge about the

dental hygiene profession is needed for family members to have a positive influence in selecting a career in dental hygiene. The public, including many high school students, is unaware of the dental hygiene profession and job responsibilities. Gaulden examined the career awareness of 109 high school seniors who approached a dental hygiene display table during a career day event.[15] A lack of knowledge about the profession of dental hygiene was identified, with 53% unaware of the difference among a dental hygienist, dental assistant, or dental lab technician. Functions of a licensed dental hygienist were also misunderstood, with many unaware of the different roles dental hygienists can pursue, such as corporate, primary school educator, and post secondary educator opportunities. Recognizing this lack of public awareness, the American Dental Hygienists' Association has launched a national marketing campaign designed to increase awareness of the profession and oral health, including educational televised programming in 25 top broadcast markets.[16] Efforts to educate the public, and thus family members, about the dental hygiene profession should be continued.

Previous research has found the least influential people on dental hygiene career choice are high school and college counselors.[1,4,6] In this study, college advisors (2.72) had more influence than college teachers (1.93), high school teachers (1.73), or high school counselors (1.70). Career counseling services provided in high school or higher education settings are constantly plagued by limited funding. While computer technology has expanded the opportunity to provide indirect assessment of career interests and goals, benefits from technology are limited by lack of credibility and cost of online assessments. Additionally, the number of occupations within America continues to grow and change as research and technology advance. Lack of recognition and inclusion of occupations by career counselors or within assessment instruments limit the ability of students to consider all career options.

Table 3. Mean Influence Levels[a] of Factors on Participants' Choice of DHYG Career

Factor	Mean Level	SD
Helping/working with people	4.65	0.65
Good career with family	4.49	0.90
Availability of jobs	4.43	0.88
Flexibility of work schedule	4.33	0.97
Good salary	4.22	0.84
Own experiences as dental patient	4.19	1.01
Wanted medical career, but not Medicine or Nursing	3.97	1.25
Make independent decisions	3.88	1.09
Working with my hands	3.83	1.13
Prestige	3.71	1.10
Wanted dental career, but not interested in DDS	3.18	1.41
Wanted dental school, DHYG was second choice	1.80	1.12

[a]1=Low Influence, 5=High Influence

Influential Activities

Participants in this study ranked observing a dental hygienist (4.14) as the most influential activity, similar to the findings of Carr.[5] Lower influential activities from previous research and participants in this study were high school and college career days or activities. Working in a dental office did not have a high mean score, but this is likely influenced by the low number of participants who have had this opportunity. This finding again supports the concept of inviting interested students to job shadow dental professionals.

Influence of Characteristics Associated with Dental Hygiene

Working with people and a flexible schedule are 2 characteristics previously identified as positive aspects of dental hygiene.[1,5] Participants in this study reported similar influential characteristics to those found in DeAngelis[1]: working with people (4.65), good career with family (4.49), availability of jobs (4.43), flexible schedule (4.33), and good salaries (4.22).

Motivations for attending college are closely related to career choice, with 72% of participants reporting they decided to attend college to be able to get a better job.[17] Increased earning is also a motivational factor, with 73.5% of men and 69% of women reporting they are attending college to make more money.[17] Research from this study suggests that while good salaries do influence dental hygiene career choice, characteristics like working with people, good career with family, and availability of jobs are more influential.

Perceptions of the Profession

Prior to course completion, participants rated contact with people and a caring profession as the highest characteristics associated with dental hygiene, similar to the findings of DeAngelis.[1] Those characteristics remained highly associated with dental hygiene after course comple-

tion; however, the course appeared to significantly increase association levels for all characteristics except job security. The introductory career course seemed to have the greatest impact on participants' perceptions of a dental hygienist as a preventive care specialist and having diverse career opportunities. This finding suggests that an introductory career course can influence participants to consider non-traditional career opportunities for dental hygienists beyond private practice.

In addition to these positive characteristics, the researchers in this study examined the influence of negative factors on dental hygiene career choice. Both before and after course completion, the most influential negative factors were the stress of prerequisite coursework, stress of dental hygiene coursework, and limited benefits depending on the employer. The introductory career course appeared to significantly increase the influence of all negative factors on career choice, with greatest weight on time constraints, production requirements, state licensing issues, positions available, and emotional stress. This finding suggests that the introductory course did increase student awareness of potential drawbacks related to dental hygiene. Awareness of these drawbacks prior to application may help increase satisfaction and retention within the program and profession.

Alternate Career Options

Researchers in this study examined the alternate career options previously or presently considered by participants enrolled in the introductory dental hygiene career course. Other dental careers, such as dentistry or dental assisting, were often considered by participants. However, outside career options such as nursing, education, and pharmacy were other alternatives either previously or presently considered. As dental hygiene programs attempt to attract highly qualified students to their programs, it may be beneficial to target recruitment to students interested in these alternate careers.

Mentoring has been shown to have positive effects in other health care disciplines.[19-20] Studies regarding nursing students report mentoring is a beneficial aspect of clinical learning experiences.[19-20] Other studies suggest mentoring should be initiated in dental hygiene graduate programs, especially for students who aspire to become directors, due

Table 4. Mean Agreement Levels of Characteristics Associated with Dental Hygiene

	Pre-Course[a]	Post-Course[a]	$\bar{x}$ Diff
Contact with People	4.56	4.78***	0.22
Caring Profession	4.49	4.76***	0.27
Career with Responsibility	4.50	4.73***	0.23
Good Salaries	4.41	4.60**	0.19
Flexible Working Schedules	4.45	4.57*	0.12
Preventive Care Specialist	4.06	4.57***	0.51
Professional Status	4.18	4.54***	0.36
Job Security: Bright Future	4.43	4.50	0.07
Intellectual Challenge	4.14	4.43***	0.29
Science-based Profession	4.05	4.19*	0.14
Diverse Career Opportunities	3.51	4.06***	0.55

[a]1=Strongly Disagree, 5=Strongly Agree.
*p<.05. **p<.01. ***p<.001.

Table 5. Mean Influence Levels of Negative Factors on Career Choice

	Pre-Course[a]	Post-Course[a]	$\bar{x}$ Diff
Stress of Prerequisite Science Coursework	3.22	3.43*	0.21
Stress of Dental Hygiene Coursework	2.70	3.37***	0.67
Limited Benefits Depending on Employer	2.39	3.04***	0.65
Inadequate Full Time Positions Available	2.21	2.95***	0.74
Dental Hygiene State Licensing Issues	2.15	2.92***	0.77
Time Constraints, Working on the Clock	2.01	2.79***	0.78
Non-compliant Patients	2.06	2.72***	0.66
Risk of Musculoskeletal Distress	2.03	2.72***	0.69
Risk of Carpal Tunnel Syndrome	2.05	2.70***	0.65
Production Requirements of Job	1.89	2.67***	0.78
Limited Career Diversification	2.10	2.66***	0.56
High Tuition (with additional fees)	2.15	2.63***	0.48
High Emotional Stress with Profession	1.88	2.60***	0.72
Stress of Prerequisite Non-science Coursework	2.12	2.35*	0.23
Risk of Contracting Infectious Disease	1.64	1.92**	0.28

[a]1=Low Influence, 5=High Influence. *p<.05. **p<.01. ***p<.001.

to the positive influence it has on the student.[21] Additionally, dental hygienists can help educate the public about dental hygiene by informing others about their education and responsibilities as compared to dental assistants and dentists. While salary does influence dental hygiene career choice, other factors such as working with people, good career with a family, and availability of jobs appear to be more influential.

Limitations

This study has several limitations that preclude generalization to other populations. The assessment instrument used to measure career influences and perceptions of pre - dental hygiene students was not validated. The participant number (N=186) represents a moderately small convenience sample. All participants were pre - dental hygiene students at a Midwestern university from the same geographic area.

Future Research

Further study is needed to confirm these findings with other pre - dental hygiene students in other states. Future endeavors might include longitudinal research to examine the influence of a prerequisite course on entry into a dental hygiene program, retention in a program, and retention in a dental hygiene career. The Career Beliefs Inventory could be used in future studies to investigate beliefs and assumptions that may prevent individuals from pursuing dental hygiene. Differences in influential factors of career choice according to career setting, such as a clinical setting, public health, education, etc., could also be investigated. However, this study contributes to the dental hygiene literature by documenting the career influences and perceptions of pre-dental hygiene students at a Midwestern university.

Table 6. Alternate Career Options of Post-course Participants[a]

	Currently Considering	Previously Considered	Never Considered
Nurse	28 (16.2%)	93 (53.8%)	52 (30.1%)
Educator	28 (16.3%)	82 (47.7%)	62 (36.0%)
Dental Assistant	32 (17.7%)	81 (47.1%)	59 (32.6%)
Dentist	38 (22.1%)	78 (45.3%)	56 (32.6%)
Pharmacist	6 (3.5%)	68 (39.3%)	99 (57.2%)
Medical Doctor	6 (3.5%)	63 (34.8%)	103 (56.9%)
Business	13 (7.5%)	62 (35.8%)	98 (56.6%)
Veterinarian	2 (1.2%)	57 (33.2%)	113 (65.7%)
Optometrist	4 (2.3%)	47 (27.2%)	122 (70.5%)
Lawyer	1 (0.6%)	30 (17.4%)	141 (82.0%)
Engineer	-	8 (4.7%)	164 (95.3%)

[a]Valid percentages reported

Conclusion

Dental hygienists play a key role in influencing career choice for students interested in dental hygiene. Inviting conversation and opportunity to job shadow the profession with potential candidates may help promote the dental hygiene career. Mentoring is a complex and important activity in the learning process of a student. A good mentor could be described as someone who possesses appropriate professional attributes, knowledge, good communication skills, and the motivation to teach and support students.[18] An introductory course for students interested in dental hygiene has the ability to increase awareness of non-traditional career opportunities while also recognizing the potential drawbacks of the profession. The combination of good mentoring from dental professionals with an introductory course about dental hygiene may help students determine good career fit, which may lead to increased satisfaction with career choice.[11-14]

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Research

The Influence of Patient Education by the Dental Hygienist:

Acceptance of the Fluorescence Oral Cancer Exam

Marie Paulis, RDH, BS

Abstract

Purpose: Oral cancer frequently goes undetected in its early and most curable stages because no clinical signs or symptoms usually exist. This study assessed the effect patient education had on the patient's decision to accept or refuse a fluorescence oral cancer examination.

Methods: Along with providing a routine clinical and white light oral cancer exam, a Visually Enhanced Lesion Scope (VELscope®) was used to evaluate the patient's oral cavity. After gaining written consent, 100 patients at a university dental hygiene clinic were provided a survey that evaluated their risk factors, opinions, and knowledge regarding oral cancer. Upon assessing the patient's willingness to receive a free oral fluorescence examination, the survey questioned if being charged a fee for the exam would serve as a deterrent to receiving it. Regardless of acceptance or refusal of the exam, the patient was educated, first by a brochure, and then by discussion with the researcher, about oral cancer.

Results: Overall, 92% of participants agreed to pay a fee for the VELscope® exam. Of those who initially refused the VELscope® exam, 78% agreed to the exam after being educated about oral cancer. Patients were very appreciative of both the education and technology offered to them.

Conclusions: Dental professionals have a responsibility to educate their patients about oral cancer in order to enable them to make informed decisions about their oral and overall health. Additionally, patient education has a significant impact on patient acceptance of the VELscope® exam.

Key Words: VELscope®, patient education, oral cancer, human papilloma virus

Introduction

Most oral cancer is discovered in stages III or IV.[1] It is usually not discovered until it has reached a secondary site, such as the lymph nodes. By this time, there is a mere 50% five-year survival rate.[1] Although the incidence of oral cancer is estimated to be very low (approximately 0.01%),[1] 25% of people with oral cancer have no known risk factors for the disease.[2] This demonstrates the importance of early screening for every patient. If patients were better educated about the risk factors for oral cancer, they may be able to recognize some of the early signs of oral cancer and dysplasia and seek diagnosis and treatment while still in stage I, the most curable of the disease process.[3]

The screening of patients for signs of oral cancer has traditionally relied upon the conventional oral examination. In recent years, there has been increased interest in new technologies for the detection of oral cancer.[4] What is not known is how patients accept these technologies. The purpose of this study was to assess the effect of patient education on the patient's decision to accept or refuse the use of a technology for oral cancer detection, the fluorescence oral cancer examination.

Review of the Literature

Detecting oral cancer in its early stages is crucial to prolonging the lives of patients with this disease. Knowledge about oral cancer is lacking among some dentists and dental hygienists, as is transmission of that knowledge from provider to patient. Both dental professionals and the general public need to be better educated about the risk factors for oral cancer, its signs and symptoms, and the benefits of early oral cancer detection.[1] A review of the literature shows the number of deaths from oral cancer to be higher than many other types of cancers, such as breast cancer, skin melanoma, and ovarian cancer.[5] Due to lack of outward signs in its early stages, oral cancer is most often discovered in its later stages, by which time the 5-year survival rate is only 50% (Table 1). The American Cancer Society estimates that approximately 30,000 people

are diagnosed with oral cancer each year, and approximately 7,000 of those people will die from the disease.[1] Surprisingly, oral cancer is actually more curable than most other cancers, but only with early detection.[6] Therefore, it is critical that oral health care providers become more adept at recognizing it.

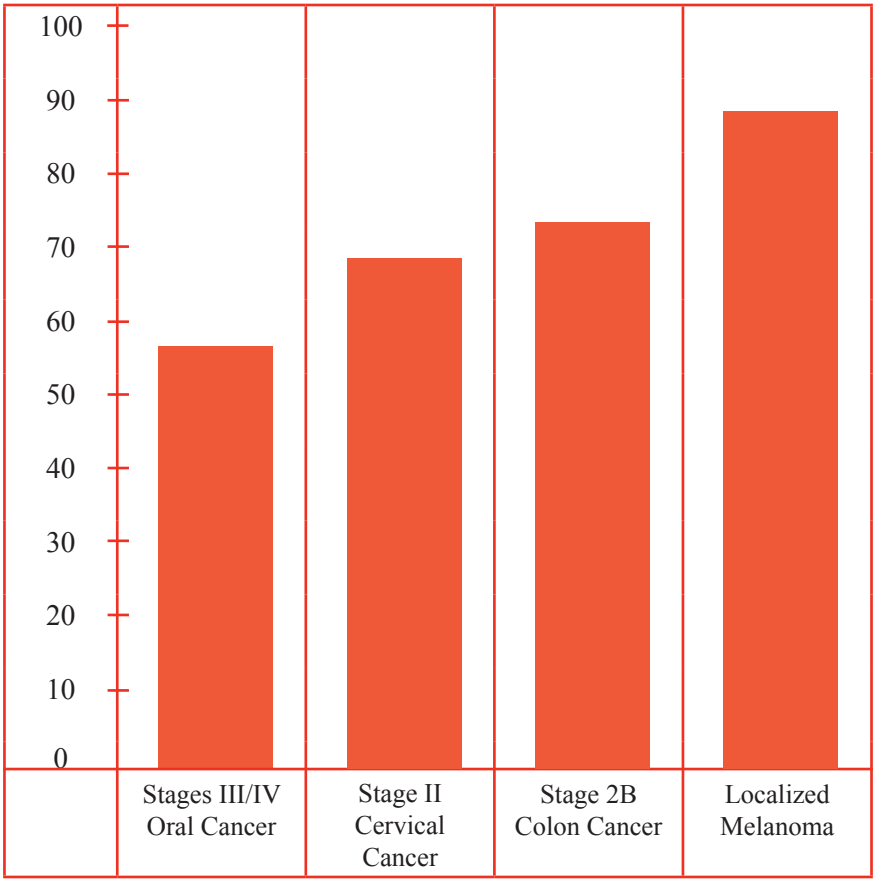
Despite the fact that many medical professionals observe their patients' oral cavities,[7] 60% of oral cancers are in stages III or IV when they are detected.[8] In a national study conducted in 2000, only 66% of dental hygienists reported providing oral cancer screenings for adults over 40 years old at their initial appointment.[9] Eighty-two percent of all physicians and 17% of all dentists surveyed in Illinois in 2005 stated they did not perform routine oral cancer exams on most of their patients.[10]

According to a 2000 survey conducted at the University of Maryland School of Dentistry, lack of knowledge appears to be the reason why many physicians, dentists, and dental hygienists do not perform thorough oral cancer exams. Therefore, dental and dental hygiene programs have a responsibility to properly educate their students about oral cancer.[11]

An important aspect of educating oral health care professionals about oral cancer is teaching them about risk factors for the condition. The known risk factors include: tobacco use, alcohol abuse, the combination of alcohol and tobacco use, sun exposure, age over 40, poor diet, immunosuppression, presence of the human papilloma virus (HPV), male gender, and being of African American descent.[2,12] Even though there are established risk factors for oral cancer, 25% of patients with oral cancer have no known risk factors.[2] However, the lack of exhibiting risk factors should not eliminate suspicion from the observant clinician conducting an oral cancer examination.[10]

Screenings for oral cancer not only detect disease but also serve as a learning experience for patients. In 2005, during an oral cancer screening of over 800 people in New York and New Jersey, it was discovered that most people did not recognize alcohol abuse as being a risk factor for oral cancer, despite it being the second highest risk after smoking.[10] Dental professionals have an ethical responsibility to educate their patients, and patient education should be performed during all phases of dental treatment. This education may include photos, handouts, pamphlets, books, videos, computer programs, and conversations. Patients must be given the necessary knowledge in order to make informed decisions about their own health care.[13]

Table 1. Comparison of Percentage of 5 Year Survival Rates for Various Cancers



VELscope® – a new technology for oral cancer detection

In recent years, new technologies for oral cancer detection have been designed and marketed for oral health care professionals.[4] One of those is the VELscope®, a handheld device that was developed in British Columbia, Canada by the British Columbia Cancer Agency in collaboration with MD Anderson Cancer Center. It received U.S. Food and Drug Administration approval in November 2001. VELscope® uses oral fluorescence technology to detect both precancerous and cancerous lesions in the oral cavity. The fluorescent light makes healthy tissue appear green and potentially cancerous lesions dark magenta or brown/black.[14] This device was designed to detect changes in tissue while the changes are still subepithelial and not yet detectable by a white light oral cancer exam.

Not all positive findings by VELscope® indicate oral cancer, as it is a screening device and does not pro-

vide a definitive diagnosis. Certain areas may appear dark during an examination, such as normal oral anatomy (tonsillar pillars and linea alba) or areas where blood is under the epithelial surface, such as a hematoma. Typically, a dark area that is bilateral and uniformly shaped is not a concern. Therefore, the clinician must be able to distinguish between "normal" or "abnormal" findings under oral fluorescence visualization.[14] The VELscope® assists the clinician in determining if any lesions are present that require further intervention.[5] Suspicious lesions must be biopsied to provide a definitive diagnosis.[9]

Patients who previously had oral cancer are at increased risk of developing it a second time.[15] However, the tissue damage incurred from the first cancer may prevent the secondary cancer from being detected. With the assistance of oral fluorescence technology, the previous tissue damage will not obscure the view of a new tumor or dysplasia. Therefore, this technology is often utilized mid-biopsy, to determine if all of the cancerous area has been removed.[15]

Although the scalpel biopsy is the "gold standard" for the diagnosis of oral cancer[4], VELscope® has been investigated as an appropriate screening tool for the identification of suspicious lesions. Lane et al used the VELscope® to investigate its ability to identify precancerous and cancerous lesions.[16] Results demonstrated a 98% sensitivity and a 100% specificity for VELscope® in identifying dysplasia and cancers from normal oral mucosa. However, all of the lesions were observed using incandescent light alone. Also, the majority of the lesions included in the study appeared to be Class 1 or "suspicious" lesions. Poh et al reported anecdotal observations of 3 lesions that were identified using VELscope® that could not be seen using normal (incandescent) light.[17] However, it should be noted that these cases were not part of a controlled clinical trial with a larger number of subjects. Another study by Poh et al investigated the use of the VELscope® for the detection of surgical tumor margins for oral cancer when used in the operating room.[18] The results found that VELscope® may be useful in oral cancer screening due to its ability to identify lesions that cannot be seen by a conventional oral examination (COE). However, the authors noted that the lesions identified in the study (Class II lesions) were found within the background of Class I lesions so it was not clear if VELscope® is able to identify Class II lesions. Although new technologies for oral cancer screening such as VELscope® may be useful for screening, oral health care practitioners still lack data to support their use over a COE alone.[4] However, their usefulness is promising, and may be helpful in educating patients about oral cancer and follow up with suspicious lesions.

The oral health care practitioner who routinely screens for potentially cancerous lesions using fluorescence has the opportunity to offer patients early education about the risk factors associated with oral cancer and to refer them for appropriate treatment if needed. The research site for the following investigation, the University of Bridgeport Fones School of Dental Hygiene, provides treatment for many patients who may be considered at high risk for this disease. Therefore, this study sought to educate these patients and provide them with the service of a technology-based oral cancer exam, even though it is recognized that a biopsy is the only definitive diagnosis of a suspicious lesion.[4] The specific purpose of the study was to assess the effect of patient education and fees associated with oral cancer screenings on patients' willingness to agree to the use of the VELscope® technology.

Methodology

In October 2007, the first 100 patients over the age of 21 who presented for treatment in the Fones School of Dental Hygiene, University of Bridgeport dental hygiene clinic were provided with a pre-study survey form to evaluate their self reported oral cancer risks and their willingness to receive a VELscope® exam with or without an additional fee. The study was approved by the Institutional Review Board of the University. All subjects who enrolled were provided an informed consent document outlining the benefits and risks of the study. The form included information about the VELscope® technology, a disclaimer stating that they would not be eligible for the use of VELscope® if they were photosensitive (since it emits fluorescent light), and that the patient would need to wear tinted safety glasses during the VELscope® examination. Subjects were informed that all information would be confidential. The principal investigator also requested permission from subjects to receive follow-up information concerning the results of any referrals.

The research was conducted by the principal investigator (PI) and the research assistant (RA), both registered dental hygienists. Recruited subjects were 100 new and recall patients. Inclusion criteria was that the subjects were over 21 years of age and had one identified risk factor for oral cancer as determined by the pre-study survey. Along with questions about the subject's age and ethnicity, the survey asked about smoking history and alcohol intake. Oral cancer risk factors were dependent upon participants' self report.

Subjects were also asked if they would agree to a non-invasive oral cancer exam whether it were free or if they were charged a fee of $20. Finally, the survey posed questions about the patient's knowledge level of oral cancer. If the subject agreed to have the VELscope® examination, either with or without a fee charged, the subject was invited to enroll in the study.

All subjects obtained education about oral cancer via a list of oral

cancer facts and a brochure about oral cancer obtained from the American Cancer Society. To evaluate the value of education on a subject's decision to have a VELscope® examination, all patients who originally agreed to have the VELscope® exam for no charge, but did not agree to an exam if a fee were attached, were studied to see if the role of education made them change their mind. If, after the examination, the patient still refused an examination for a fee, the PI asked the patient for the reason for the refusal. Potential reasons could be the added fee, fear of the examination, time restraints or other reasons. Regardless of the response, all patients who wanted the VELscope® examination received it for no fee. If the patient refused the examination under any circumstances, the VELscope® examination was not done and the patient received the regular dental hygiene treatment and conventional oral examination (COE).

The PI and RA conducted all VELscope® exams. Training occurred by reading an instruction manual, discussion with VELscope® company representatives, and viewing an informative step-by-step DVD supplied with the VELscope®. The PI first conducted a visual oral cancer examination using a mirror, dental light, palpation, and gauze to assist in tongue retraction. A VELscope® examination followed, and the PI discussed the risk factors, signs, and symptoms of oral cancer with the patient. The dentist on staff evaluated examination findings and confirmed the need for any referral. At the conclusion of the examination, positive and negative findings were discussed with the patient and, when necessary, the patient was referred to an oral surgeon. The PI or RA documented all findings in the patient's chart and on the VELscope® examination form. In addition, all potential positive findings were photographed. Two photos were taken, one showing the clinical view under white light and one demonstrating the view through the VELscope®. Participants with potential positive findings were referred to an oral surgeon, dentist, or medical doctor.

After the examinations were complete the data was analyzed. Frequencies and percentages were calculated for each response. The most relevant statistics were those representing the difference in the patient's agreeing to a VELscope® exam prior to and after being educated about oral cancer. In order to compare these results, the number of patients who refused an exam prior to education was translated into a percentage and compared to the percentage of participants who refused an exam post-education.

Results

Of the 100 participants who completed the survey, 97 consented to a VELscope® exam. The remaining 3 did not have the exam because 1 was photosensitive and 2 refused for an unknown reason, speculated to be a language barrier.

Table 2 displays the survey including study demographics. Most subjects were between 40-59 years of age, Caucasian and male. Thirty seven percent were current smokers while 35% previously smoked. Out of the patients who currently smoke, 59% (n=22) were very interested in quitting, 27% (n=10) were slightly interested, and 14% (n=5) were not interested. A smoking cessation program was initiated for any patients who wanted to participate. Of the 37 participants who currently smoke, 59% (n=22) smoke while consuming alcoholic beverages.

The incidence of a positive history of cancer among the participants was 8% (n=8), with 1 participant having had throat cancer, 2 breast cancer, 1 prostate cancer, 1 colon cancer, and 2 not disclosing the type of cancer. Among the 100 research participants, 6 had an immediate family member who was diagnosed with oral cancer.

Upon being offered a free oral fluorescence exam, 93% (N=93) of respondents accepted, while 7% (N=7) declined. However, upon learning there might be a $20 fee for the fluorescence exam, only 63% (n=63) accepted it and 37% (n=37) refused the exam (Table 3). Out of the 37 participants who declined the exam, the majority refused due to cost (73%, n=27), followed by fear (14%, n=5), other (8%, n=3), photosensitivity (3%, n=1), and lack of time (3%, n=1). Of those who refused the exam if there were a fee, 47% (n=17) were female and 53% (n=20) were male.

Of the participants who initially refused the exam, 78% (n=29) agreed to the exam after being educated about oral cancer. In describing their own opinion of their oral cancer knowledge prior to being educated by the researcher, 52% (n=52) considered themselves not at all knowledgeable, 43% (n=43) somewhat knowledgeable, and 5% (n=5) very knowledgeable.

After completing 97 VELscope® and white light oral cancer exams, 8% (n=8) of respondents were referred for further examination by an oral surgeon, dentist or medical doctor. One subject was followed for 2 weeks and with no changes, was referred to an oral surgeon. The surgeon decided to re-evaluate in 6 months since it did not appear to be serious. Four subjects were referred due to white findings on the tongue, all found to be innocent by VELscope® and the oral surgeon. A female patient was referred to the oral surgeon for an evaluation of a 7 mm pink, pedunculated, irregularly shaped pink lesion on the right side of the soft palate, which appeared suspicious through VELscope®. The biopsy indicated normal mucosal tissue, although the tissue sample contained HPV. Again, the patient will have a 6-month follow-up with the oral surgeon. The oral surgeon suspected the area might have been precancerous, although no dysplasia was noted by the biopsy. No photos

Table 2. Oral disease risk assessment

1) Age	# of patients	2) Gender	# of patients	3) Ethnicity	# of patients
21-29 years	25	Male	62	African American	7
30-39 years	8	Female	38	Asian	9
40-59 years	41			Caucasian	61
Over 60	26			Hispanic	14
				Native American	2
				Other	7
4) Do you smoke cigarettes?	# of patients	5) Do you chew tobacco?	# of patients	6) If "yes" to #4 or #5, how interested are you in quitting?	# of patients
Yes	37	Yes	2	Not at all	5
No	63	No	98	Slightly	10
If yes, how many per day?	Avg. – 10	If yes, how many containers per day?	Avg. – ½ pack	Very	22
For how many years?	Avg. – 30 years	For how many years?	Avg. – 6 years		
7) Did you use tobacco in the past and quit?	# of patients	8) Besides you, do any other members of your household smoke?	# of patients	9) How many alcoholic beverages do you drink per week?	# of patients
Yes	65	Yes	52	0 to 1	62
No	35	No	48	2-7	32
				8-14	4
				Over 15	2
10) Do you smoke while drinking alcoholic beverages?	# of patients	11) Have you been diagnosed with cancer?	# of patients	12) Have any of your family members been diagnosed with oral cancer?	# of patients
Yes	22	Yes	8	Yes	5
No	78	No	92	No	95
13) Would you agree to having a free, non-invasive oral cancer exam that takes less than 5 minutes?	# of patients	14) If you answered yes to #13, would you agree to the exam if there were a fee of $20	# of patients	15) Are you knowledgeable about oral cancer?	# of patients
Yes	73	Yes	49	Not at all	52
No	7	No	31	Somewhat	43
				Very	5

Prepared By: Marie Paulis, RDH, BS October 2007

were taken of this participant. The remaining 2 subjects who were referred did not have malignancies.

Discussion

The purpose of the study was to determine if educating a patient about oral cancer had an impact on accepting and paying for an oral fluorescence cancer exam. It was found that 63% of participants accepted the fee prior to being educated. However, out of those who refused the exam, patient education about oral cancer did improve patient acceptance of the exam by 78%. In order to educate patients about oral cancer, it is imperative that oral health care professionals first be educated about the risk factors and clinical manifestations of the disease. In a study conducted in 2003, 85% of medical doctors and 63% of dentists cited receiving insufficient training to correctly identify oral pathologic conditions.[5] Similarly, in a survey conducted in Texas in 2006, only 15% of dentists and dental hygienists reported educating new patients about risk factors and symptoms for oral cancer.[6] Dental professionals have a legal and ethical responsibility to educate their patients to enable

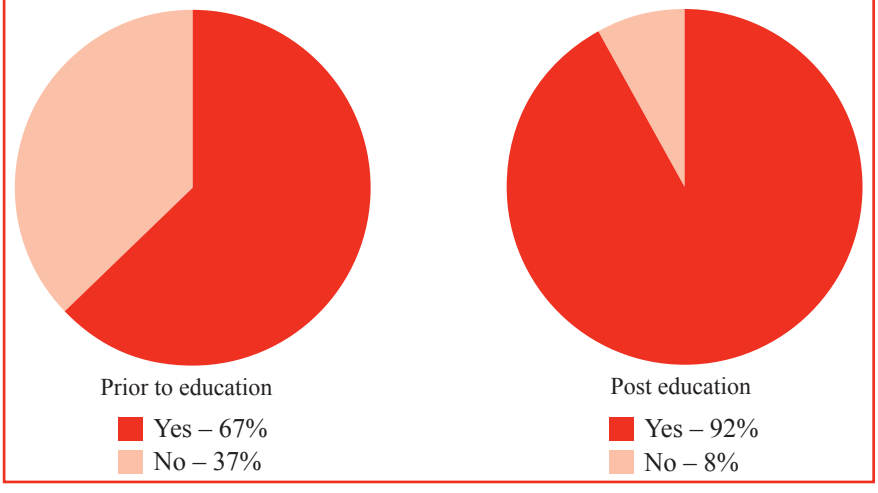
them to make informed decisions about their own care. All participants of the study accepted the oral cancer informational brochure presented to them, regardless of whether they accepted the fluorescence examination.

Although risk factors such as smoking and high alcohol consumption contribute to the incidence of oral cancer, 25% of those diagnosed have no known risk factors.[1] In the current study population, 37% were current smokers and 35% were previous smokers. Of those who currently smoke, 59% drink alcohol while smoking. The combination of smoking and drinking increases oral cancer risk by 15%.[19] New research indicates that HPV, in particular HPV-16, may be linked to oral cancer.[16] A study completed in 2003 found that 18% of females between 14 and 19 years of age were infected with HPV.[17] Therefore, incidences of oral cancer are expected to rise, making early detection an increasingly important goal.[19]

The results of the study have direct implications on dental hygiene practice, as the dental hygienist is one of two practitioners in most dental offices who can provide an oral examination. Every dental hygienist should be informed about risk factors for oral cancer and this information should be relayed to their patients. All patients should receive a conventional oral examination in the dental office. The dental hygienist should also stay informed about new technologies for oral cancer screening such as the VELscope® and use those that have clear evidence to support their use.

Several studies support the use of VELscope® as a screening tool for oral cancer.[16-18] Even though large clinical trials have yet to be reported, these technologies that have benefit might be considered for use in practice. While our study did not find malignancies with the VELscope®, several subjects were identified as having suspicious lesions and were readily referred for more extensive evaluation. This situation is common in private dental practice and the technology may assist practitioners in determining which suspicious sites need to be re-evaluated or referred at a later appointment.

Table 3. Education's Influence on Patient's Acceptance of Fee for Oral Fluorescence Cancer Exam



Since patient education was the only variable introduced between the refusal of the VELscope® exam and acceptance, it is likely that patient education was the main determining factor in changing the patient's decision. However, it is also possible that the patient felt more comfortable with the physical surroundings, the student dental hygienist, and the researchers after spending time in the clinic. This may have had an impact on the patient's choice to have or not have the exam. This same or even greater comfort level would be achieved in the dental practice.

The initial cost of VELscope® is approximately $5,000, and the maker, LED Dental, recommends charging the patient approximately what is charged for 4 bitewing radiographs. The American Dental Association approved the CDT code, D0431: "Adjunctive prediagnostic test that aids in the detection of mucosal abnormalities including pre-malignant and malignant lesions not to include cytology or biopsy procedures," which applies to VELscope®. Although not all insurance companies are currently reimbursing for such procedures, it is recommended that the claims be submitted to the insurance company for review so the companies can access the increase in use and the need for coverage of these screenings. As of October 2008, at least one major dental insurance company has announced its decision to reimburse its members for the cost of a VELscope® examination.[20]

Limitations

Participants in this study were limited to the first 100 willing participants, with one risk factor for oral cancer, over 21 years of age, who presented for dental prophylaxis at the Fones School of Dental Hygiene. Those under the age of 21 were not included as oral cancer incidence is very low in this population[1] and testing participants of that age would have necessitated the need for parental consult. Participants with photosensitivity were not eligible for a VELscope® examination, as the fluorescent light may have posed a health risk.[5] Also, this study did not compare the incidence of oral cancer found by traditional white light examination with that found by oral fluorescence technology. Finally, since alcohol abuse and tobacco use are not widely accepted practices,

patients may have not disclosed their use upon self report.

Conclusion

The study results demonstrate that patient education by the dental professional is a relevant factor in the patient's acceptance of a VELscope® oral cancer examination. In addition, the use of the VELscope® was well accepted by the study subjects. Dental hygienists have an obligation to provide comprehensive care to their patients and, in the case of oral cancer detection, this care may be life saving. VELscope® is a new technology that may provide the dental professional with a more exact means to detect oral cancer in its earliest stages when it is most curable.

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At the time of this writing, Marie Felker-Paulis, RDH, BS was in the Bachelor's Degree online completion program at the Fones School of Dental Hygiene at the University of Bridgeport. Currently, she is pursuing her MS Degree in Dental Hygiene Education at the University of Bridgeport, where she is employed as a second year dental hygiene clinical instructor. She is also Trustee for the Bridgeport Component of CDHA and served as a CT Delegate to ADHA in Washington D.C.

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Research

Toothpaste Use By Children, Oral Hygiene, and Nutritional Education:

An assessment of parental performance

R. Constance Wiener, DMD; Richard J. Crout, DMD, PhD; and Michael A. Wiener, DMD

Abstract

Purpose: The aim of this study was to determine oral health habits and educational needs of children as reported by their parents or guardians attending a health fair in West Virginia.

Methods: Parents and/or guardians completed a questionnaire about the oral hygiene care, food and beverage consumption of their children. They also demonstrated the amount of toothpaste applied to their children's toothbrush. Toothpaste samples were then weighed.

Results: Eighty-seven parents or guardians participated. An average of 0.53 mg of toothpaste was dispensed per brushing, almost double the recommended amount. Most of the parents or guardians (75%) indicated their children had brushed twice the day prior to completing the questionnaire. Only 21% reported that their children's teeth had been flossed. Most children had a limited soda, sweet drinks, and fruit juice intake.

Conclusions: Participants were apparently knowledgeable about prevention, the need to limit sugary beverages, and the importance of brushing twice a day. They were not as knowledgeable about the need for flossing, providing fruits and vegetables to their children, the significance of not skipping a meal, or the appropriate amount of toothpaste use.

Key Words: toothpaste, parents, nutrition, children, oral health

Introduction

The Dental Health Education and Community Dentistry Program at West Virginia University involves first-year dental hygiene and dental students in the provision of dental education to West Virginians. Students present tailored, targeted oral hygiene programs to meet various needs throughout the state. A significant amount of education is directed to reaching parents and guardians of young children to help in the effort against early childhood caries and caries in newly erupted permanent teeth. Public service announcements discuss oral hygiene, particularly in February during Children's Oral Health Month. Companies that sell toothpaste and toothbrushes ask people in their advertisements to brush twice a day and floss daily. Despite educational efforts, the bulletin *Trends in Oral Health Status: United States 1999-2004* reported the national caries rate in children age 2-5 is 28%, and the prevalence of decay in permanent teeth in children age 6-11 is 21%.[1] The most recent oral evaluation survey of West Virginia children was in 1998. The results showed 47% of children age 8-18 had caries in their permanent teeth.[2]

Poor oral health in children has many serious sequelae. Children with untreated caries may have difficulty chewing and may not take sufficient nutrients to grow and develop to their potential. Without proper nutrition, and with the presence of oral pain, children may show difficulty with concentration and learning. Appearance may be affected by the discoloration of carious teeth, and permanent teeth may be poorly positioned as a result of early tooth loss from decay. In addition, low self-esteem can also result from caries and tooth loss. Ultimately, untreated advanced caries can result in massive infections that could lead to death. The tragic death of 12-year-old Deamonte Driver in 2007 brought national attention to the seriousness of untreated dental caries.[3]

The domino effect of comorbidities may be interrupted with proper oral health habits and behaviors. An effective home oral hygiene program, as well as nutritional guidance, may prevent caries infection in certain situations.[4] The American Academy of Pediatric Dentistry recommends that an infant have a dental home with a dental professional and a thorough oral evaluation by 1 year of age to help in the provision of effective home care.[5] Dental hygienists and dentists would like to have the opportunity to provide instruction to parents or caregivers when the child is approximately 6 months old, approximately when the first

tooth erupts. At that time, the parents are excited and receptive to keeping the child caries-free. Ideally, caries risk assessment, nutritional guidance, oral hygiene instructions, and initial evaluation could occur, and any child who is identified as having a high caries risk could receive the needed attention to limit the child's caries burden.

Additionally, it is likely the child is caries-free between 6 months to a year old. If this is the case, dental hygienists and dentists would have the opportunity to interact with the child in a warm, welcoming, nonthreatening environment, alleviating some of the fear and negativity often surrounding dental care. The dental hygienist or dentist could provide education to the parents or guardians about brushing and flossing the child's teeth, the types and amount of toothpaste to use, the effects of sugar exposure, and other oral hygiene aids that are available. Many parents are unaware of the sugars and acid in beverages, especially fruit juices. Consequently, their child may drink sodas and sugary drinks as substitutes for milk and water. Additionally, if children are sipping the drinks over a long period of time, the constant exposure can keep the pH of the teeth's biofilm in the demineralization range and place the child at risk for caries. Early educational efforts could address these issues.

Fluoride use should also be discussed. It is important that the dental hygienist and dentist know the amount of fluoride exposure their pediatric patients have. Hydroxyapatite [Ca10(PO4)6(OH)2] is the primary component of the enamel. During amelogenesis, ingested low levels of fluoride (from food, water, or supplements) can replace the hydroxyl group in some of the hydroxyapatite crystals. The resultant enamel has sites of fluorapatite [Ca10(PO4)6F2], or fluoridated hydroxyapatite, which makes the child's enamel more resistant to dietary acids.[6] Additionally, enamel in erupting teeth is permeable to the minerals in saliva. Garcia-Godoy reports that enamel will mature with more acid-resistant surface hydroxyapatite and fluoridated hydroxyapatite in a salivary environment with available fluoride.[7] Topical applications of fluoride (from toothpastes, varnishes, rinses, gels, and other sources) are expected to protect the outer surface of enamel from acidic challenges in fully erupted teeth.[6]

As a child consumes foods high in dietary sucrose or acid, and the plaque pH drops to a critical value (approximately 5.5), the equilibrium of demineralization/remineralization is shifted toward demineralization of teeth.[6] Some studies support the role of fluoride in remineralization and caries reduction while some show no correlation between fluoride uptake and caries reduction.[6] Garcia-Godoy indicates that when fluoride is present in concentrations between 0.03 and 0.08 parts per million in a tooth's biofilm, the fluoride increases the reformation of hydroxyapatite and fluoridated hydroxyapatite.[7]

Too much fluoride is a concern as well. Skeletal fluorosis, dental fluorosis, endocrine changes, neurological effects, and even death may occur with chronic overdose or acute poisoning. The acute toxic level was reported by Beltran-Aguilar et al as 1 mg F/kg body weight.[8] Whitford reported a probable toxic dose of 5 mg F/kg body weight, suggesting a 1-year-old child of average weight has a probable toxic fluoride level of 50 mg, which could be met by swallowing 3.2 ounces of a typical fluoride toothpaste or 215 ml of a typical over-the-counter fluoride rinse.[9]

Moderate-to-severe dental fluorosis is characterized by mottled, porous, pitted areas in enamel that may flake off. The mottled areas may begin as opaque spots that may stain to shades of yellow and brown.[10] It is important to know a child's fluoride exposure before considering supplementing fluoride. The Environmental Protection Agency's Integrated Risk Information System database suggests that moderate-to-severe fluorosis may occur with exposure above 0.06 mg/kg/day (0.96 mg for a child weighing 35 pounds), although the 1997 Institute of Medicine places the level at 0.10 mg/kg/day (1.6 mg for a child weighing 35 pounds).[10] De Almeida reported that fluoride intake of 0.05-0.07 mg/kg body weight/day is optimal, but fluorosis could result from levels of 0.04 mg/kg body weight/day in some children.[11] Most children in de Almeida's study were exposed to a daily fluoride intake above the threshold for fluorosis, with toothpaste being responsible for 81% of the daily fluoride intake.[11] Although fluorosis is a health and aesthetic concern for dental hygienists and dentists, parents in a study conducted by O'Mullane, who had children with a Thylstrup and Fejerskov Index Grade 3 fluorosis, only expressed concern about the appearance of their children's teeth when the investigators drew their attention to the mottling.[12]

The proper amount of toothpaste use is consequential to the overall fluoride exposure of a child, and parents or guardians should have an understanding of the overall fluoride exposures their children have. Dental evaluations conducted when the child's first tooth erupts provide the opportunity to discuss all aspects of preventive care, including the appropriate amount of toothpaste to use, which has been described as a "pea-sized" amount or "smear" of toothpaste weighing 0.25g.[13]

Limiting the amount of toothpaste is important when a child is too young to expectorate, and instead swallows the toothpaste, especially if the toothpaste is fluoridated. Children 15-24 months old may be at risk of fluorosis of the maxillary central incisors if fluoride exposure is above the optimum, which in one study was as low as 0.04 mg/kg/day.[11] Flavorings added to toothpastes may encourage swallowing of the toothpaste.[12] Van Loveren reports

that studies show only 5% of children under age 2.5 years and 32% of children ages 2.5-4 years old rinsed after brushing (27% rinsed and swallowed all or almost all of the rinse). Parents need to know the possibility of additional fluoride exposure if young children are using and swallowing fluoride toothpaste.[14]

Effective oral hygiene education programs should not only address toothpaste use, brushing, flossing, and nutrition, but also early preventive care, which many children do not receive. Children from households of lower socioeconomic status are reported to have more oral health problems, some of which are related to accessing care, than children from households of higher socioeconomic status.[6] Approximately 66% of children nationally receive 1 yearly preventive dental visit - the very young often do not receive any dental care.[11] There are many factors for children not receiving dental care: lack of interest by the parent or guardian, distance to a dental office, lack of transportation, and inability to pay for care. Without the opportunity to receive instructions, some parents may not learn of ways to improve their child's oral health and well-being. Outreach educational programs are initiated to help bridge the gap, provide convenient locations for educational opportunities, and encourage follow-up dental visits. These programs are becoming increasingly important to meet people's needs with quality information about preventive care.

Methodology

A convenience sample of West Virginia parents and/or guardians of children under the age of 15 were recruited for the study. The participants, who were attending a health fair, enlisted to help researchers determine amount and type of toothpaste, the oral hygiene protocols in place, and beverage consumption of their children. The need for additional oral hygiene and nutritional education was also determined. Participants completed a survey which included questions about frequency of brushing, flossing, and type of toothpaste. A short description of the beverages and food consumed the day before the study was also provided by parents or guardians. They were also asked to demonstrate the amount of toothpaste typically applied to their child's toothbrush. Gum® youth toothbrushes were weighed upon a Denver Instrument MXX-612 balance. The parent or guardian applied toothpaste (Crest, Regular Paste®) to the brush, and a total weight was obtained.

Results

There were 87 participants: parents and/or guardians of 43 girls and 44 boys. The average age of the children was 5.4 years.

The mean amount of toothpaste used by participants in this study measured 0.53±0.07g with a range of 0.11g to 1.41g. This is approximately twice the recommended amount of 0.25g. The parents or guardians of 0- to 3-year-old children used a mean of 0.44±0.14g. According to parents or guardians, 75% (65) of children were brushed 2 or more times a day. Seventy-five percent (65) used fluoride toothpaste. Of the children under 3 years, 8% (2) of their parents did not know if the toothpaste had fluoride; 41% (9) used nonfluoridated and 51% (11) used fluoride toothpaste. Overall, 21% (18) of parents or guardians reported their children's teeth were flossed daily.

Median and range of beverage consumption for the previous day are presented (Table 1). Foods and beverages consumed by children at the most recent meal or snack are summarized in Table 2.

Table 1. Children's Median and Range of Beverage Consumption for the Previous Day

Variable	Median (in cups)	Range (in cups)
Soda	0	0-4
Sweet Drinks	0	0-4
Fruit Juice	0	0-10
Milk	2	0-10
Coffee	0	0-1
Tea	0	0-3

Discussion

The average parent or guardian brushed their children's teeth twice daily, but did not floss daily. Flossing should remain a major topic in oral hygiene education presentations.

Seventy-five percent of children used fluoride toothpaste, while 51% of children less than 3 years old used fluoride toothpaste. Parents were using more than the recommended amount of toothpaste, especially with children in the 0- to 3-year-old range.

Although toothpaste is not intended to be swallowed, many children do swallow toothpaste. Martinez-Mier reported that children 15-36 months ingested between 10% and 99.8% of the toothpaste on their toothbrushes.[15] It is important to educate parents about the proper amount of toothpaste to use. Dentists' and dental hygienists' educational programs should include discussions of a "pea sized" amount or "smear" of toothpaste and demonstrate that amount.

It is also important that dental hygienists and dentists know the amount of fluoride to which the child is exposed, so they can discuss fluoride use and over-use with parents or guardians. Source of fluoride may include water (which may be from multiple locations and may include bottled water), prescription multiple vitamins from the child's pediatrician, and toothpaste. With combined ingestion from multiple sources, total levels of fluoride could lead to fluorosis. Pendrys reports that one third of fluorosis cases in nonfluoridated

areas and two thirds of fluorosis cases in fluoridated areas are attributable to early fluoridated toothpaste use, and two thirds of mild-to-moderate fluorosis cases in nonfluoridated areas are attributable to fluoride supplements with the pre-1994 protocol.[16] Anticipatory guidance about keeping fluoride toothpaste, fluoride rinses, and fluoride tablets out of the reach of children is recommended.

The study also indicated a need for nutritional education. According to parents or guardians, most children had few exposures to sugary beverages (soda, sweet drinks, and fruit juices). However, there were 80 exposures to processed carbohydrates. The survey, conducted between 10:00 a.m. and 2:00 p.m. on a Saturday, showed 25.4% missed breakfast. Meat or eggs were eaten by 35 and dairy products by 46 children at their most recent meal. Parents provided a diet high in processed carbohydrates but low in fruits and vegetables (6 children had a piece of fruit and 1 child had a vegetable). Educational programs that emphasize the importance of not skipping a meal and providing more fruits and vegetables to children continue to be needed.

This study was conducted at a health fair for children with a convenience sample of 87 parents and/or guardians, which presents a limitation. Because of the limited sample, care should be taken generalizing the results to other populations. It is possible that since the parents were attending a health fair the sample was more health conscious. It is also possible parents were aware of the "expected correct" responses and adjusted their responses as a result.

Table 2. Food and Beverages consumed by children at their most recent meal or snack

Breakfast (61 children)	Number of children eating the food (quantities not available)
Cereal (with milk)	25
Meat (Bacon, Sausage, Pepperoni)	13
Toast/Bagel/Biscuit and gravy	12
Pancake/Crepe/Waffle/French Toast	11
Eggs	10
Pastry/Cereal Bar/Graham Crackers/PopTart®	8
Fruit (Banana/Grapes/Strawberries)	6
Yogurt/cheese	3
Chinese/Ramen noodles	2
Pizza	1
Milk (in addition to cereal)	13
Juice	4
Lunch (17 children)	
Bread (Sandwich bread/hotdog bun)	5
Meat (Sandwich/hot dog/chicken)	10
French fries	5
Pizza	3
Chinese/Rice	2
Spaghetti	1
Yogurt	1
Green beans	1
Milk	4
Dinner (1 child)	
French Fries/Potato Chips	1
Meat (Chicken, meat in taco)	1
Taco Shell	1
Snack (4 children)	
Candy	1
Pretzel	1
Cereal	1
Chips	1

Conclusion

Despite the great strides made in eliminating caries, it continues to be the most common chronic pediatric disease in the United States.[17] Dental hygienists and dentists have significant roles in the provision of education to parents and/or guardians concerning pediatric oral and nutritional health. This study's findings identified clinical aspects of oral health education in which the dental team may help mitigate the caries epidemic and limit the possibility of fluorosis. Such education includes: showing parents the recommended amount of toothpaste to use for children, having parents demonstrate the application on a toothbrush, showing parents how to floss their child's teeth and observe and correct them as they perform the procedures on their child or in simulation, and counseling parents about balanced, regular meals and the importance of not skipping meals.

We also identified questions for

further study regarding oral health education for parents. How can the dental team be certain that the oral hygiene message is conveyed? What constitutes the most effective presentations? How can we verify learning has occurred? How do we perpetuate the motivation that is initiated and encourage parents to follow through in the provision of proper oral hygiene and nutrition to their children? Are incentives, rewards, or punishments appropriate? At what level should state, local, or federal governments intervene? Dental hygienists are faced with the same teaching obstacles as any other teacher. The information must be heard, understood, and internalized. Parents must develop skills to perform the home care their child requires. Even with a clear understanding of oral hygiene and nutritional needs, parents may not follow through with the desired behavior. Obstacles in daily living may erode parents' motivation and sense of necessity to address the dental needs of their children. These issues are complex and require further study.

Having basic dental knowledge may make it possible for the national caries trend to be arrested and reversed. The findings of this study can help the dental hygienist know which additional information to share with parents to help improve nutrition, oral health, and safety, along with the usual topics of how and when to brush and floss.

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