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## Thankfully, some things never change

MA Gaston

*Mary Alice Gaston is emeritus professor of dental hygiene at the University of Tennessee Health Science Center, a past president of the American Dental Hygienists' Association, and current editor-in-chief of the Journal of Dental Hygiene.*

**Keywords:** dental hygienist, dental hygiene profession, oral health care, change



I am so thankful that some things never change. This may sound strange coming from me, since I am usually a strong advocate for change, and am always looking for better ways to do things. Interestingly, these are two of the essential characteristics of dental hygienists and of the American Dental Hygienists' Association (ADHA) that have not changed since our profession began. These and other characteristics of dental hygienists and ADHA were highly visible during the 2005 ADHA annual session. Let me share my observations with you, and discuss why I believe it may be best for some things to remain the same.

Dental hygienists are the most cheerful, futuristic-thinking, caring people I know. They really enjoy their professional practice, regardless of the setting. The vast majority are clinical practitioners who work every day in practices across the country serving the oral health needs of diverse clientele. Many others have used their basic dental hygiene professional degree to great advantage in forging careers in related areas other than clinical practice. Whatever the practice setting, dental hygienists are proud of their professional credential and are enthusiastic about their future. This is common to all dental hygienists and has not changed since I've been observing them as a group.

Dental hygienists who are active in the regulatory arena are very special people, especially those who continue their work year after year. ADHA supports such work throughout the year in individual states through its Division of Governmental Affairs. Once a year, the ADHA governmental affairs division hosts an open meeting during the annual session program to provide constituent legislative chairs and others the opportunity to share common experiences, challenges, goals, strategies, and successful and unsuccessful outcomes of legislative activities, as well as to explore possibilities for the next legislative session. Members of the ADHA governmental affairs division staff are always present to provide encouragement, insight, and guidance; and to offer assistance when requested. The collective enthusiasm of the people who attend these meetings is inspiring and contagious. Regardless of the losses experienced in the previous legislative sessions, or the negative outcomes in generating support among constituent dental hygienists, the dental hygienists who are legislative leaders never give up and are always eager to prepare for the next legislative session. This commitment among dental

hygienists to change state laws to increase access to oral health care for underserved populations and to improve delivery of oral health care is one thing that I hope will never change. The legislative changes that have been made in individual states through the combined efforts of a few dedicated dental hygienists continue to inspire the rest of us. I still marvel at how some dental hygienists can suffer defeat in their state's legislature one year and get up and prepare to work again for change during the next legislative session. Time after time, this characteristic of dental hygienists never changes.

Dental hygiene educators are another group that never changes. Only the issues that concern them change. In recognition of these issues, ADHA sets a time in each annual session schedule for educators to enjoy a program and to visit with one another, sharing ideas and discussing concerns. These annual session programs may be well attended because all educators must continually work to prepare professional entry-level students for future practice within the time and credit-hour limits determined by the institutions in which they are located, regardless of the degree granted. Those teaching in institutions that grant dental hygiene baccalaureate and postgraduate degrees face other challenges, such as ensuring that the curriculum meets academic standards that allow dental hygiene courses to transfer for admission to master's degree programs. Furthermore, faculty in dental hygiene master's degree programs are challenged to admit and graduate enough dental hygienists with advanced degrees to fill the growing need in education, research, administration, and areas of employment yet unknown. Despite these challenges and others resulting from factors such as accreditation standards, institutional requirements, professional practice requirements, limited funding, limited faculty, and less than desirable facilities, dental hygiene educators remain committed to the task and excited about the future of their profession. As a group, dental hygiene educators are enthusiastic about their role in the profession, and about the future of their profession. After being one of them for nearly 30 years, I'm convinced that, as a group, they never change. For that, we can all be thankful indeed.

I am thankful that, in many respects, the ADHA annual session does not change from year to year. Even the program remains so similar each year that people can plan far in advance because they generally have come to expect certain meetings and social events to be scheduled on the same days during the meeting. It must be working, because attendance continues to increase each year. People come to take advantage of the continuing education courses, enjoy the social events, visit with old friends, take care of association business, see the products, and learn from their colleagues. The 2005 annual session held in Las Vegas was well attended and highly successful. I expect the 2006 meeting in Orlando will be even better because people will likely view it as an opportunity for a family vacation and will bring their children to see Disney World. Yes, the ADHA annual session schedule has become so successful that it might be a good idea for it to stay the same until an obviously better one is proposed.

Dental hygienists continue to conduct research, write reports, and submit them for publication in refereed journals, such as the *Journal of Dental Hygiene*. The spark of curiosity that ignites scientific investigation is growing for our profession and is being encouraged by the funds that are now more readily available for it. Dental hygiene researchers still swim upstream, so to speak, regarding research in general. Yet, they continue to swim! I believe they show great tenacity and enduring will to succeed in a highly competitive arena. Thank goodness their will to compete hasn't changed over the past 30 to 40 years. The commitment of a few has kept the spark of dental hygiene research alive.

I'm thankful that every time there is a need to develop a special plan for some aspect of our future, or to react to some present or future threat, talented dental hygienists volunteer and accept the challenge. Often, these volunteer jobs are difficult and thankless and require many hours of hard work. Yet people step forth to the task without fail. I trust this will never change because this characteristic makes our volunteer association work.

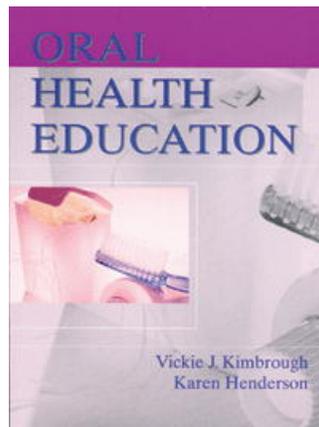
I could go on and on with this list of things that never change and should never change, and I'm sure you could add your own to mine. I've given you enough examples for you to do so if you wish. I love dental hygiene, the fact that we change when we need to, and the fact that we remain the same in the characteristics that are uniquely ours. I guess our continuing challenge will be to somehow know when to change and when to stay the course. We've been pretty good at it so far.

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## **Review of: Oral Health Education**

Christine Nathe

*Reviewed by Christine Nathe, RDH, MS, associate professor and graduate program director in the Division of Dental Hygiene at the University of New Mexico in Albuquerque.*



### **Oral Health Education**

**Kimbrough V, Henderson K**

**Prentice Hall, 2005**

**Upper Saddle River, New Jersey**

**176 pages, indexed, paperback**

**ISBN: 0-1310-9051-8**

**\$36.00**

*Oral Health Education* provides a brief description of trends in health perceptions from infancy to older adulthood and lifestyle influences on health. It also discusses how to bridge the gaps in communication styles to better work with patients and suggests ways to collaborate with community organizations and other health providers. The book discusses the systemic and oral health in various population groups. Current trends in oral health and general health are discussed, with chapters presented on learning styles and providing chairside oral health education. Information on certain target populations and a chapter on oral health products from a consumer's perspective are also presented.

All chapters include references, objectives, critical thinking exercises, and activities that can be done as a class or individual assignment. These additions help the student or provider understand the material presented. Helpful appendices cover dentition eruption tables, examples of drugs associated with xerostomia, the food guide pyramid, topics for basic oral

health lessons, lesson plan forms, and Internet resources. Additionally, the textbook is indexed and contains a few photographs and diagrams to help support concept understanding.

Many times after graduating, dental hygienists are asked to present oral health information to groups. This book would be a welcome resource for dental hygienists planning lessons geared toward oral health and its relation to overall health.

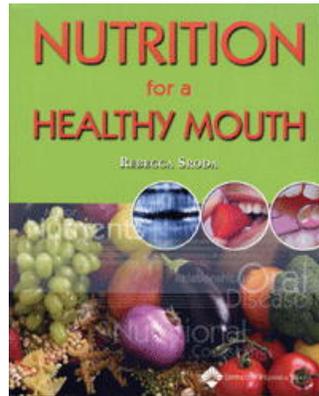
This is a concise book written to help providers communicate well with patients and groups. The text is an excellent resource for the practicing dental hygienist or dentist interested in improving communication with patients or presenting to groups. It would also be a helpful supplementary text to courses focusing on oral health education or dental public health in the dental hygiene curriculum.

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## **Review of: Nutrition for a Healthy Mouth**

Mary Cooper

*Reviewed by Mary Danusis Cooper, LDH, MSED, professor in the dental hygiene program at Indiana University-Purdue University in Fort Wayne, Indiana.*



### **Nutrition for a Healthy Mouth**

**Sroda R**

**Lippincott Williams & Wilkins, 2006**

**Philadelphia, Pennsylvania**

**260 pages, illustrated, indexed, soft cover**

**ISBN 0-7817-5155-1**

**\$49.95**

This new nutrition textbook is specifically designed to be used by dental assisting and dental hygiene students, as well as practicing clinicians. The text is divided into seven sections that cover the major components of nutrition and their relationship to dental health. The author covers the material in an easy-to-read style that may at times seem inadequate; however, most of the information necessary for the dental hygiene or dental assisting student or practicing clinician is provided.

This textbook presents the reader with several appealing and practical features. Each chapter provides box tips, which offer insightful information about the material being presented. For example, in the water chapter, one box tip states that bone is made up of one-third water, and that fat is one-fourth water, muscle is two-thirds water, and whole blood is four-fifths water. Also included in each chapter are activities for the reader, such as fill-in-the-blank questions and review quizzes, both of which provide an opportunity for reviewing and, in turn, make it easier to retain the material. Of special

interest in each chapter is the section entitled, "Putting This into Practice." This material enhances critical thinking skills about the subject just covered and provides daily food choices for the patient as well as the reader. In addition, at the conclusion of each chapter, there are suggested patient counseling tips and chapter review questions, followed by Web resources, references, and suggested readings, in case further information is desired or needed.

Provided with this text is a laminated dental nutrition quick reference card that can be used during chairside education. On one side, dental caries is addressed. In addition to the equation for the progression of dental caries, recommended healthy snacks are listed. On the flip side, nutrition and periodontal disease are addressed. Listed are the nutrients that promote healthy tissues. Although the patient is informed of nutrients that may promote healing, form and maintain epithelium, and maintain supportive alveolar bone, it would have been beneficial to list examples of food sources that contain these nutrients.

In addition, the text discusses several topics of interest that are not always presented in dental nutrition textbooks. One such area is dietary and herbal supplements. Since there is an increase in herbal use among patients, it is important to be aware not only of possible adverse reactions to them, but also their effects on dental treatment. Recognizing this, dental hygienists should always include herbal use on the dental and medical history form.

The chapter on reading labels is exceptionally practical. Many consumers lack the knowledge of how to read a food label in order to decipher its significance to their diets, which, in turn, can help them make wise food choices.

Another strong area is the nutritional counseling section. Providing nutritional assessment is especially important when a patient has a high caries rate. In addition to identifying the amount and types of cariogenic foods being consumed, the evaluation can help identify nutritional deficiencies and excesses. Once the diet survey is analyzed, suggestions can be made to help patients make changes in their diets.

However, there are some shortfalls in this textbook that could easily be rectified in the second edition. First and foremost is the introduction of the new food guide pyramid. Since the publication of this textbook, the new pyramid has been introduced. Another topic that could warrant attention is the growing concern about childhood and adult obesity. In addition, although the answers to the review questions are given for each chapter in the appendices, providing the rationales for the correct and incorrect answers could be helpful and would provide an additional learning tool for the student.

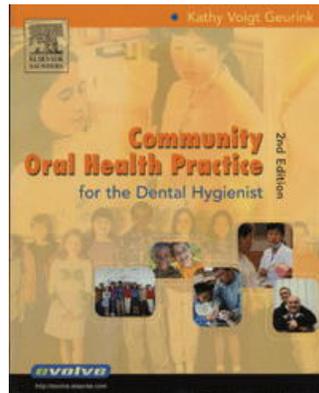
Overall, this textbook provides an excellent review of nutrition and its relationship to dental health. It is highly recommended for use in the classroom, as well as a reference for the practicing dental hygiene clinician. Not only is it easy to read, but it also provides many valuable features that will benefit the reader and the patient.

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## **Review of: Community Oral Health Practice for the Dental Hygienist**

Ruth Fearing Tornwall

*Reviewed by Ruth Fearing Tornwall, RDH, MS, instructor IV at the Lamar Institute of Technology in Beaumont, Texas.*



### **Community Oral Health Practice for the Dental Hygienist**

**2<sup>nd</sup> edition**

**Geurink KV**

**Elsevier Saunders, 2005**

**St. Louis, Missouri**

**379 pages, illustrated, indexed, soft cover**

**ISBN: 1-4160-0096-8**

**\$44.95**

The second edition of *Community Oral Health Practice for the Dental Hygienist* includes 12 chapters that offer a comprehensive overview of community oral health. The purpose of the text is to provide students with information about community oral health that is relevant to dental hygiene. By reading the chapters and participating in the suggested activities, dental hygiene students will develop an understanding of the importance of community oral health to themselves and to the future of their profession. This text is also a valuable resource for all dental hygienists who are practicing their responsibility of improving the oral health of people in their communities.

The author has updated the text and has made the concepts easier to understand. Each chapter has an opening statement to set the stage for that chapter and a statement of guiding principles for the concepts being discussed. Complementing each chapter are objectives, key terms, activities, relevant dental hygiene competencies, and community cases with multiple choice questions. A glossary is located at the end of the text. Also helpful in this text are the appendices, which contain the addresses of Web sites for oral health resources, dental hygiene competencies list, and information for forming community partnerships and performing community health assessments.

Chapter 1 defines community oral health through examples of public health problems and solutions. Basic public health functions and crucial public health services are also defined. Chapter 2 describes careers in public health, featuring dental hygienists who practice in the field of community oral health. By profiling these careers, the author seeks to help students understand the importance of the content in the future chapters. The next three chapters, Chapters 3, 4, and 5, focus on assessment and measuring oral health. The author has added an additional chapter here, building on the first edition. The information has been refined and clarified. Common terms used in epidemiology have been expanded, the table of data collection methods has been eliminated, and more assessment resources have been added at the end of Chapter 3. The author emphasizes the importance of the fundamental steps in planning community oral health programs and uses *Healthy People 2010* oral health objectives as a framework for assessing community oral health programs.

Chapter 6, which is about community oral health programs, discusses the planning, implementation, and evaluation phases of program development. Local, state, and national programs are presented. All state oral health Web sites are included. Chapter 7 provides an overview of research and statistics, describing the steps in the scientific method, the steps in analyzing the literature, and the components of a primary research manuscript. Theories of health promotion and strategies for delivering health information to the public are covered in Chapter 8. Chapter 9, "Social Responsibility," discusses the dental hygienist's professional responsibility with respect to cultural competency and improving access to care for underserved populations. Chapter 10, "Cultural Competency," a new chapter, defines the term for students and provides models of how to incorporate cultural competency into interactions with patients and in community health promotion activities. "Service-Learning," Chapter 11, is also a new chapter. In this chapter, the importance of the collaboration between the needs of the community and student learning is defined. The author discusses the benefits of service-learning for students, the community, the dental hygiene program, the academic institution, and the nation's oral health. Chapter 12, the final chapter, provides students with practice in answering community oral health test questions similar to those on the National Board Dental Hygiene Examination.

*Community Oral Health Practice for the Dental Hygienist* provides students and practicing dental hygienists with the information they need to practice their profession with a positive attitude toward community dental health and a willingness to contribute to the oral health of all persons in their communities.

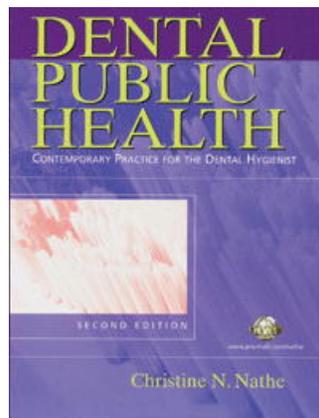
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## **Review of: Dental Public Health: Contemporary Practice for the Dental Hygienist**

Lisa Shaw

*Reviewed by Lisa Shaw, RDH, MS, residential health care coordinator at St. Luke's Memorial Hospital Dental Service in Utica, New York.*



### **Dental Public Health: Contemporary Practice for the Dental Hygienist**

**2<sup>nd</sup> edition**

**Nathe C**

**Pearson Prentice Hall, 2004**

**Upper Saddle River, New Jersey**

**391 pages, illustrated, indexed, soft cover**

**ISBN: 0-13-113-4442**

**\$45.00**

With the advent of the Healthy People Initiatives and the Advanced Dental Hygiene Practitioner movement, it is imperative that all dental hygienists are up-to-date on national health care goals and alternative practice settings that help meet those goals. Christine N. Nathe, RDH MS, has, in her book *Dental Public Health: Contemporary Practice for the Dental Hygienist*, set out to familiarize dental hygiene students and those dental hygienists already practicing with the components of dental public health practice.

Nathe divides her book into four units:

## **Introduction to Dental Public Health**

This unit is divided into five chapters that cover a wide range of topics. Chapter 1 is the most important chapter, in that Nathe defines dental public health, provides a historical overview of dental hygiene practice, and provides an overview of prevention modalities. An exciting chapter, it takes one back to the roots of dental hygiene practice and reminds us that while, ironically, the title defines dental public health as contemporary practice for the dental hygienist, it does, in fact, only mirror our original purpose. This mirroring is further demonstrated by Nathe's comparison of the 2000 surgeon general's *Oral Health in America* goals to those of the *Mouth Hygiene* textbook from 1916 to 1934.

Chapter 1 also clearly defines the practice of public health as "concerned with the aggregate health of a group, a community, a state, or a nation. Not limited to the health of the poor, or to rendering health services, or to the nature of the health problems." Nor is public health defined by the method of payment. Dental public health is further defined as the "science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts. [it] serves the community as the patient rather than the individual." Nathe goes on to compare private practice and public health practice for dental hygienists, and to outline roles that dental hygienists may play in dental public health.

Chapters 2 through 5 outline oral health care delivery in the United States, the financing of oral health care, oral health care delivery around the world, and legislative initiatives affecting dental hygiene practice. Chapter 4, "Dental Care Delivery around the World," while interesting, is diminished because it suffers from poor sentence structure, editing errors, missing citations, and tables that have not been updated or expanded. Chapter 5, "Legislative Initiatives Affecting Dental Hygiene," is an extremely important chapter that highlights both the legislative process and the legislative barriers for dental hygienists. It might have served this chapter better to highlight a hygienist who is currently actively working within the legislative process, and to provide the ADHA practice act overview chart and illustration of permitted functions and supervision levels by state. In addition, the ADHA also provides an overview of dental hygiene legislative activity that helps to illustrate legislative efforts made within the last 12 years.

## **Dental Hygiene Public Health Programs**

This unit is divided into five chapters that focus on the premise that the goal of dental public health is group education aimed at changing values and behaviors. Chapter 6 gives an overview of several health models and theories. Changing behavior through effective use of models and theories is a cornerstone of the educational process, both in clinical and public health settings. This chapter is particularly disappointing and disserving in that it provides only cursory explanations of these models and theories, and what it does provide is not supported by primary references to the authors of these models and theories (i.e., Prochaska or Bandura).

Chapter 7 provides an overview of lesson plan development using the dental hygiene process of care that includes the assessment of target group needs, a dental hygiene diagnosis or lesson focus, planning, implementation, and evaluation processes. Chapter 8 focuses on identifying target groups, guidelines for cross-cultural dental hygiene competence, and barriers to dental care.

Chapter 9 moves the public health dental hygienist beyond education into program development. Because of differences in state practice act supervision requirements, this is probably the most exciting and difficult issue that dental hygienists who have decided to embrace public health will encounter. Nathe gives an overview of some public health efforts that include sealant programs, school-based dental health programs, inner-city health centers, faith-based non-Medicaid clinics, and an international effort to provide oral health care and education for the world's needy. Finally, she outlines and gives an example of an operational dental hygiene program planning paradigm. Chapter 10 highlights clinical and non-clinical program evaluation strategies and tools, with the focus on clinical indices and indicators.

## **Dental Hygiene Research**

This unit is divided into four chapters. Chapter 11, "Oral Epidemiology of Dental Diseases," attempts to give the reader a picture of the oral health conditions that affect a given population. Again, this chapter is diminished by editing errors and the use of old data. For example, the statement that "the prevalence of recurrent aphthous ulcers has indicated that the prevalence in the general population can vary from 5 to 25 percent" is referenced by data from 1967 through 1976.

In Chapter 12, "Research in Dental Hygiene," Nathe outlines the importance of research in dental hygiene. Advocacy for research will, she believes, move dental hygienists beyond the use of treatments based on trial and error or anecdotal reports. She provides a table that outlines different research approaches, a short description of several of these approaches, and a short description of research design, research methods, sampling techniques, informed consent, and literature review. Again, the chapter is choppy, confusing, and does not provide enough detail.

Chapter 13, "Biostatistics," by Chris French-Beatty, RDH, PhD, provides an overview of data analysis and data interpretation. While her focus is primarily on quantitative data analysis, French-Beatty does an excellent job in helping the student to understand the basics of a difficult subject. Further, she provides numerous figures and tables that further explain or expand on the text.

Chapter 14, "Evaluation of Scientific Literature and Dental Products," outlines the role of the Food and Drug Administration in the regulation of oral health care products. Nathe also highlights the meaning of the American Dental Association (ADA) seal of acceptance and the possible political influences that may play in its application. She advocates that product promotion should be based not on whether or not it bears the ADA seal of approval, but rather on "FDA approval, scientific literature and reported product findings." While she provides a table that highlights where dental hygienists can find product information, she does not provide caveats to these sources or adequately outline the proper way to evaluate sources, particularly those from the Internet.

### **Practical Strategies for Dental Public Health**

Unit IV is divided into three chapters. Chapter 15, "Careers in Dental Public Health," outlines career opportunities in government agencies such as the U.S. Public Health Service, the National Health Service Corps, and the U.S. Civil Service, which includes the Department of Veterans Affairs, military installations, and the federal prison system. Many of the positions available are clinical positions, and some agencies and programs have age restrictions.

Chapter 16, "Strategies for Creating Dental Hygiene Positions in Dental Public Health Settings," recognizes that, while dental hygiene at its roots was aimed at serving the public health, its primary theater of operation is the private dental office. This chapter highlights "strategies for implementing dental hygiene positions within the health care delivery systems." Nathe restates the planning paradigm covered in Chapter 9 and introduces elements of business plan strategies. Further, she provides simplified employment agreements, policy statements, and affiliation and role statements as well; however, none of these examples may be thorough enough to adequately define dental Hygienists' roles and obligations in these settings.

Chapter 17, "Dental Public Health Review," completes the text chapters with a public health review. Nathe and Meg Zayan, RDH, MPH, guide students through the requirements and expectations of the National Board Dental Hygiene Examination. This chapter also provides key concepts for community activities and eight "testlets" with answers that help prepare student dental hygienists for the examination.

The remainder of the text provides appendices that highlight organizations that are involved with dental public health, resources for dental samples and pamphlets, government departments serving dental needs, state public health agencies, table clinic presentations, poster session preparation, international dental care opportunities, dental terms and phrases translated to Spanish and Vietnamese, standards for dental hygienists in dental public health education, guide to scientific writing, and a glossary of terms.

One of the best features of this text is the online study guide that can be found at [http://wps.prenhall.com/chet\\_nathe\\_dental\\_2](http://wps.prenhall.com/chet_nathe_dental_2). This guide takes the student through and beyond the text by providing laboratory, true or false, fill-in-the-blank, matching, extra research multiple-choice, and essay questions and board review hints. In addition, it provides Microsoft PowerPoint presentations, links to current issues and workshops, and the latest information related to dentistry. Instructors are provided a link (<http://vig.prenhall.com/catalog/academic/product/0,1144,0131134442,00.html>) that provides an overview of the text, an instructor resource center that includes text banks, and a link to other community dental health texts.

Another important feature of the text is the highlights of dental hygienists who practice in public health settings. Most of the dental hygienists featured, however, have advanced degrees, which might imply that public health service requires a degree beyond the associate level.

Finally, Janet Carroll Memoli, RDH, MS, in her foreword to this book, restates the original plan that Alfred C. Fones had for dental hygienists: "to direct services, educational and clinical, to groups of people, to the masses" and to "play a valuable and critical role in the dental health of people everywhere." Nathe expands these ideas by acknowledging that dental hygiene is the "only health care profession that is truly focused on preventive health as its foundation." As she passionately restates the original goals of the profession-to work outside of the office clinical setting as outreach workers who help to both prevent oral disease and bring patients into dental practices for treatment-she brings us back to our roots.

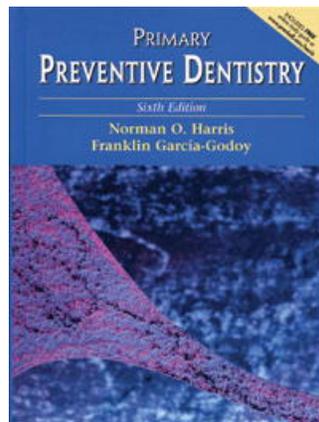
The task of encouraging dental hygiene students to pursue careers in public health practice can be arduous, especially when the focus of dental hygiene education is the application of clinical skills for the private practice setting. Beyond familiarizing students and practitioners about the components of dental public health, I looked for whether or not this book went beyond that and succeeded in encouraging dental hygienists to participate in public health efforts and practice. While I applaud Nathe for taking on this Herculean task, I find that the book falls short of accomplishing both the goal of educating and encouraging, primarily because it just skims the surface of many of the important elements related to the practice of public health.

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## **Review of: Primary Preventive Dentistry**

Margaret Six

*Reviewed by Margaret Six, RDH, MSDH, associate professor at West Liberty State College in West Liberty, West Virginia.*



**Primary Preventive Dentistry**

**Sixth edition**

**Harris NO, Garcia-Godoy F**

**Pearson Prentice Hall, 2004**

**Upper Saddle River, New Jersey**

**695 pages, illustrated, indexed**

**ISBN: 0-1309-1891-1**

**\$66.60**

The sixth edition of *Primary Preventive Dentistry* is a comprehensive text relative and beneficial for all readers interested in the prevention of oral disease. Representing the international community, the contributors who assisted in authoring the text are oral health and health professionals with expertise in the areas of research, education, and public health.

The text contains information that is factually correct and includes controversial topics such as water fluoridation and the misuse and misdiagnosis using the dental explorer. State-of-the-art technologies, including digital radiography, computerized charting, and intraoral photography, are discussed.

Composed of 23 chapters, this text addresses primary prevention concepts and techniques, as well as the development of public health programs designed to address early childhood through geriatric oral health. This text is an "easy read," making

it useful for new students, as well as a reference text for the experienced oral and allied health professionals. Each chapter includes objectives, an introduction, and a summary. A comprehensive list of references that adequately support the context of the text is included at the end of each chapter. Throughout each chapter, true or false and multiple-choice questions are introduced and highlighted in a colored box relative to the text previously presented. These questions provide an opportunity for readers to immediately test their knowledge and comprehension of theory and concepts. The answers, with associated explanations for each question, are printed after the summary in each chapter, providing immediate feedback for readers. Additionally, each chapter includes 10 fill-in-the-blank questions designed for self evaluation. A host of tables, appendices, and black-and-white photographs complement the text.

In an effort to incorporate technology into the learning process, Prentice Hall has included an interactive teaching and learning tool through a Web site to complement the text. This Web site includes an opportunity for self-evaluation through the completion of true or false, multiple-choice, and essay questions for each chapter. Students may submit their answers for evaluation. A comprehensive glossary and a link to the *New York Times* is provided, which posts the latest news related to dentistry. Faculty may wish to utilize the syllabus manager, a free service provided by Pearson through this Web site.

The content of this text is comprehensive, the organization is effective, and the inclusion of Web-based resources all contribute to the success of this text. *Primary Preventive Dentistry* is a useful addition to the library collection for all those interested in oral health.

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## **Sodium Bicarbonate and Hydrogen Peroxide: The Effect on the Growth of Streptococcus mutans**

Kelly J Silhacek and Kristin R Taake

*Kelly J. Silhacek, BS, RDH, and Kristin R. Taake, BS, RDH, are 2004 graduates of the University of Nebraska College of Dentistry in Lincoln, Nebraska. Both are currently working in private practice in Nebraska.*

***Purpose.*** This in vitro experiment studied the effects of sodium bicarbonate and hydrogen peroxide on the cariogenic bacteria Streptococcus mutans through analysis with a spectrophotometer.

***Methods.*** The growth of S. mutans was analyzed using seven different environments. Twelve wells in each of the seven rows of a multi-well plate were used to incubate the test materials. In combinations of 10 µl distilled water, 100 µl broth, 10 µl 10% sucrose, 10 µl S. mutans, 10 µl 10% sodium bicarbonate, and 10 µl 3% hydrogen peroxide, seven different environments were created for testing. Environments had either sodium bicarbonate or hydrogen peroxide with S. mutans, or a combination of sodium bicarbonate and hydrogen peroxide with S. mutans. The plate was incubated at 37°C and measured at 0, 18, 20, 22, 24, 26, 28, 30, and 42 hours by optical density with a spectrophotometer.

***Results.*** Results showed bacterial growth was prevented by sodium bicarbonate, hydrogen peroxide, and the combination of sodium bicarbonate and hydrogen peroxide. Although hydrogen peroxide is bacteriocidal and sodium bicarbonate is bacteriostatic, there were no significant differences among the three treatment groups in spectrophotometer readings at any of the nine readings over 42 hours.

***Conclusion.*** There was no significant difference among the effects of hydrogen peroxide, sodium bicarbonate, or the sodium bicarbonate and hydrogen peroxide combination, as measured by optical density. The hydrogen peroxide, sodium bicarbonate, and the sodium bicarbonate and hydrogen peroxide combination prevented bacterial growth of S. mutans. The results show that products containing these agents have the ability to stop the growth of S. mutans. Products containing sodium bicarbonate and/or hydrogen peroxide may be useful to caries-prone patients. More studies are needed to confirm these results on patients.

**Keywords:** Gerontology, Web-based instruction, distance education, dental hygiene education

### **Introduction**

There are many products on the market today that aim to reduce the amount of dental biofilm and bacteria in the oral cavity. Over the years, numerous different ingredients and combinations of ingredients have been utilized to accomplish this task. There exists such an abundance of oral care products that finding safe, effective, and appropriate products can be very confusing for consumers.<sup>1</sup> With so many products to choose from, even oral health care professionals may have difficulty making these decisions. In fact, recommending the right products for each individual patient can be a challenging task. However, being knowledgeable about the efficacy of active ingredients in oral care products is advantageous to oral

health care professionals and can lessen confusion. This study was designed to compare the antimicrobial properties of sodium bicarbonate and hydrogen peroxide, two ingredients that are commonly used in oral health care products and advertised as effective antimicrobial agents. This study is designed to solely evaluate how these agents specifically affected *Streptococcus mutans*.

A common bacterium found in dental biofilm, *S. mutans* is widely thought of as one of the main bacteria that causes dental caries.<sup>2</sup> Because previous studies have shown that high concentrations of sodium bicarbonate and/or hydrogen peroxide inhibit or slow bacterial growth, it was hypothesized that the results of this study would mirror these findings. The most effective bacteriocidal formulation was expected to be a combination of sodium bicarbonate and hydrogen peroxide, as prior research indicated.<sup>3</sup>

## Literature Review

New oral hygiene products are introduced on a regular basis. Each one has different guarantees and promises, and many go untested. It is important to read the current literature on oral health care products to determine which products may be safe and effective and which ones may not. Because many consumers do not take the time to inform themselves about this topic or may not have access to such information, it is imperative that oral health care professionals take responsibility for being knowledgeable sources regarding product efficacy and safety, such as with products containing sodium bicarbonate and/or hydrogen peroxide.

Sodium bicarbonate is an ingredient in numerous dentifrices, such as Colgate Baking Soda toothpaste (Colgate-Palmolive, Piscataway, NJ), PeroxiCare Tartar Control toothpaste (Church & Dwight, Princeton, NJ), Crest Baking Soda toothpaste (Procter & Gamble, Cincinnati, OH), Mentadent Tartar Control toothpaste (Chesebrough-Pond's USA, Greenwich, CT), Sensodyne with Baking Soda (Block Drug, Jersey City, NJ), and many more.<sup>4</sup> Every major dentifrice manufacturer offers some type of baking soda toothpaste.<sup>4</sup> Approximately 31% of the consumer market for toothpaste consists of dentifrice combined with baking soda, or a baking soda and hydrogen peroxide combination.<sup>4</sup>

Hydrogen peroxide, an inhibitor of microbial growth, may be found in dentifrices with sodium bicarbonate, such as Mentadent.<sup>4</sup> Hydrogen peroxide alone has other uses in dentistry as well. For example, it is the active ingredient in tooth whitening products, such as Crest White Strips (Procter & Gamble, Cincinnati, OH) or Colgate Simply White (Colgate-Palmolive, Piscataway, NJ).

Sodium bicarbonate, NaHCO<sub>3</sub>, has particular significance in dentistry because of its ever-growing use in dentifrices and mouth rinses. Sodium bicarbonate is appealing for its safety, low cost, low abrasivity, water solubility, acid buffering properties, compatibility with fluoride, and, in high concentrations, antibacterial properties.<sup>1,5</sup>

Because of its alkalinity, or buffering capacity, sodium bicarbonate has the ability to neutralize acids produced by the microbes in dental biofilm. By neutralizing the acids, the enamel matrix of the tooth is less likely to be demineralized by the effect of the acids.<sup>5</sup> Another factor in sodium bicarbonate's bacteriocidal abilities comes from changes in osmotic pressure. The hypertonic sodium bicarbonate solution causes the more hypotonic microbial cell to lose water, consequently dehydrating and eventually killing the cell.<sup>6</sup> Although these are all desirable outcomes, some studies have shown that the sodium bicarbonate must be allowed to interact at least 30 minutes with the bacteria cell to be fully effective. Fletcher et al. showed that sodium bicarbonate had no effect on the viability of *S. mutans* when exposed only for a short time.<sup>7</sup> A study by Pihlstrom et al. also showed no benefit of using sodium bicarbonate.<sup>8</sup>

In many cases, sodium bicarbonate was found to be effective against periodontal microorganisms. In a study by Rams et al., a five-minute exposure to sodium bicarbonate quickly immobilized spirochetes and motile rods.<sup>9</sup> Gram-positive cocci bacteria, such as *S. mutans*, were also shown to be susceptible against 4% sodium bicarbonate in a study by Drake.<sup>5</sup> Additionally, in a four-week study by Legier-Vargas et al., it was found that regular use of Arm & Hammer Dental Care dentifrice (Church & Dwight, Inc., Princeton, NJ), containing 65% sodium bicarbonate, lowered the level of *S. mutans* in

saliva.<sup>10</sup> It has also been demonstrated that brushing with a dentifrice that contains high concentrations of sodium bicarbonate may not only suppress harmful bacteria in the mouth, but may also lead to increases in healthy bacteria.<sup>11</sup>

As well as affecting microbial populations, sodium bicarbonate may also neutralize the acidic environment in the oral cavity produced by the bacteria present.<sup>10</sup> The critical pH level in human dental biofilm is from 4.5 to 5.5.<sup>12</sup> When the pH is at the critical level, enamel is more susceptible to decalcification, which can lead to dental caries. The ideal pH of dental biofilm is a neutral 7.0. Acting as a buffering agent, sodium bicarbonate can raise the pH from the critical pH to a safer pH closer to neutrality. Thus, in addition to the ability of sodium bicarbonate to reduce the effects of harmful bacteria in the mouth, it also increases pH levels to a safe, neutral level.

Oral health care providers have utilized hydrogen peroxide, H<sub>2</sub>O<sub>2</sub>, therapeutically since the early 20th century. According to Marshall et al., hydrogen peroxide was used as early as 1913 to decrease plaque development.<sup>13</sup> Today, hydrogen peroxide is used to reduce the number of bacteria associated with periodontal disease and to promote healing following gingival surgery. Usually, a 3% concentration is used for these purposes. With higher concentrations of hydrogen peroxide, there is some concern about the compound being corrosive to the soft tissues as well as being precarcinogenic or carcinogenic. However, little evidence exists that cancer is a direct effect of hydrogen peroxide when used in low concentrations in the oral cavity.<sup>13</sup>

The antibacterial properties of hydrogen peroxide are exhibited in the elimination of gram-positive and gram-negative bacteria. When hydrogen peroxide is exposed to other compounds, it breaks down very quickly into water and oxygen. Notably, the oxygen is released in the form of a free radical and, through oxidation, destroys microorganisms, particularly those that are anaerobic.<sup>13</sup> More specifically, anaerobes lack the enzymes needed to detoxify products such as hydrogen peroxide. When hydrogen peroxide reacts with oxygen, a free hydroxyl radical is formed. This radical is a very potent oxidant and can attack any organic substance in the cell.<sup>14</sup>

The effect of hydrogen peroxide on the oral cavity, like many compounds, is controversial. Previous studies have shown that rinsing with a 1% solution of hydrogen peroxide has very little effect in reducing dental biofilm and gingivitis.<sup>13,15</sup> Pihlstrom et al. also found no benefits of hydrogen peroxide in patients with mild to moderate periodontitis.<sup>8</sup> Conversely, a study by Marshall et al. found that when a 3% hydrogen peroxide solution was irrigated into periodontal pockets twice a week for six months, the solution suppressed or eliminated *Actinobacillus actinomycetemcomitans*, a bacterium that is a common perpetrator in periodontal diseases.<sup>13</sup>

Researchers have investigated the effectiveness of sodium bicarbonate in combination with hydrogen peroxide in preventing and treating oral diseases. An investigation conducted by Keyes et al. showed a reduction in spirochetes and motile rods when the mixture was used.<sup>16</sup> Sodium bicarbonate and hydrogen peroxide have also been shown to reduce bleeding, gingivitis, suppuration, and motility, as well as decrease pocket depths.<sup>16</sup> Also, the cariogenic bacteria *S. mutans* has been shown to be susceptible to the combination of sodium bicarbonate and hydrogen peroxide.<sup>13</sup> Finally, using this combination of sodium bicarbonate and hydrogen peroxide has been shown to be more bacteriocidal than using either ingredient alone.<sup>3</sup>

Even though sodium bicarbonate and hydrogen peroxide have been shown to be effective in many studies, some studies have shown the combination of sodium bicarbonate and hydrogen peroxide to be ineffective and non-beneficial to the oral cavity.<sup>17,18,19</sup> One study showed that a sodium bicarbonate and hydrogen peroxide dentifrice had little to no beneficial effects on dental biofilm reduction, biofilm regrowth, and gingival scores, compared to a sodium fluoride dentifrice.<sup>20</sup> These results suggest that the utilization of sodium bicarbonate and hydrogen peroxide is no better than traditional home care methods.<sup>19</sup> In some studies, the positive results were accredited to scaling and root planing during the experiment, and not to the sodium bicarbonate and hydrogen peroxide.<sup>19</sup>

While conflicting evidence exists on the use of sodium bicarbonate and hydrogen peroxide, the results supporting the reduction of *S. mutans* are noteworthy and suggest the need for more research. *S. mutans*, a capsular, gram-positive bacteria

found in dental biofilm, feeds off the sucrose from substances entering the oral cavity.<sup>2,12</sup> The sticky, protective capsule helps the bacteria adhere to the teeth, growing stronger from each sucrose, fructose, or glucose molecule.<sup>14</sup> The sugars are added to the capsule layer and provide energy to the bacteria. During the metabolic processing of the sugars by *S. mutans*, lactic acid is produced as a by-product. This acid causes the oral pH to lower and begins the demineralization of tooth enamel, leading to dental caries.<sup>14</sup>

Sodium bicarbonate and hydrogen peroxide have potential for reducing the effects of *S. mutans* in the mouth. Knowledge of these effects would be very beneficial for oral health care professionals, as it could affect which oral health care products are recommended to patients. The goal of this study was to test the effectiveness of sodium bicarbonate and hydrogen peroxide on the specific organism, *S. mutans*, through analysis with the spectrophotometer, and to evaluate the results.

## Methods and Materials

To study the effects of hydrogen peroxide and sodium bicarbonate on *S. mutans*, a multi-well plate was used to hold 84 test environments. Growth of *S. mutans* was measured by optical density using a spectrophotometer. Wearing gloves and working under an EdgeGARD hood (Baker, Sanford, ME) to maintain a sterile work environment, investigators gave Rows A through G different environments, with 12 wells in each row. The rows were incubated for 42 hours and measured nine times at hours 0, 18, 20, 22, 24, 26, 28, 30, and 42.

Using a Labnet Labpette micropipette (Labnet International, Inc., Edison, NJ) with a different sterile tip for each constituent, Row A was filled with 100.00 µl of Brainheart Fusion broth and 10.00 µl of distilled water. Row B had 100.00 µl of broth and 10.00 µl 10% sucrose. Row C included 100.00 µl broth, 10.00 µl 10% sucrose, and 10.00 µl *S. mutans* isolated from a human cariogenic lesion (American Type Culture Collection). Row D held 100.00 µl broth, 10.00 µl 10% sucrose, 10.00 µl *S. mutans*, and 10.00 µl sodium bicarbonate. Row E contained 100.00 µl broth, 10.00 µl 10% sucrose, 10.00 µl *S. Mutans*, 10.00 µl sodium bicarbonate, and 10.00 µl 3% hydrogen peroxide. Row F was filled with 100.00 µl broth, 10.00 µl 10% sucrose, 10.00 µl *S. mutans*, and 10.00 µl 3% hydrogen peroxide. Row G had 100.00 µl broth and 10.00 µl *S. mutans*. Rows A, B, C, and G were used as controls for the experiment. Rows D, E, and F were the experimental groups. Table I illustrates the factors used in each row.

**Table I: Components of Experimental and Control Groups**

	Brainheart Fusion Broth	Distilled Water	10% Sucrose	<i>S. mutans</i>	Sodium Bicarbonate (NaHCO <sub>3</sub> )	3% Hydrogen Peroxide (H <sub>2</sub> O <sub>2</sub> )
Row A*	100 µl	10.00 µl	-----	-----	-----	-----
Row B*	100 µl	-----	10.00 µl	-----	-----	-----
Row C*	100 µl	-----	10.00 µl	10.00 µl	-----	-----
Row D	100 µl	-----	10.00 µl	10.00 µl	10.00 µl	-----
Row E	100 µl	-----	10.00 µl	10.00 µl	10.00 µl	10.00 µl
Row F	100 µl	-----	10.00 µl	10.00 µl	-----	10.00 µl
Row G*	100 µl	-----	-----	10.00 µl	-----	-----

\*These rows were used as control groups.

After Rows A through G were filled, the lid was placed on top of the well plate. The plate was tapped gently on the countertop to mix each well. No droplets remained on the side of the cylinder. Tapping was carried out until all droplets were mixed at the bottom of the cylinder.

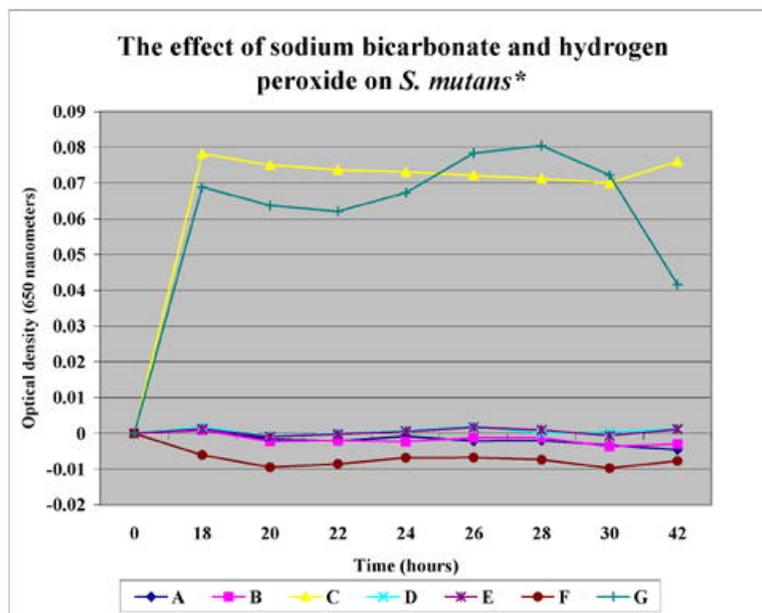
The plate was placed in the Emax Precision Microplate Reader (Molecular Devices Corp., Sunnyvale, CA) with the lid off. The initial reading of optical density was taken with the spectrophotometer at 0 hours. An increase in bacterial population causes density in the well to increase, therefore increasing the optical density measurement. A decrease in bacterial population would decrease the optical density measurement. Conditions were set with the Elisa Reader (Bio-Tek Instruments, Inc., Winooski, VT) computer program. Conditions of the spectrophotometer were placed at 650 nm wavelength to read the optical density. Immediately after the optical density reading was taken and data were collected, the lid was replaced on the plate and transferred into the Thelco Precision Scientific incubator (Precision Scientific, Winchester, VA) at 37°C

until the next reading. Data were saved in the computer through the Elisa Reader program after results were printed out. Results were analyzed using a repeated measures analysis. If the overall tests were found to be significant, the means were separated using the least significant difference test.

## Results

Hydrogen peroxide, Row F, showed bacteriocidal qualities as evidenced by a decrease in optical density, indicating that initial *S. mutans* bacteria were being killed (Figure 1). Sodium bicarbonate (Row D) and the sodium bicarbonate and hydrogen peroxide combination (Row E) exhibited bacteriostatic properties because optical density remained approximately at zero. No increase or growth, as well as no decrease or loss, of *S. mutans* occurred. The bacterial growth was inhibited. There was little change when no bacteria were present for growth (Rows A and B). *S. mutans* demonstrated growth when no influencing agents, such as sodium bicarbonate and/or hydrogen peroxide, were added to prevent bacterial growth (Rows C and G).

Figure 1: The Effect of Sodium Bicarbonate and Hydrogen Peroxide on *S. mutans*



Although Row F appeared to have the most influence affecting *S. mutans*, no statistical significance was found among any wells containing sodium bicarbonate, hydrogen peroxide, or a combination of these agents (Table II). A significant statistical difference occurred between Rows D, E, and F that contained sodium bicarbonate, the hydrogen peroxide and sodium bicarbonate combination, and hydrogen peroxide from Rows C and G that contained *S. mutans* alone. After statistical analysis of each treatment row, the results revealed that there was no effect of time on treatment (Table III). The treatment remained consistent from hour to hour.

Table II: Least Square Means of Treatments

Effect	Treatment	Estimate	Standard Error	DF	T Value	Pr >  t
Treatment	A*	-.00221	.02794	77	-.08	.9372
Treatment	B*	-.00186	.02794	77	-.07	.9470
Treatment	C*	.08027	.02794	77	2.87	.0052
Treatment	D	.000583	.02794	77	.02	.9834
Treatment	E	.000448	.02794	77	.02	.9872
Treatment	F	-.08067	.02794	77	-2.89	.0050
Treatment	G*	.006717	.02794	77	2.40	.0186

\*These rows were used as control groups.

**Table III: The Effect of Time on Treatments**

Effect	Numerator DF	Denominator DF	F Value	Pr > F
Treatment	6	77	3.61	0.0033
Hour	7	539	1.05	0.3922
Treatment times Hour	42	539	1.00	0.4776

## Discussion

Few differences were present in the results, and no statistical differences were shown among sodium bicarbonate, hydrogen peroxide, and the sodium bicarbonate and hydrogen peroxide combination. No significant statistical difference was found between *S. mutans* with sucrose and broth, and *S. mutans* with broth only. However, a significant statistical difference was present between the rows containing sodium bicarbonate and/or hydrogen peroxide and the rows not containing these agents. Differences among the groups of rows occurred because of the ability or inability to control bacterial growth. When sodium bicarbonate and/or hydrogen peroxide were present with *S. mutans*, bacterial growth was limited. When these were not present with the bacteria, significant growth occurred.

These results support the findings by Rams et al., that sodium bicarbonate is effective against periodontal pathogens.<sup>9</sup> These results also agree with the results of the studies by Drake and by Legier-Vargas et al., that sodium bicarbonate is specifically effective against *S. mutans*.<sup>10</sup> The data did not support the conclusion by Pihlstrom et al., that sodium bicarbonate was ineffective.<sup>8</sup>

The results also support the previous findings by Marshall et al., that hydrogen peroxide has antibacterial benefits.<sup>13</sup> The findings did not reinforce studies that found hydrogen peroxide to have no benefits against oral pathogens.<sup>8</sup>

The combination of sodium bicarbonate and hydrogen peroxide was found to be effective against *S. mutans*. This result again agrees with the study by Marshall et al.<sup>13</sup> This result also supports other studies that found the combination to be beneficial. However, the sodium bicarbonate and hydrogen peroxide combination was not found to be better than using only sodium bicarbonate or hydrogen peroxide alone and, therefore, does not confirm the findings by Miyasaki et al.<sup>3</sup> The results from this study also do not support the studies by Beiswanger et al.,<sup>17</sup> Cerra and Killooy,<sup>18</sup> and Bacca et al.,<sup>20</sup> which found no benefits with the sodium bicarbonate and hydrogen peroxide combination.

## Conclusion

When recommending products to patients, oral health care professionals should be aware that hydrogen peroxide and sodium bicarbonate do affect the growth of *S. mutans*, an effect which may be beneficial to patients concerned with caries and periodontal disease. Hydrogen peroxide may work more effectively by possibly eliminating *S. mutans*, while sodium bicarbonate may only inhibit *S. mutans*. Any products containing either or both of these ingredients could be recommended to patients.

These results were limited because they were studied only in vitro. Results were also limited because of the small sample size. Recommendations for future studies would be to conduct the study in vivo and to have a larger sample and longer experimental time. More studies need to be done on the effects of sodium bicarbonate and hydrogen peroxide to determine their maximum clinical significance.

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## Notes

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## **Assessment of the Alveolar Bone Surrounding the Mandibular Anterior Teeth of Individuals Wearing a Tongue Stud**

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**Purpose.** *One of the latest trends in ornamental body piercing focuses on the oral cavity, with the most common piercing site being the tongue. Oral health care professionals are anecdotally reporting the incidence of radiographically detectable alveolar bone abnormalities surrounding the mandibular anterior teeth in patients who wear tongue studs. This research study was conducted to assess the frequency and extent of bone abnormalities in the supporting alveolar bone adjacent to the mandibular anterior teeth in individuals wearing tongue studs.*

**Methods.** *With the use of convenience sampling, periapical radiographs were taken of the mandibular anterior teeth of individuals wearing tongue studs and compared to the radiographs of individuals who had never worn tongue studs (N = 46). Additionally, a self-report questionnaire was used to gather demographic data on participants and specific information related to their piercings. A periodontist conducted blind evaluations of the radiographs.*

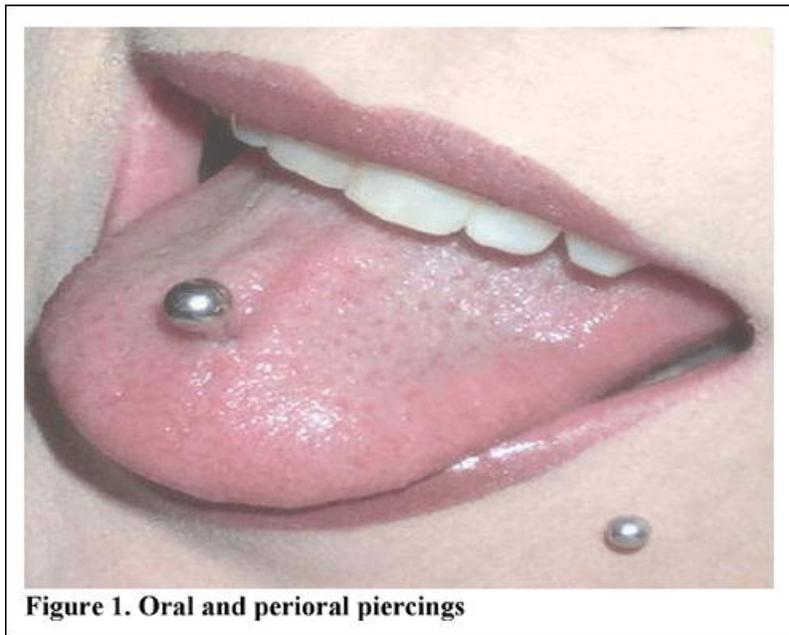
**Results.** *With an alpha level of .05, a one-tailed t test indicated a significant difference between the two groups,  $t_{44} = 1.902$ ,  $P = .032$ . However, the correlation coefficient comparing length of time to presence of alveolar bone abnormalities was 0.216, indicating a weak relationship between the amount of time that the tongue stud had been worn and the development of abnormalities in the alveolar bone.*

**Conclusion.** *These findings indicate that individuals wearing a tongue stud for any length of time are at risk for developing abnormalities in the alveolar bone surrounding the mandibular anterior teeth.*

**Keywords:** Oral piercing, tongue piercing, alveolar bone loss, oral pathology

### **Introduction**

The incidence of ornamental body piercing has increased dramatically in the last decade.<sup>1-11</sup> Recently, much of the focus of body piercing has been in the oral cavity.<sup>2,4-7</sup> The most common oral piercing site is the tongue, with the piercing extending from the dorsal to the ventral surface<sup>2-7</sup> (Figure 1). A small percentage of patients have several piercings, usually one towards the anterior portion of the tongue and the other piercing more posterior.<sup>6</sup> On rare occasions, the piercing is horizontal from one lateral border of the tongue to the other.<sup>3</sup>



**Figure 1. Oral and perioral piercings**

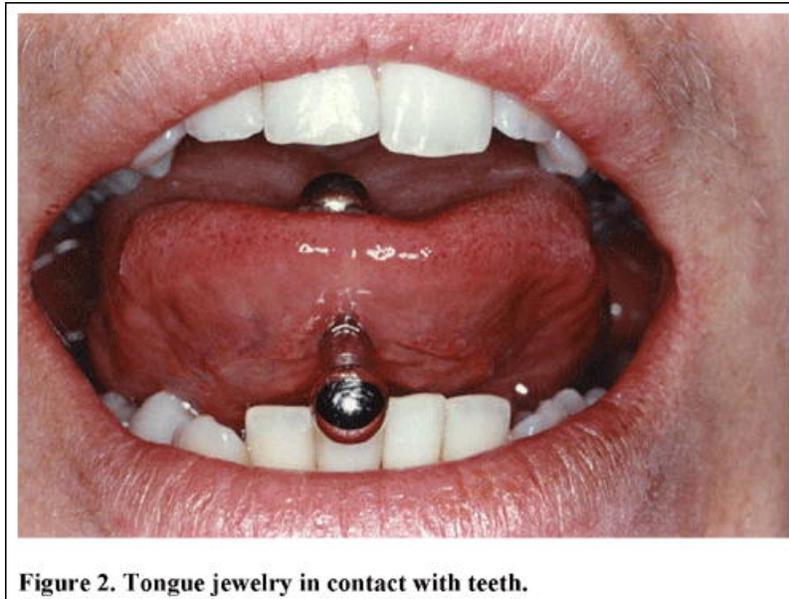
For most patients with oral piercings, oral health care professionals are providing services after the piercings are already in place, with no opportunity to inform the patient regarding the rationale for not having the piercings done. Therefore, the primary focus should be to inform patients about oral hygiene care for the piercing site and tongue jewelry, as well as the possible negative consequences of the piercing. The ideal outcome would be that after patients are informed about the negative consequences of oral piercing, they would choose to remove the tongue jewelry. That is not a likely outcome, however, and the focus of dental hygienists should be on the health of the oral cavity.

## **Review of the Literature**

In recent years, the incidence of oral piercings has increased in popularity.<sup>1-11</sup> Of the oral piercing sites, the tongue is the most common,<sup>2,4-7</sup> with 81% of the piercing sites reported to be the tongue.<sup>7</sup> The majority of information related to oral piercing is observational and anecdotal.<sup>2</sup> Scientific oral piercing information is primarily in the form of case reports.<sup>2,4</sup> Many of these case studies have been published within the last 10 years.<sup>2</sup> Only minimal scientific data from clinical trials related to oral piercing exists in the dental literature.<sup>2,8</sup> Prior to 2002, there did not appear to be any clinical studies that assessed tongue piercing variables in relation to prevalence of oral complications.<sup>5</sup> The adverse effects associated with oral piercing include clinical and systemic complications.

The most prevalent clinical complication of oral piercing is damage to tooth structure<sup>7,9</sup> (Figure 2). Reports of the percentage of patients with chipped or fractured teeth range from 19.2%<sup>5</sup> to 80%.<sup>7</sup> This wide range of difference could be attributed to the differences in data collection methodology. Clinical manifestations that may occur immediately after tongue piercing include pain,<sup>1,2,4,5,7,8,10-13</sup> edema,<sup>1,2,7,8,11,12</sup> swelling,<sup>1,4-6,10,13</sup> and prolonged bleeding.<sup>2-8,11,12-15</sup> In a case report of a healthy 19-year-old female, continuous bleeding following tongue piercing resulted in hypotensive collapse requiring hospitalization.<sup>12</sup> As time progresses, other clinical complications of oral piercing include difficulty in chewing and swallowing,<sup>2,4-7,8,11-14</sup> increased salivary flow,<sup>2-4,7-14</sup> speech changes,<sup>2-4,6,7,10-14</sup> mucosal or gingival trauma or recession,<sup>1-7,9-14,16</sup> galvanic reactions,<sup>2,4,5,9,13</sup> jewelry aspiration or ingestion (resulting in injury to the respiratory or digestive tract),<sup>2-4,6,7,12-14,17</sup> and nerve damage.<sup>3,6,7,12-14,17</sup> Multiple case studies report tongue jewelry becoming embedded in the tissue, resulting in the

necessity of surgical removal of the tongue stud.<sup>3,7,13,18,19</sup> In addition to clinical complications associated with tongue piercing, there are also numerous systemic effects.



**Figure 2. Tongue jewelry in contact with teeth.**

Systemic complications associated with oral piercing include infections,<sup>1-8,10,12-14,17,19</sup> Ludwig's angina (inflammation of the connective tissue),<sup>1-4,6-8,11-13,17</sup> and endocarditis.<sup>2,7,8,11,14,20-22</sup> A correlation based on research has not been established between piercing and endocarditis, but case reports that indicate that a correlation may exist are increasing.<sup>2,8</sup> The National Institutes of Health (NIH) has indicated that oral piercing can be associated with the transmission of hepatitis B, C, D, and G.<sup>2,4,11,14</sup> The development of metal hypersensitivity has also been reported.<sup>2,4,7,8,12-14,17</sup> Infections, Ludwig's angina, and metal allergy reactions can cause swelling severe enough to cause airway obstruction.<sup>2,3,6,12-14</sup> Other case studies report a rare form of tetanus<sup>23</sup> and a cerebellar brain abscess<sup>24</sup> following tongue piercing.

In a recent study by Campbell et al., the effects of the time period of wearing a tongue stud and the length of the tongue stud were evaluated in relation to gingival recession and tooth chipping.<sup>5</sup> Fifty-two adults, with a mean age of 22, were examined clinically for recession on the maxillary and mandibular anterior teeth and chipping anywhere in the entire dentition. Ten (19.2%) subjects had lingual recession on the mandibular anterior teeth. Of the affected teeth, 88% were the mandibular central incisors, with tooth #24 accounting for 53% of affected teeth. Lingual recession on the mandibular central incisors was documented in 50% of the subjects wearing long barbells for two or more years. Tooth chipping was documented in 10 (19.2%) subjects, and only two subjects exhibited both recession and tooth chipping. Ninety-two percent of all chipped teeth were molars and premolars. Of the subjects who had worn tongue jewelry for four or more years, 47% exhibited chipping of molar and/or premolar teeth.<sup>5</sup>

The findings of the above study concur with a 2003 review of case studies, which found that the lingual surfaces of teeth #24 and #25 are the sites of recession most commonly associated with tongue piercing, accounting for 75% of patients examined.<sup>7</sup> Other case studies have reported similar findings. A young female with a tongue piercing presented with gingival recession on the mandibular anterior lingual tooth surfaces, with the recession more pronounced on the lingual surface of tooth #24.<sup>16</sup> Clinical observations of a 22-year-old male revealed that teeth #24 and #25 exhibited recession, 6 mm interproximal probe depths, and radiographic bone loss.<sup>10</sup> A third case study of a young adult with both a tongue and lip piercing reported severe recession and radiographic pathological changes of the periodontium. This case study concluded that "oral body art (piercing) can be hazardous to the periodontium; nevertheless, patients inclined to such practices do not see them as health hazards and are very reluctant to remove them."<sup>25</sup>

Current literature on the negative consequences of oral piercing is presented primarily as informative articles and case studies, with the first medical literature on the subject published in 1992.<sup>12</sup> Literature published from 1992 to 1999 reveals similar findings as previously discussed of possible multiple negative consequences of oral piercing. Although oral health care professionals are anecdotally reporting the presence of radiographically detectable bone loss associated with the wearing of a tongue stud, there have been no clinical research studies on this variable. The purpose of this research was to investigate the prevalence and extent of radiographically detectable osseous deformities in the alveolar bone surrounding the mandibular anterior teeth in individuals wearing a tongue stud.

## **Methodology**

The subjects participating in this study were a convenience sample residing in the Ogden, Utah area. After institutional review board approval, patients receiving services at the Weber State University (WSU) dental hygiene clinic were evaluated for the presence of a tongue stud and offered the opportunity to participate in the study. In addition, subjects were recruited from the WSU campus through promotion of the research in a campus newspaper, flyers on campus bulletin boards, and tabletop signs in areas of student activity. All subjects completed a health history form and interview, and signed a consent form to participate in the study. A self-report questionnaire was used to gather information regarding demographics (age and gender) and specific questions related to their piercings. Specific questions included the length of time that the tongue stud had been worn, how often the tongue stud was worn, and how often the tongue stud was bothersome to the teeth and/or gingiva.

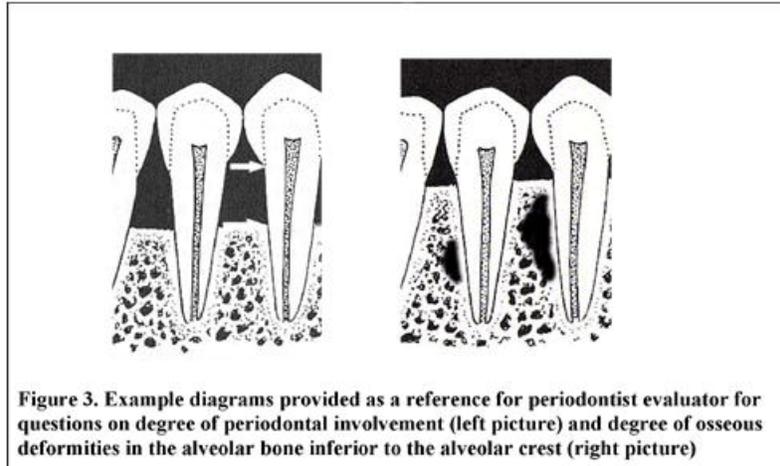
Following completion of the self-reported questionnaire, the oral health care provider (a registered dental hygienist or a dental hygiene student under the supervision of a registered dental hygienist) measured the length of the tongue stud and the diameter of the tongue stud ball with a UNC-12 probe with millimeter markings. Additionally, information was collected by visual examination on the presence or absence of damage to the teeth and gingival tissues. Level of oral hygiene care (good, fair, or poor) was noted for each subject. A periapical radiograph of the mandibular anterior teeth was exposed using double-film packet F-speed (Insight) film. The paralleling technique with the XCP/Rinn film holding device was used for all radiographs. One radiograph was retained for the research data, and the other radiograph was given to patients for their dentists to review and retain. Patients were then given verbal information on oral hygiene care of their piercing area. Verbal information and a two-sided printed handout on the possible negative consequences of oral piercings were given to the patients.

Control group subjects were a convenience sampling of patients who had previously been treated at the WSU dental hygiene clinic and had had a full mouth series of radiographs exposed at a prior appointment. The control group subjects were selected to match the same gender distribution and similar mean age as the experimental group. All control subject radiographs had been taken with the paralleling technique using the XCP/Rinn film holding device and F-speed (Insight) film. The mandibular anterior periapical radiograph of the existing full mouth series was utilized for the control group comparison film.

Following data collection, the radiographs were evaluated by a periodontist in a blind process, so as to not identify subjects by name or status of tongue stud presence. The periodontist evaluated each radiograph on the presence or absence of radiographic calculus, degree of periodontal involvement, and degree of osseous deformities in the alveolar bone inferior to the alveolar crest. For degree of periodontal involvement, the evaluation question asked, "Does the enclosed radiograph show evidence of bone loss in the anterior alveolar bone, as measured from the CEJ [cemento-enamel junction] to the alveolar crest?" The periodontist evaluated for no bone loss (CEJ to alveolar crest = 1.5 mm), minimal bone loss (CEJ to alveolar crest 2-4 mm), moderate bone loss (CEJ to alveolar crest 5-7mm), or advanced bone loss (CEJ to alveolar crest 7 mm).

For degree of osseous deformities in the alveolar bone inferior to the alveolar crest, the evaluation question asked, "Does the enclosed radiograph show evidence of osseous deformities unrelated to periodontal disease as evidenced by radiolucent areas in the alveolar bone, apical to the most coronal portion of the alveolar bone?" The periodontist rated each radiograph as no bone loss or abnormalities observed, minimal evidence to support bone defects apical to coronal bone, moderate evidence to support bone defects apical to coronal bone, or definite evidence to support bone defects apical to coronal

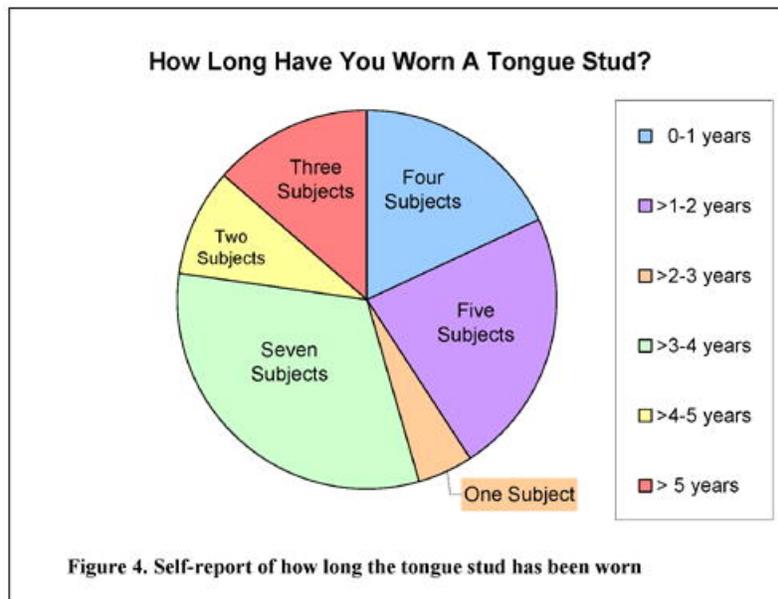
bone. Example diagrams were provided as a reference for degree of periodontal involvement and for degree of osseous deformities in the alveolar bone inferior to the alveolar crest (Figure 3). For both evaluation questions, the periodontist could also evaluate the film as nondiagnostic due to image or shape distortion, density problems (too light or too dark), or other problems that resulted in a nondiagnostic radiograph.



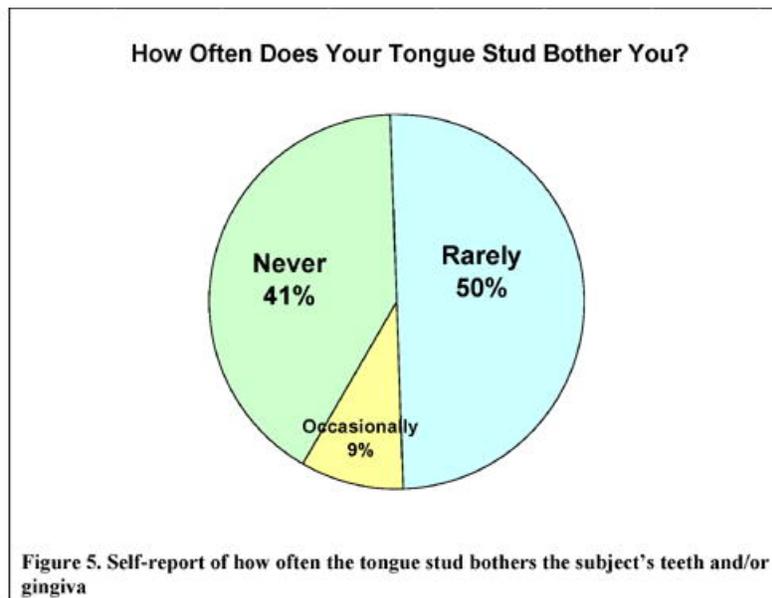
Statistical analysis of data was conducted using Microsoft Excel software (2002, Redmond, WA), and included descriptive, correlational, and independent sample t-test statistics. Descriptive statistics for the experimental group related to the length of time that the tongue stud had been worn, how often the tongue stud was worn, how often the tongue stud bothered the subjects' teeth and/or gingiva, and level of oral hygiene. Correlational statistics compared three variables (the length of the tongue stud, the diameter of the tongue stud ball, and the length of time that the tongue stud had been worn) to presence of osseous abnormalities inferior to the alveolar crest. Independent sample t-test statistics were conducted comparing the experimental group to the control group in relation to presence or absence of mobility, recession, periodontal pocketing, and broken teeth. Additionally, independent sample t-test statistics were conducted comparing the experimental group to the control group in relation to radiographic presence of calculus, periodontal disease, and osseous deformities in the alveolar bone inferior to the alveolar crest.

## **Results**

The experimental group and the control group each consisted of 14 females and nine males, for a total of 23 subjects in each group. The mean age of the experimental group was 23.4 years old, with a range of 18 to 39 years. The mean age of the control group was 23.9 years old, also with a range of 18 to 39 years. Each subject in the experimental group had only one tongue piercing, with none having multiple piercings of the tongue or other oral sites. Descriptive statistics for the experimental group were calculated for the length of time the tongue stud had been worn, how often the tongue stud was worn, how often the tongue stud was bothersome, and level of oral hygiene. The mean length of time that the tongue stud had been worn was 3.36 years, with a range of 0.33 years to 12.50 years. Four subjects had worn the tongue stud for up to one year, five from one to two years, one from two to three years, seven from three to four years, two from four to five years, and three for more than five years (Figure 4). One of the 23 subjects did not respond to the question.



When asked how often the tongue stud was worn, 21 subjects reported that they always wore the tongue stud, one reported wearing it occasionally, and one declined to answer. No subjects reported rarely or never wearing the tongue stud. Descriptive statistics on how often the tongue stud was bothersome revealed that nine (41%) were never bothered, 11 (50%) were rarely bothered, and two (9%) were occasionally bothered (Figure 5). None of the subjects reported that their tongue stud always bothered their teeth and/or gums, and one subject declined to answer the question. For the experimental group, the oral health care provider reported seven subjects having poor oral hygiene (30%), eight having good oral hygiene (35%), and six having excellent oral hygiene (26%). Two were not reported (9%).



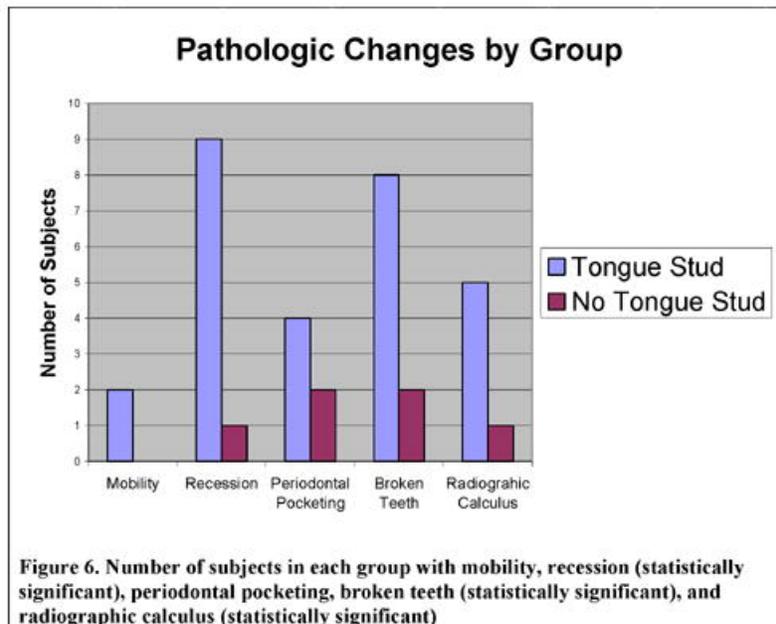
The mean length of the tongue stud was 17.24 mm, with a range of 13.00 mm to 22.00 mm. The mean diameter of the tongue stud ball was 6.19 millimeters, with a range of 5.00 mm to 9.00 mm. The correlation coefficient comparing length of tongue stud to evidence of osseous deformities was 0.152, indicating that there was a very weak relationship between the length of the tongue stud and evidence of osseous abnormalities. The correlation coefficient comparing size of tongue stud ball to evidence of osseous deformities was -0.366, indicating a weak negative correlation between the two variables.

Additionally, a correlation coefficient was calculated comparing the length of time the tongue stud had been worn to evidence of osseous deformities. The correlation coefficient was 0.216, indicating a very weak relationship between length of time the tongue stud had been worn and presence of osseous deformities.

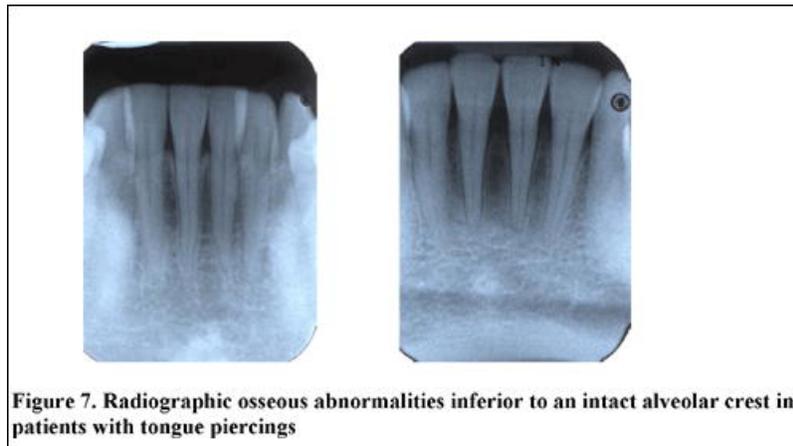
Mobility of the mandibular anterior teeth was documented in two subjects in the experimental group as compared to none in the control group. Mobility data were not available for five subjects in the experimental group and six subjects in the control group. With an alpha level of .05, a one-tailed *t* test for two independent samples indicated no significant difference between the two groups for mobility,  $t_{33} = 1.415$ ,  $P = .0831$ . Recession was noted for nine subjects in the experimental group as compared to one in the control group. Recession data were not available for one person in the experimental group and six in the control group. The *t* test for two independent samples indicated a significant difference between the two groups for recession,  $t_{37} = 2.637$ ,  $P = .006$ .

Periodontal pocketing was documented in four subjects in the experimental group as compared to two in the control group, and broken teeth were noted for eight subjects in the experimental group, as compared to two in the control group. In the experimental group, data were not available for two subjects for periodontal pocketing and one subject for broken teeth. For both variables, control group data were not available for six subjects. A *t* test for two independent samples indicated no significant difference between the two groups for periodontal pocketing,  $t_{36} = 1.184$ ,  $P = .1220$ . However, there was a statistically significant difference between groups for presence of broken teeth,  $t_{37} = 1.770$ ,  $P = .0425$ .

In the blind evaluation by the periodontist, all radiographs were assessed to be diagnostically acceptable. Radiographic calculus was noted for five subjects in the experimental group, as compared to one in the experimental group. A *t* test for two independent samples indicated a significant difference between the two groups for presence of radiographic calculus,  $t_{44} = 1.773$ ,  $P = .0416$ . Figure 6 compares the experimental group and the control group for mobility, recession, periodontal pocketing, broken teeth, and radiographic calculus.



A one-tailed *t* test for independent samples with an alpha level of .05 was conducted to compare the experimental group and the control group for evidence of radiographic bone loss due to periodontal disease. This indicated a significant difference between the two groups for presence of periodontal disease,  $t_{44} = 2.244$ ,  $P = .0149$ . Additionally, a one-tailed *t* test was conducted to compare the experimental group and the control group for evidence of osseous deformities unrelated to periodontal disease as evidenced by radiolucent areas in the alveolar bone inferior to the alveolar crest,  $t_{44} = 1.902$ ,  $P = .0319$ , indicating a statistically significant difference between groups (Figure 7).



## **Discussion**

These results suggest that individuals wearing a tongue stud for any length of time are at risk for development of osseous deformities in the alveolar bone surrounding the mandibular anterior teeth. Current literature portrays tongue piercing as a trend more prominent in young adults, which concurs with the descriptive data of this study. Although the age range of the subjects was 18 to 39 years, the mean age was less than 24. More females than males were subjects in this study, 14 versus nine. Initially, it may appear that more females than males have tongue piercings. However, the difference could be due to the possibility of females seeking oral health care more frequently than males.

Seventeen of the 23 subjects in the experimental group had their piercings for four years or less. This supports the evidence in the literature of the growing trend of oral piercings. Twenty of the 23 subjects reported that their teeth and/or gingiva were never or rarely bothered by their tongue stud. Because of this, many with oral piercings may perceive that there are no negative effects from the presence of an oral piercing. Even if these individuals were informed about the possible pathologic changes, they might feel that the information is not pertinent to their oral cavity. Seventy-one percent of the experimental group were evaluated by the oral health care provider to have good or excellent oral hygiene. Overall, it would appear that most of the subjects with oral piercings practiced adequate oral hygiene. However, as this variable was not defined on the data collection tool, it is subjective and cannot be considered reliable.

The length of the tongue stud had a very weak correlation to the presence of osseous deformities. This may be dissimilar to the results reported in current literature, which found that a long-stem barbell resulted in a significantly greater prevalence of lingual recession. However, when considering the length of the tongue stud and its relationship to osseous changes, the size of the person and/or person's tongue could impact outcomes. If the length of the tongue stud is longer, it may have been due to the fact that the person's tongue is larger and required a longer tongue stud. The diameter of the tongue stud ball also had a very weak correlation to the presence of osseous deformities. The very weak correlation may be indicative of multiple other variables that could result in pathologic alveolar bone changes. The behavior of the person in amount of movement of the tongue stud would impact the degree of pathologic changes. Some people are very aware of their tongue studs, and move their tongues with increased frequency, which results in the tongue stud balls having more contact with adjacent structures. Another additional variable not investigated is the composition of the tongue stud ball. The acrylic tongue stud balls may be less detrimental than stainless steel metal balls to oral structures.

Most importantly, the length of time that the tongue stud had been worn had a very weak correlation to the presence of osseous deformities. One would think that, as the tongue stud was worn for a longer period of time, more alveolar bone abnormalities would be detected, but this did not appear to be the case. This finding conflicts with current literature that found that gingival recession and tooth chipping increased at a statistically significant rate over time. However, statistical analysis for this study on radiographic alveolar bone abnormalities found that the length of time wearing the tongue stud did not appear to be a reliable indicator of possible osseous changes in the mandibular anterior alveolar bone. Inherently, there are many other variables that could impact a person's resistance to pathological changes in the bone, such as the

person's overall health, the strength of the immune system, and the initial anatomical features and quality of the alveolar bone.

A statistically significant difference between groups for recession and broken teeth was observed when the variables for mobility, recession, and periodontal pocketing of the mandibular anteriors and broken teeth in the entire dentition were examined. This supports the current literature reports of a higher incidence of recession and broken teeth associated with the presence of an oral piercing. The experimental group and the control group were statistically different when examining the variables for radiographic presence of calculus and periodontal disease. The higher incidence of radiographic calculus in the experimental group could potentially lead to a higher prevalence of periodontal disease. This difference may be due to multiple variables other than the presence of a tongue stud. However, as the current literature suggests that there is increased salivary flow with the presence of a tongue stud, there is a sequential effect of increased salivary flow leading to increased calculus accumulation, which could lead to an increased incidence of periodontal disease. The variable comparing the experimental group and the control group for evidence of osseous deformities unrelated to periodontal disease as evidenced by radiolucent areas in the alveolar bone inferior to the alveolar crest was statistically significant. There does not appear to be other commonly known variables that would result in this type of pathological change.

There are several weaknesses to this study. Weaknesses include the convenience sampling of subjects selected for the study, as experimental group subjects were specifically recruited to participate in the study, while control group subjects were pulled from existing patient records. The convenience sampling was also from a small geographic area, which could be biased. The sample size was small and limits generalization of the results to a larger population. Additionally, multiple oral health care providers collected the data. Investigators were calibrated with a one-page instructional sheet. Some variables, such as level of oral hygiene, were not clearly defined. If the study were to be repeated, a larger sample from a larger geographic area would be critical in order to increase generalizability of results, fewer and more calibrated oral health care providers should collect the data, and variables should be more clearly defined to lend objectivity to more subjective information. A future study recommendation would be to examine radiographs of the same subjects prior to piercing and subsequent radiographs over time after piercing.

As dental hygienists provide services for an increasing number of patients with oral piercings, they must have current and comprehensive knowledge concerning treatment recommendations, oral hygiene instruction, and patient education on the negative effects of oral piercing. When considering treatment recommendations, radiographic treatment planning should be considered for patients with oral piercings. In the mandibular anterior area and any other areas where negative effects from oral piercing appear to be clinically present, periapical radiographs should be taken. An initial periapical survey of the area should be made to establish baseline alveolar bone characteristics. Regular subsequent repeated film surveys of the involved areas should be exposed. How often subsequent radiographs are exposed would require consideration of the individual's degree of pathology observed with the baseline films. For a patient with obvious osseous involvement, radiographs may need to be taken at six-month intervals, whereas a patient with an appearance of a normal, healthy alveolar bone may have radiographs exposed annually to examine the area. To benefit the patient to the greatest degree for diagnostic purposes, radiographs should be of high quality and exposed with the paralleling technique to minimize distortion. Panoramic radiographs should not be used for this purpose because they lack adequate detail.

Continuing education on oral piercings would be beneficial for dental hygienists. Information on oral hygiene instructions for patients with piercings and the negative effects of oral piercings can be obtained through a variety of methods. The Association of Professional Piercers (APP) has a brochure available on care following tongue piercing. The brochure can be accessed and printed at [http://www.safepiercing.org/PDFs/aftercare\\_oral.pdf](http://www.safepiercing.org/PDFs/aftercare_oral.pdf). The American Dental Association (ADA) has a one-page color handout to utilize for patient education on the negative effects of oral piercing. The handout can be viewed and printed from the ADA Web site at [http://www.ada.org/prof/resources/pubs/jada/patient/patient\\_04.pdf](http://www.ada.org/prof/resources/pubs/jada/patient/patient_04.pdf). Adobe Acrobat or Adobe Acrobat Reader is required to download both of the above publications.

The Academy of General Dentistry (AGD) has two patient handouts on the topic of oral piercing. The first handout, "To Pierce Or Not To Pierce," is for the non-pierced patient who is considering tongue piercing. It emphasizes the oral implications of tongue piercing. This handout can be viewed and printed from the AGD Web site at <http://www.agd.org/consumer/topics/piercing/tongue.html>. The second handout, "So You Want To Pierce Your Tongue," details oral complications and discusses oral hygiene care for the piercing area and available at <http://www.agd.org/consumer/topics/piercing/main.html>. Jordan and Stein<sup>3</sup> recommend that patients treat tongue jewelry

like orthodontic appliances, avoiding hard, sticky foods and cleaning the barbell after each meal by removing and brushing it. Additionally, if an individual with a tongue stud participates in sports activities, an athletic barbell made of resin is recommended. A better option for sports participation would be removal of the tongue stud during the activity.<sup>26</sup>

## **Conclusion**

This study supports the hypothesis that patients who wear tongue studs for any length of time have an increased risk of osseous deformities in the alveolar bone surrounding the mandibular anterior teeth. Considering this and the other known pathologic consequences of oral piercing, dental hygiene professionals must be knowledgeable to provide the highest quality of care for patients with oral piercings. Ongoing radiographic analysis of the alveolar bone is important for oral piercing patients. Patients must be informed that wearing a tongue stud for even a short time may place the supporting structures of their mandibular anterior teeth and other affected areas at risk.

Dental hygienists should be aware of the increasing occurrence of oral piercing and its health implications. Oral health care providers have an ethical responsibility to be current in knowledge that will assist all patients in attaining optimum oral health. Patients, especially those who are in their adolescent, teen, and young adult years, need to be informed of potential complications and dangers associated with oral piercings and how to maintain their pierced areas. Dental hygienists must have a goal of enabling patients who choose not to remove their oral piercings to attain the healthiest level possible of oral health. The ultimate goal is to inform patients prior to the oral piercing so that more make the choice not to pierce or, if pierced, choose to remove their piercing for their future oral health.

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## **Notes**

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## **Development and Evaluation of a Tobacco Cessation Motivational Program for Adolescents Based on Physical Attractiveness and Oral Health**

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***Purpose.*** Little is known about how to motivate youth to participate in smoking cessation programs. This paper reports an investigation of the feasibility and acceptability of an intervention that used vanity and oral health issues associated with tobacco use to motivate adolescent tobacco users to enter a school-based tobacco cessation program.

***Methods and Materials.*** Sixty-four continuation high school students aged 14 to 19 (31% female) and living in rural California participated in a youth-oriented, vanity and oral health-focused intervention designed to motivate tobacco users to join a six-week tobacco cessation group.

***Results.*** Following the intervention, 21 of 37 (57%) regular smokers signed up for the cessation program. Of these smokers, seven (33%) did not indicate on the baseline questionnaire any desire to quit smoking. Of the 21 smokers who signed up to participate in the cessation program, 16 (76%) actually participated (10 males and six females), eight (50%) completed all treatment sessions, and four (25%) reported that they quit smoking at the end of the program.

***Conclusions.*** Overall program evaluations were very favorable. Findings were interpreted to provide support for the feasibility and acceptability of using physical appearance and oral health-oriented programs to motivate adolescent tobacco users to enter school-based cessation programs. Further study is needed to determine the effectiveness of such programs.

**Keywords:** Adolescence, smoking cessation, recruitment strategy, adolescent health, addiction

### **Introduction**

Adolescence is the primary time during which cigarette smoking is initiated and during which the transition from experimentation to some level of dependence occurs. It has been estimated that 65% to 70% of adolescents will try smoking before they finish high school, more than a third will become daily smokers, and almost one quarter will become nicotine dependent. It is well documented that the vast majority of adult smokers began smoking by the age of 18. Given the association between smoking in adolescence and resulting health problems in adulthood, initiation and maintenance of

smoking during adolescence represent a genuine public health concern. The need for effective interventions to prevent the transition from youthful smoking to adult smoking was clearly indicated by the 1994 surgeon general's report.<sup>3</sup> Sussman and colleagues point out that, among reported cessation and prevention programs, adolescent cessation rates are about twice the rate of naturally occurring quit rates (3% to 8%). More advanced scientific work, however, needs to be undertaken in the area of adolescent tobacco use cessation research because most reported cessation studies used single group designs with no control group.<sup>1,4</sup>

Among the challenges of tobacco research is that of motivating adolescent tobacco users to quit.<sup>5</sup> Feedback from focus groups of high school smokers indicates that most are not thinking about quitting, interested in quitting, or planning to quit. These findings suggest that cessation programs need to devote substantial effort to attract adolescent smokers.<sup>6,7</sup> Appealing and meaningful motivational strategies for adolescents are needed.

Common health concerns reported by adolescents include those related to appearance (height, weight, acne) and dental problems.<sup>8,9,10,11</sup> Across studies, adolescents consistently rank dental concerns and oral health as being of great importance.<sup>9,10</sup> <sup>12</sup> In a seven-year cohort study of 2,406 sixth graders in two communities who were followed annually through the 12th grade, physical appearance was found to be the most valued characteristic and the only one that grew in importance over time.<sup>13</sup> In addition, four focus groups of high school smokers (aged 14 to 18), with six to 11 participants each, identified aesthetic problems such as bad breath, foul-smelling clothes and hair, yellow fingers, and "it looks gross," as major disadvantages of their smoking.<sup>14</sup> Moreover, in a spit (smokeless) tobacco cessation study of 1,085 male high school baseball athletes, 92% of the subjects in the intervention group rated the showing of slides of graphic facial disfigurement associated with the surgical treatment of oral cancer as a very important component of the intervention.<sup>15</sup> These research findings suggest that addressing tobacco cessation in the context of physical appearance and oral health may motivate adolescents to make an attempt to quit their tobacco use. To gather data on that hypothesis, we developed an intervention to motivate adolescent tobacco users to enter a school-based cessation counseling program and evaluated it for feasibility and acceptability in a sample of high school students. The purpose of this paper is to report the intervention development process and the results of that pilot study.

## **Methods and Materials**

Researchers at the University of California in San Francisco (UCSF) contacted the tobacco use prevention coordinator at the Office of Education in Lake County, California, to inquire about the use of tobacco among high school students in Lake County. The prevention coordinator reported that a 2000 Lake County Office of Education survey of a representative sample of middle school and high school students (N = 924) revealed that 60% of the respondents had tried smoking and 36% were self-reported regular smokers. In addition, 31% of respondents reported having tried spit tobacco (oral snuff and chewing tobacco), and 14% of males reported dipping or chewing within the last 30 days.

To address the need for effective tobacco cessation intervention strategies for adolescents in Lake County, a collaborative research partnership was formed among researchers at UCSF and staff at the Lake County Office of Education, the Lake County Health Services Department of Public Health, and Carle High School in Lake County. In 2001, that partnership received a Community Academic Research Award from the Tobacco-Related Disease Research Program of the State of California. The purpose of that award was to develop and pilot test for feasibility and acceptability an intervention that emphasized the effect of tobacco use on physical attractiveness and oral health. The goal of the intervention was to motivate adolescent tobacco users to enroll in an existing state-funded, school-based tobacco cessation program and to stop their tobacco use. In addition, the intervention would apply a public health perspective to promote behavioral change by bringing the program to all adolescent tobacco users in their school environment, using student peers and the county public health school nurse in its delivery. The school nurse was chosen as an interventionist because, in rural areas of California, school nurses provide all school-based health screenings and coordinate student health care. Once developed, the intervention was to be evaluated among a sample of adolescents attending high school in rural Lake County. Development of the intervention involved the following:

### **Student Feedback**

We contacted three high schools in Lake County, California, and gained permission from the principals to recruit students to complete a questionnaire about tobacco use and to participate in focus groups. The purpose of the questionnaire was to gain insight about adolescent tobacco use by collecting pilot data on reasons for use, experience with withdrawal symptoms, reasons for relapse, and perceptions about factors that would motivate smokers to attempt to quit. The purpose of the focus groups was to gain feedback regarding the feasibility and acceptability of a proposed tobacco cessation recruitment intervention that consisted of the following: 1) digital photography and "special effects" software to simulate facial wrinkling or disfigurement due to smoking and oral cancer, respectively; 2) an analysis of facial skin and fingernail care, advice that smoking causes facial wrinkling and stains fingers and fingernails, and referral to cessation counseling; and 3) an oral cancer screening by a school nurse trained by a dental hygienist to point out tobacco-related dental staining and soft tissue changes in students' mouths, relate tobacco use to halitosis and oral cancer, advise tobacco users to quit, and refer them to a school-based tobacco cessation counseling program.

After receiving positive parental consent, we conducted 20 gender-specific and tobacco use status-specific focus groups with 139 high school adolescents, aged 16 to 19 (69 males and 70 females). The sample included 71 current tobacco users (53 smokers and 18 spit tobacco users), 37 former tobacco users (34 former smokers and three former spit tobacco users), and 30 who had never used tobacco. At the beginning of the focus groups, all students completed the questionnaire on tobacco use.

### **Questionnaire Assessment**

To inform intervention development, the questionnaire assessed tobacco use status, reasons for smoking, sensations experienced when unable to smoke, reasons for relapse after quitting, and factors that might motivate a quit attempt. Current tobacco use was defined as use within the last 30 days. Reasons for smoking were determined by providing a list of possible reasons and asking subjects to indicate how important each was in explaining why they smoked (four possible response options, ranging from "not at all" to "very much so"). Sensations experienced when unable to smoke were assessed by providing a list of possible sensations and asking if each was experienced when unable to smoke due to either restrictions on smoking, or because they were trying to quit (response options were "yes" or "no"). Reasons for relapse were assessed by providing a list of reasons and asking whether or not each was a reason why they started to use tobacco again after making an attempt to quit (response options were "yes" or "no"). Perceived factors that would motivate quit attempts were assessed by providing a list of situations and asking each subject to indicate if any would motivate a quit attempt in the next three weeks (response options were "yes" or "no").

Although all students completed the questionnaire, findings are reported only for smokers because they made up the largest group of tobacco users and those most relevant to intervention development. "Tension reduction" and "cravings" were the main reasons reported for smoking (Table I), and "boredom," "personal problems," "desire for tobacco," and "withdrawal symptoms" were the most common reasons reported for relapse (Table II). Table III shows reported sensations experienced when smokers were unable to smoke. All of these findings suggested that many high school adolescents who smoke are nicotine-dependent, and that discussion of the nature of nicotine addiction and ways to cope with nicotine withdrawal needed to be included in our intervention.

**Table I. Mean scores indicating extent of importance of reasons for smoking (N = 53 smokers)**

	Smokers' mean score
Tension reduction	2.48
Cravings	1.62
Pleasure/relaxation	1.11
Habit	1.05
Weight concerns	0.94
Social	0.83
Stimulation	0.83
Handling	0.73

Composite scale, range 0 to 3: 0 = "not at all," 1 = "a little," 2 = "quite a bit," 3 = "very much so"

**Table II. Percentage of smokers reporting specific reasons for relapse (N = 53)**

	Smoker %
Boredom	70
Personal problems	68
Desire for tobacco remained high	66
Withdrawal symptoms	62
Enjoyed tobacco too much and found no good substitute	56
Pressure from friends to start again	48
Concern about gaining weight	22
Actual weight gain	22

Response options were "yes" or "no"

**Table III. Percentage of smokers reporting sensations experienced when unable to smoke (N = 53)**

	Smokers %
Irritability/frustration/anger	85
Depressed mood	74
Difficulty concentrating	71
Anxiety	69
Restlessness	62
Trouble falling asleep	53
Loneliness	42
A racing heart	40
Headaches	40
Increased appetite/weight gain	37

Response options were "yes" or "no"

With regard to perceived motivational factors related to making a quit attempt, most smokers reported that believing that smoking is related to premature facial wrinkling, sexual impotence, gum disease, facial disfigurement, a funny-sounding voice, and/or cancer would motivate them to try to stop smoking. These findings were consistent with feedback received from focus groups described below. Some smokers also identified tobacco-stained teeth, bad breath, a free quit program, and a special girlfriend or boyfriend asking them to quit as factors that also might motivate them to quit. Very few identified friends in general asking them to quit, or the harmful effect of cigarette smoke on the health of others close to them, as reasons that might motivate them to quit (Table IV).

**Table IV. Percentage of smokers reporting factors that would motivate quit attempts (N = 53)**

	Smokers %
Facial disfigurement	89
Gum disease	87
Lung or mouth cancer	81
Sexual impotence	79
Stomach ulcers	74
Facial wrinkling	73
Harmful to others	72
Infertility	66
Changes in voice	65
Free quit program	59
Girl/Boyfriend asking to quit	58
Bad breath	55
Stained teeth	53
Coughing	46
Friend asking to quit	17

Response options were "yes" or "no"

### ***Student Focus Groups***

Content analyses conducted on the qualitative focus group data identified the following themes related to the proposed intervention components. Most participants believed that a mouth examination was a good way to highlight tobacco-related adverse health and cosmetic effects on teeth, oral tissues, and breath. Most believed it would be a good strategy to motivate tobacco users to make a quit attempt. A large number of smokers, however, reported that loss of confidentiality and the embarrassment of having an oral cancer screening in front of one's peers would be major barriers to participation. To counteract these barriers, participants unanimously recommended that all students, tobacco users and nonusers alike, participate in not only the mouth exam, but also in all components of the recruitment program. Most participants strongly felt that singling out tobacco users would be too uncomfortable and embarrassing for them. Interestingly, the male students were as enthusiastic as the female students about having skin care information offered as part of the recruitment program. All students supported the use of computer simulation to morph digital images of students and recommended that color printouts be given to each student.

With regard to incentives to encourage participation in the recruitment program, students made the following suggestions: Refer to the recruitment program as a "Tobacco and Health Fair," rather than as a tobacco cessation recruitment program; implement the program during school hours; offer credit toward a required class for attendance; use advance, positive advertising to highlight the fun of participation; and offer free toothbrushes, skin care products, and nicotine gum and patches. These findings are consistent with those reported by others and were incorporated into the motivational intervention scheduled for pilot testing.<sup>7</sup>

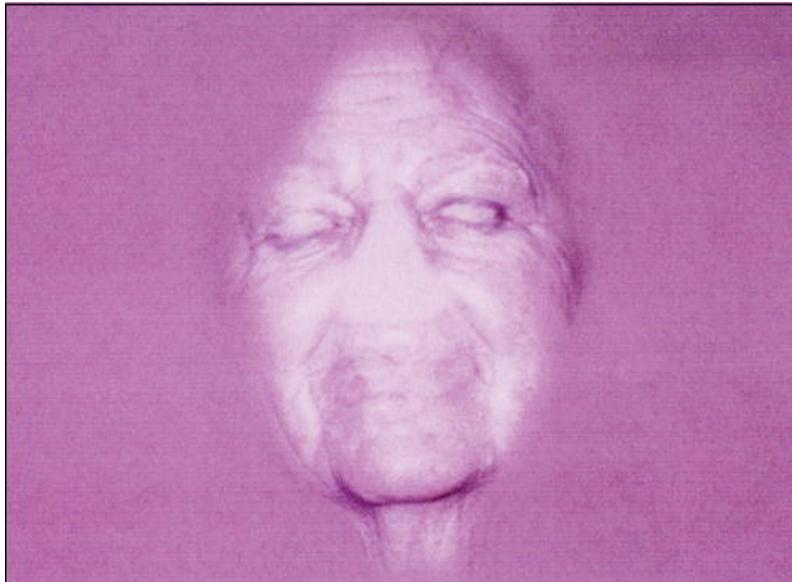
### ***Nurse Focus Group***

Because the infrastructure for school nurse delivery of school-based health screenings and health care is already in place in rural California counties, we contacted the director of the County Nurse Program at the Lake County Department of Health Services to obtain permission to recruit nurse-employees to participate in a focus group to inform our intervention development. The purpose of the focus group was to gain feedback on the feasibility and acceptability of the proposed school-based tobacco cessation recruitment program that would involve county-employed school nurses. As part of the focus group experience, a study investigator who is a dental hygienist explained that a component of the proposed intervention involved school nurses conducting oral cancer screenings of students and educated the nurse participants on the study's oral cancer screening protocol. In addition, the dental hygienist explained that, as part of the oral cancer screening process, the nurses also would be required to ask about tobacco use, point out any tobacco-associated problems in the students' mouths, advise users to quit, and refer them to the schools' tobacco cessation treatment program. Feedback from the six public health nurses who participated in the focus group revealed that the nurses would be willing to implement the oral cancer screening protocol if they received detailed training with continuing education credits at no cost to them. In addition, all participants indicated they would need administrative support, and some stated they would need additional funding for time spent. The nurses identified positive parental consent as a significant barrier to student participation. They recommended the use of a passive parental consent process, given that oral cancer screenings are relatively non-invasive compared to other screening procedures performed by school nurses that required only passive parental consent (e.g., scoliosis examinations). Based on feedback from this focus group, we developed a training manual and videotape for school nurses and trained a school nurse to assist with pilot testing the oral cancer screening component of the proposed tobacco cessation recruitment intervention.

### ***Collaboration with High School Computer Technology Faculty and Students***

We collaborated with faculty and students from the Carle High School computer technology educational program in Lake County to develop a "special effects" computer program. The objective of this program was to "morph" digital photographs of students to simulate facial wrinkling associated with smoking and facial disfigurement associated with oral cancer from tobacco use. A study investigator who is a plastic surgeon provided prototype photographs of facial wrinkling, and other UCSF investigators provided prototype photographs of facial disfigurement due to oral cancer. Using these photographs, Carle High School faculty and students using Adobe Photoshop 6.0 (Adobe Systems, Inc., San Jose, CA) created a digital facial wrinkling overlay, or mask, to be placed on digital photographs of students to simulate facial wrinkling (Figure 1). Figure 2 and Figure 3 show the resultant product. An overlay of facial disfigurement due to oral cancer also was created

in a similar fashion. Figure 4 shows the "morphed" photograph when the facial disfigurement overlay is placed on a student photograph, allowing students to see potential effects of tobacco use on their own facial appearances.



**Figure 1.** A digital facial wrinkling overlay, or mask, that was placed on digital photographs of students to simulate facial wrinkling.



**Figure 2.** Photograph of a student prior to placement of the digital overlay to simulate facial wrinkling.



**Figure 3.** Photograph of student in Figure 2 after placement of the digital overlay to simulate facial wrinkling.



**Figure 4.** Photograph of a student after placement of the overlay simulating facial disfigurement due to oral cancer.

### ***Collaboration with Clinique Skin Care, Inc., and Local Cosmetology Students***

A member of the investigative team contacted staff at Clinique Skin Care, Inc. (New York, NY), to obtain a diagnostic chart for determining skin care products to recommend for use. Clinique, Inc., also donated skin care products, including sunscreen, to pass out as free samples as part of the recruitment program. After developing a training manual for the skin and nail care interventionists, a member of the investigative team from Lake County Office of Education contacted a local cosmetology educational program and recruited three students to participate as skin and nail care interventionists in the planned pilot study of the recruitment program. These cosmetology students were trained in the study protocol by investigators in a one-hour session. The focus of the skin and nail care training was to prepare them to ask about tobacco use, to inform participants that smoking causes premature facial wrinkling and discolored fingernails, to advise users to quit, and to refer them to the school-based group cessation program. In addition, these cosmetology students were trained to ask students specific questions to determine areas of facial skin that were oily or dry and how often sunscreen products were used. Based on responses obtained, the cosmetology students used the Clinique, Inc., diagnostic chart to recommend appropriate products and distribute samples of recommended products.

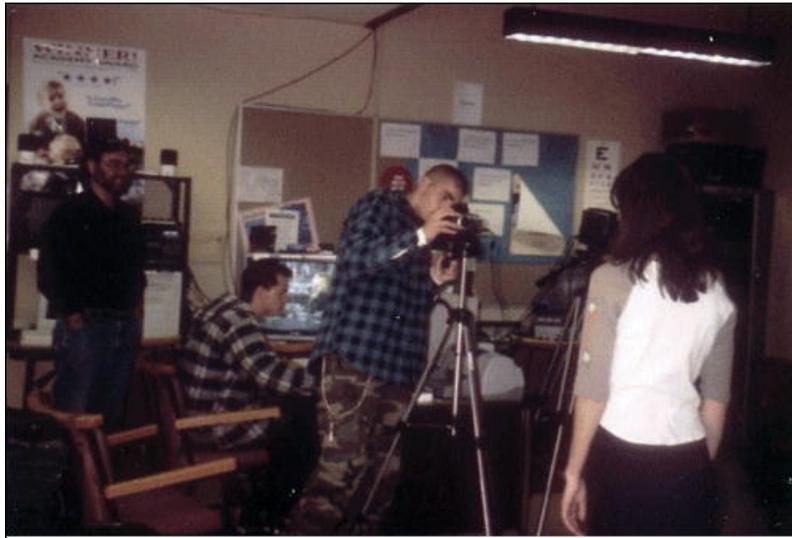
### ***Pilot Testing for Feasibility and Acceptability***

After refining our motivational intervention based on questionnaire and focus group feedback, we contacted the principal of one Lake County High School to gain permission to pilot test our recruitment intervention for feasibility and acceptability at the school. All enrolled students with parental consent were eligible to participate in the "Tobacco and Health Fair" (described below) conducted from 9 a.m. to noon on one school day in an available school classroom. Students moved through the program at their own pace within the allotted time period. All consenting, eligible students were released from class to participate and completed a baseline questionnaire to assess demographics, tobacco use, and interest in quitting. Upon completion of the motivational intervention, an exit questionnaire was administered to each participant to determine acceptability of the program. In addition, any tobacco users interested in participating in the school-based group cessation program wrote their name on a sign-up sheet. One week later, tobacco users who had indicated interest in participating in the group cessation counseling program were contacted and assigned to a cessation group that met for an hour once a week for six weeks. At each session, attendance was taken and group participants reported their tobacco use status to the group leader, who was a trained tobacco cessation counselor.

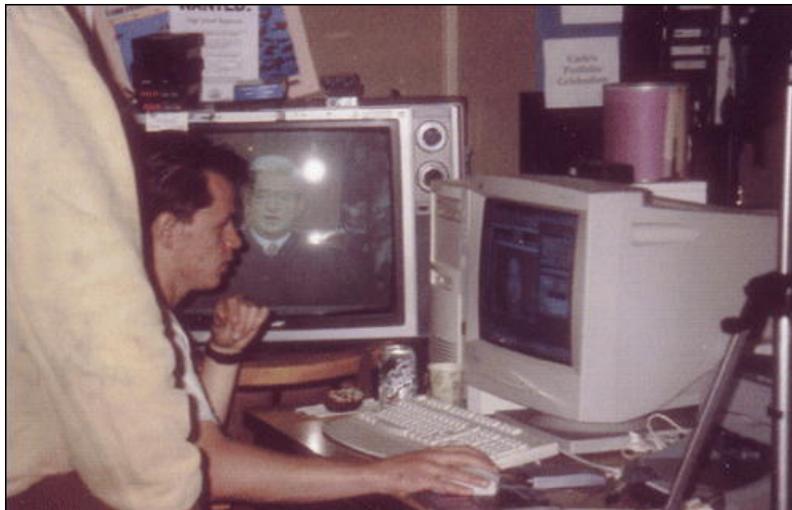
### ***The Motivational and Recruitment Intervention***

The motivational intervention to recruit tobacco users into a school-based cessation counseling program was framed as a tobacco and health fair. The intervention targeted all students-tobacco users and non-users alike and included the following three components:

**Computer Simulations.** Computer technology was used to simulate facial appearance changes related to tobacco use and oral cancer. A student from Carle High School in Lake County took a digital photograph of each student participating in the "Tobacco and Health Fair" at the pilot high school. Then, within four minutes, he morphed the student's picture to simulate facial wrinkling from smoking, or facial disfigurement from oral cancer (Figure 5, Figure 6). Upon completion of the morphing process, a hard copy of the morphed photograph was printed in color and given to each student.



**Figure 5.** Student taking a digital photograph of participant at “Tobacco and Health Fair.”



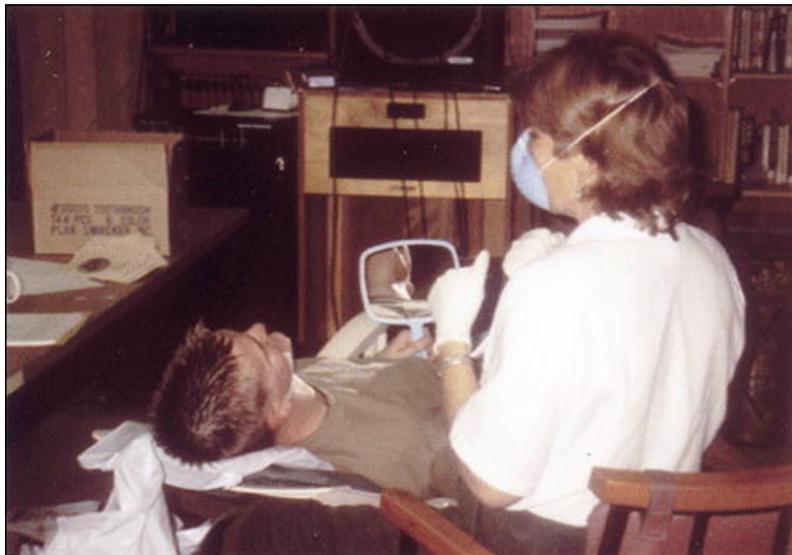
**Figure 6.** High school student using Adobe Photoshop to morph digital images of students to illustrate premature facial wrinkling and skin aging associated with smoking.

**Facial Skin and Fingernail Care Analysis.** Three college-age cosmetology students from Lake County performed a simple analysis of facial skin type and fingernail care and provided free samples of suggested appropriate skin care products donated by Clinique, Inc. (Figure 7). In addition, they advised users to quit tobacco use to avoid facial wrinkling, yellowing of fingernails, and staining of fingers.



**Figure 7.** Cosmetology students counseling pilot high school students.

**Oral Cancer Screening.** A county school nurse conducted an oral cancer screening on each participant. She pointed out any tobacco-related problems in students' mouths, such as soft tissue changes, tooth discoloration, and halitosis. Non-users of tobacco were encouraged to remain tobacco-free. Tobacco users were advised to stop all forms of tobacco and were referred to the school-based cessation group for assistance with quitting. The nurse explained that nicotine is an addictive drug, and nicotine withdrawal symptoms often make it difficult to quit without help (Figure 8).



**Figure 8.** Public health school nurse performing oral cancer screening on a pilot high school student prior to giving cessation advice and offering assistance.

### ***The Tobacco Cessation Counseling Program***

This program targeted only tobacco users and consisted of a group tobacco cessation program that was conducted one hour per week for six weeks by a local tobacco cessation counselor. Sessions included identifying reasons for quitting, self-monitoring of tobacco use and associated moods and severity of cravings, replacing rewards that students received from nicotine with other pleasant activities, and "talking back" to harmful thoughts.<sup>17</sup> Each session provided tools for

self-monitoring of behaviors to help participants internalize cognitive and behavioral coping strategies taught. Additionally, nicotine addiction was discussed and students were helped to set a quit date and make a plan for quitting (e.g., switching to lower nicotine content brands, cutting back to half the usual amount, practicing going without tobacco at a few favorite times). At each session, those who had stopped tobacco use were praised and reminded of how many days they had been abstinent. Strategies used to cope with nicotine withdrawal and problems experienced were discussed. Those who had slipped were reminded that most people do not always stop on their first attempt, were helped to identify why they slipped and what they could do to avoid slipping in the future, and encouraged to get back on track. If a full relapse occurred, the group facilitator encouraged a new quit date and plan and offered support.

## Results

### *Subject Characteristics*

Table V presents the demographics and smoking status of the 64 students who participated in the "Tobacco and Health Fair" to recruit smokers to participate in a tobacco cessation counseling program. The majority were white (77%), followed by American Indian (13%) and Hispanic (6%); about one third were female, and three quarters of the participants had some history of smoking. Overall, the prevalence of current smoking was 58%, with 67% among whites and 27% among ethnic and racial minority groups. A higher percentage of females participating in the study smoked than males (70% vs. 52%) (Table VI).

**Table V. Demographic and smoking status characteristics of high school students participating in the pilot test of the intervention (N = 64)**

<b>Ethnicity</b>	<b>% (n)</b>
African American	3 (2)
American Indian	13 (8)
Asian American	2 (1)
Hispanic	6 (4)
White	77 (49)
<b>Gender</b>	
Male	69 (44)
Female	31 (20)
<b>Smoking Status</b>	
Current	58 (37)
Former	17 (11)
Never	25 (16)

**Table VI. Prevalence of smoking overall and by ethnicity and gender among students completing an exit questionnaire after the intervention pilot test (N = 64)**

	<b>% current smokers (n)</b>
<b>Overall</b>	58 (37)
<b>Ethnicity</b>	
African American	0 (0)
American Indian	25 (2)
Asian American	0 (0)
Hispanic	50 (2)
White	67 (33)
<b>Gender</b>	
Female	70 (14)
Male	52 (23)

**Acceptability of Program**

Table VII shows student evaluation of the usefulness of the various components of the motivational and recruitment intervention. Of the responding 61 students, 48% (n = 29) identified the oral cancer screening as the most useful part of the program; 28% (n = 16) identified the computerized morphing simulations; 20% (n = 12) the skin and nail care analysis; and 5% (n = 3) identified a combination of the components. Interestingly, 26% of males compared to only 6% of females identified the skin care analysis as the most useful component. A slightly higher percentage of females (39%) than males (23%), however, cited the simulated photography as the program's most useful component.

**Table VII. Percentage of students evaluating components of the recruitment intervention as "most useful" overall and by gender**

	Most useful part of the program			
	Oral cancer screening % (n)	Morphing simulation % (n)	Skin care % (n)	Other* % (n)
<b>Overall</b> (N=61)	48 (29)	28 (17)	20 (12)	5 (3)
<b>Females</b> (N=18)	50 (9)	39 (7)	6 (1)	6 (1)
<b>Males</b> (N=43)	47 (20)	23 (10)	26 (11)	5 (2)

\* Combinations of the three other components

Table VIII shows the percentage of students by smoking status who agreed with statements about the recruitment program (five response options ranging from "strongly agree" to "strongly disagree"). More than two thirds of all non-smokers, former smokers, and current smokers agreed that they would recommend this program to other students. More than half of all respondents agreed they were going to tell other smokers about the program, and that they learned about side effects of tobacco use that they previously did not know. Among smokers, 70% indicated that the program made them "start to think about quitting smoking," 49% agreed that they "would like more information about quitting smoking," and 43% indicated they would "like help to quit smoking." Only 7% of all respondents thought "the program was a waste of time," and 14% indicated they learned nothing from the program.

**Table VIII. Percentage of students who “strongly agree” or “agree” with statements related to the recruitment program**

STATEMENT	Non Smoker N=15 %	Former Smoker N=8 %	Current Smoker N=37 %	All N=60 %
I would recommend this program to other students	87	88	76	80
I am going to tell other smokers about this program	60	88	65	67
I learned about some side effects of tobacco use that I didn't know before	73	63	65	67
I learned useful information from the oral exam portion of the program	80	75	65	70
I learned useful information from the skin care portion of the program	80	88	57	67
I learned useful information from the photography/computer simulation portion of the program	60	75	49	55
I did <u>not</u> learn anything from this program	7	13	14	12
I think this program is a waste of time	7	0	8	7
This program has made me start to think about quitting smoking	n/a	n/a	70	70
I would like more information about quitting smoking	n/a	n/a	49	49
I would like help to quit smoking	n/a	n/a	43	43

### ***Feasibility of the Program***

Of the 37 regular smokers attending the recruitment intervention, 21 (57%) signed up to participate in the cessation program and were assigned to one of three cessation groups of seven to eight students that met once a week for six weeks. Included among these students were seven (33%) regular smokers who did not indicate on their baseline questionnaire that they had any desire to quit smoking. Of the smokers who enrolled, 16 (65%) actually participated (10 males, six females) in the cessation program, eight completed all sessions, and five reported that they had quit smoking at the end of the six-week program. Although the group cessation program appeared to be well received by the students and group leader, feedback from students indicated that a three-week cessation program that met twice a week for one hour would be preferable in the future.

### **Discussion**

Results from this developmental study of a youth-oriented tobacco cessation recruitment program support the feasibility and acceptability of using vanity and oral health issues associated with tobacco use to motivate adolescents who smoke to enter cessation treatment. A dental hygienist trained a school nurse on how to conduct an oral cancer screening and how to use that process as a teaching moment to promote tobacco cessation. Dental hygienists are in an ideal position to take a leadership role in this type of motivational intervention, either by directly providing oral cancer screenings or by training other health care providers, such as school nurses, to deliver the oral cancer screening component of the intervention. This latter strategy is consistent with the 2000 surgeon general's report on oral health in America, which emphasizes the lack of access to oral health care for many in the United States and the need to develop practical solutions.<sup>18</sup> The school nurse was selected as an interventionist for this pilot because of the existing county school nurse program in rural areas of

California and the potential for that program to incorporate the proposed motivational intervention on an ongoing basis. Rural school nurse programs established in many rural counties provide an excellent infrastructure for properly trained nurses to sustain ongoing promotion of tobacco cessation in the context of providing oral cancer screenings. Although county school nurses in rural areas may visit high schools on a monthly basis only, many students could be exposed to their cessation assistance over time.

Approximately half of the smokers in this pilot study who attended the health fair signed up for (57%) and attended (43%) the school-based group cessation program. Eighty percent of all participating students and 76% of smokers agreed they would recommend the program to other students. In addition, 93% of participating students agreed that the time spent at the health fair was useful. These results, although preliminary, suggest that using vanity and oral health issues to recruit high school smokers to participate in school-based tobacco cessation programs may be an effective approach. Further strengths of this program are the direct access to the high-risk target population through high schools, the responsiveness of the proposed program to needs expressed in focus groups of tobacco-using adolescents, and public health nurses who serve the school system. Further research to determine the effectiveness of this innovative recruitment strategy for adolescents is warranted.

Cause for concern, however, can be found in the low proportion of users who were actually tobacco free (25%) at the end of the six-week counseling program. In addition, eight students (50%) dropped out as the study progressed. Perhaps it is too much to expect that a strictly behavioral program would result in high quit rates among adolescents, given the experience with withdrawal symptoms reported on our questionnaire by focus group participants. We did not include nicotine replacement therapy due to cost and to published findings suggesting that teens need more behavioral consulting than adults.<sup>19</sup>

Another possible explanation for the lack of higher quit rates is that perhaps not all students who enrolled in the program may have been highly committed to quitting. The fact that students were given release time from classes may have enticed some students to enroll in the cessation counseling program who were not really ready to quit. Level of commitment of adolescents to cessation programs entered needs to be further studied. The design of future school-based tobacco cessation interventions for adolescents in general may need to take this lower level of commitment into consideration.

Several limitations of the present study must be considered when interpreting the present data. First, there was no control group; thus, one cannot view the present results as evidence for intervention efficacy. The outcomes reported are encouraging, however, and deserve further investigation. Second, the small sample size dictated limited data analysis and power for detecting significant differences. Nevertheless, the results that did emerge in the present study can serve to guide future research directions. Third, the fact that students were given release time from classes and course credit for program involvement, both for the recruitment program and for the cessation counseling, may have been mediating factors that enticed some students to participate. Our findings may not be transferable to students in high schools unwilling to offer credit toward course requirements and/or to give up class time to implement the programs. According to student feedback in our focus groups, implementing the recruitment and the counseling programs during school hours is important for motivating adolescent students to take advantage of assistance offered. Future studies should compare the effects of our youth-oriented recruitment program on student participation in tobacco cessation counseling programs when offered during and outside of class time and with and without the incentive of course credit.

Finally, another limitation of our findings is that the pilot study was conducted among vocational technical students who are at higher risk for high smoking intensity when compared with same-age students enrolled in academic programs.<sup>1</sup> Thus, our results may not apply to students in mainstream high schools. We chose to work with continuation high school students because a high prevalence of smoking is reported in this population and to maximize exposure of our program to as many tobacco users as possible given limited time and resources.<sup>20</sup> The fact that our youth-framed recruitment strategy was well received is promising because motivating tobacco quit attempts in this group of adolescents may be more challenging compared to other groups. Future research is warranted to compare the effect of our recruitment intervention on motivating quit attempts with that of other strategies among mainstream and continuation high school students.

The acceptability of our intervention approach to adolescents is not surprising, as physical appearance and oral health have been reported to be very important values among adolescents.<sup>8,9,10,11,15, 21</sup> Smokeless (spit) tobacco marketing efforts have gone to great lengths to associate their products with activities and attractive people who embody extraordinary physical

prowess, such as baseball players, rodeo stars, and other athletes. In a study of baseball athletes attending 44 high schools in rural California (N = 1,084), participants were asked to select three items from a list of 11 intervention components that most influenced them to stay tobacco-free or to try to quit their tobacco use during the study period. Ninety-two percent of spit tobacco users (n = 351) cited seeing graphic slides of facial disfigurement from oral cancer, and 81% (n = 330) cited receiving a mouth exam with feedback about spit tobacco-associated oral lesions.<sup>21</sup> In addition, in a survey of 473 spit tobacco users on football and baseball teams in 16 California colleges, seeing oral lesions in their own mouths and receiving advice to quit from an oral health care professional were highly ranked as factors that might influence them to quit.<sup>15,22</sup> Similarly, in the current study, the mouth examination was identified by almost half of the participating students as the most useful component of the intervention program.

Other studies also suggest the important value that adolescents place on physical appearance.<sup>23,24</sup> For example, a study of 15,175 girls and 7,846 boys showed a dose-response relationship between smoking and the belief that "smoking keeps weight down," a factor related to perceived attractiveness in many adolescents.<sup>23,24</sup>

In addition, in one school-based study on reduction of cigarette smoking and spit tobacco use conducted in 48 junior high schools, two-year follow-up data suggested that a physical consequences curriculum is successful in reducing adolescent spit tobacco use. Additionally, instruction in refusal skills, awareness of social value misconceptions, and physical consequences were necessary to reduce the combined use of spit tobacco and cigarettes.<sup>4</sup> Sussman and colleagues found that regular smokers report less knowledge of the negative consequences of tobacco use than do same-age nonsmokers.<sup>4</sup> In another study, nonsmokers from high-risk groups were less likely to be smokers if they placed a high value on health.<sup>25</sup> Although long-term serious health risks associated with tobacco use seem to produce little success, in terms of bringing about cessation with adolescents,<sup>26</sup> some studies report that tobacco cessation programs that emphasize immediate consequences of use and instruction in coping strategies are relatively successful.<sup>3</sup>

Although the use of tobacco is decreasing among adults, it remains high among adolescents. Twenty-three percent of high school students in the United States smoke cigarettes on a regular basis.<sup>27</sup> There is a paucity of literature on how to recruit adolescents to enter school-based smoking cessation programs, and, to our knowledge, no recruitment strategies that focus on physical attractiveness and oral health have been published. Our findings demonstrate high acceptance of the program by students. Involved faculty also reported that the experience was positive for all concerned.

## **Conclusion**

The design of tobacco cessation interventions for high school tobacco users needs to include recruitment formats that not only educate and inform, but also motivate adolescents to make quit attempts. Although these formats differ from actual treatment programs, they are an important part of developing an effective treatment program. Attracting high school smokers to participate in smoking cessation programs is critical. This study represents an early attempt to develop a motivational program expressly for adolescent tobacco users to recruit them into school-based cessation treatment programs. We hope that it will serve as a guide and model to future developments in this area.

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## Notes

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## **Oral Health Providers and Secondary Prevention of Disordered Eating: An Application of the Transtheoretical Model**

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**Purpose.** *Although oral health providers have an important role in early identification, referral, and case management of patients with eating disorders, little is reported regarding their current secondary prevention practices. The purpose of this study was to assess readiness among dentists and dental hygienists pertaining to secondary prevention of disordered eating among their patients.*

**Methods.** *This study employed a randomized cross-sectional study. Data were collected from 207 dentists and 369 dental hygienists using a self-administered paper and pencil questionnaire. The questionnaire included items derived from constructs from the Transtheoretical Model in addition to demographic information. Five criterion-specific secondary prevention behaviors were assessed with regard to eating disorders: identification of oral manifestations, addressing concerns, prescribing oral treatment, patient referral, and case management.*

**Results.** *Generally speaking, the majority of responding dentists and dental hygienists were observed to be in a low state of readiness with regard to the five criterion-specific behaviors. Less than 33% of responding dentists and 43% of dental hygienists reported that they assessed patients for disordered eating, and only 42% of dentists and 44% of dental hygienists prescribed specific home oral health care instructions for patients suspected of eating disorders. Less than 21% of dentists and 20% of dental hygienists currently arranged a more frequent recall program, while less than 20% of dentists and 17% of dental hygienists reported that they referred patients with oral manifestations of eating disorders for treatment. Only 13% of responding dentists and 7% of dental hygienists reported communicating with the patient's primary care provider. Statistically significant differences were observed among oral health providers with regard to assessing their patients for disordered eating ( $p = .006$ ) and communicating with the patients' primary care providers ( $p < .001$ ). In general, more dental hygienists indicated assessing patients for oral manifestations of disordered eating, while more dentists reported communicating with their patients' primary care providers.*

**Conclusions.** *Engaging the oral health care provider in secondary prevention of eating disorders is important for decreasing the potential for further damage to the teeth and oral tissue, as well as improving the patient's overall health and quality of life. Although both dentists and dental hygienists play important roles in secondary prevention of eating disorders, increasing the number who engage in consistent secondary prevention practices is essential. Increasing the involvement of oral health care providers in secondary prevention behaviors will involve movement along the continuum of stages (pre-contemplation to contemplation to action to maintenance), while also understanding that movement may take time and involve regression along the way.*

**Keywords:** Transtheoretical Model, eating disorder, secondary prevention

## **Introduction**

Epidemiological studies suggest an increased incidence of eating disorders occurring among developed countries around the world.<sup>1</sup> Current studies have observed a 5% increase in the incidence of eating disorders over the past three decades.<sup>1,2</sup> To attest to the seriousness of this issue, eating disorders were included in a position paper for the American College of Physicians as one of the nine most serious problems affecting adolescents.<sup>3</sup>

Secondary prevention of illness consists of preventive measures that lead to early diagnosis and treatment of the disease or illness, and that prevent the potential for severe pathogenesis.<sup>4</sup> Secondary prevention of eating disorders consists of reducing the rates of the development of a full-blown disorder through early identification, referral, and treatment.<sup>5</sup> Recovery from an eating disorder is partially dependant upon early secondary prevention.<sup>6</sup> Influencing secondary prevention of disordered eating is the ability of various health providers (physicians, dentists, dental hygienists, school nurses) to detect physical and oral manifestations that are the result of the behaviors associated with disordered eating.

The role of oral health providers in secondary prevention of eating disorders is vital, as they are often the first health professionals to observe overt clinical health effects, enabling them also to be first to identify the problem.<sup>7-9</sup> The crucial role of early identification is significant in reducing the development of oral and medical complications, decreasing health care costs, and avoiding death. In addition to early identification of disordered eating, the oral health provider's role extends to management of the oral manifestations of disordered eating, as well as referral to other specialists and involvement in case management with other treatment providers.

Although oral health providers have an important role in early identification, referral, and case management of patients with eating disorders, little is reported regarding their current secondary prevention practices. DiGiacchino, Keenan, and Sargent assessed 37 oral health providers regarding secondary prevention behaviors specific to eating disorders.<sup>10</sup> This assessment revealed that the majority of the dentists and dental hygienists were not found to be engaged in secondary prevention behaviors specific to eating disorders.<sup>10</sup> Results indicate that only 28% of dentists and 37% of dental hygienists reported assessing patients for oral manifestations of disordered eating behaviors, and only 28% of dentists and 26% of dental hygienists indicated providing patient-specific home oral health care instructions for patients exhibiting oral manifestations of disordered eating behaviors. Less than one quarter of both dentists and dental hygienists participating in this study indicated arranging for a more frequent recall program, making a referral for treatment, and communicating with their patients' primary care providers.<sup>10</sup>

This study adds to the current literature of secondary prevention practices among oral health care providers with regard to eating disorders. The purpose of this study was to assess the readiness among dentists and dental hygienists with regard to the identification of oral manifestations of eating disorders, provision of oral treatment for those with oral manifestations specific to eating disorders, referral of such patients, and case management of persons presenting with disordered eating behaviors.

## ***Theoretical Framework***

Integrating various processes of change within a stage approach to behavior change is the basis of the Transtheoretical Model.<sup>11</sup> This model consists of a progression through five stages of behavior change: pre-contemplation (not thinking about adopting the behavior) contemplation (intending to adopt the behavior, but not having made a commitment), preparation (actively planning to adopt the behaviors), action (adopting the behavior for at least six months), and maintenance (adopting the behavior for more than six months), with the understanding that each stage is a temporal dimension with the possibility of regression at any time.<sup>11</sup>

Progression through the stages (eg, pre-contemplation to contemplation to preparation to action to maintenance) is influenced by specific processes of change.<sup>11</sup> These processes of change include intrapersonal, interpersonal, and environmental change activities that increase the readiness for behavioral adoption to occur. For example, as depicted in Table I, processes of change to increase the likelihood of movement from pre-contemplation to contemplation include increasing knowledge of the consequences and severity of the health issue, assessment of barriers and benefits to behavioral adoption, and role clarification. Hence, as applied to the behavioral adoption of eating disorder-specific secondary prevention behaviors among oral health providers, increasing readiness (eg, movement from pre-contemplation to contemplation) would include increasing their knowledge of oral manifestations of eating disorders, perceived seriousness of eating disorders, perceived benefits of secondary prevention, and perceived role in secondary prevention.

**Table I. Secondary Prevention of Eating Disorders: Stages of Change for Oral Health Providers**

Stage of Change	Description of stage	Processes of change for progression to next stage	Example of necessary factors for movement to next stage
<b>Pre-contemplation</b>	Has no intention of practicing behavior within the next six months	<ul style="list-style-type: none"> <li>• Increase knowledge of consequence of behavior, severity of health problem, and patient susceptibility of health problem</li> <li>• Assess benefits to and barriers of adopting behavior</li> <li>• Clarify role</li> </ul>	Oral health providers: <ul style="list-style-type: none"> <li>• Are knowledgeable of the oral manifestations of disordered eating behaviors</li> <li>• Perceive their patients to be susceptible of eating disorders,</li> <li>• Perceive severity of disordered eating behaviors</li> <li>• Understand benefits of identification of oral manifestations, patient approach, referral, and oral treatment</li> <li>• Perceive their role in secondary prevention of disordered eating</li> </ul>
<b>Contemplation</b>	Intends to perform behavior within the next six months	Clarify values	Oral health providers value holistic approach to patient assessment and treatment
<b>Preparation</b>	Intends to perform behavior within the next 30 days and has taken some behavioral steps in this direction	Develop a plan for change	Oral health providers develop mechanisms for: <ul style="list-style-type: none"> <li>• Patient identification</li> <li>• Patient approach</li> <li>• Oral treatment</li> <li>• Frequent recall</li> <li>• Patient referral</li> </ul>
<b>Action</b>	Has performed behavior for less than six months	<ul style="list-style-type: none"> <li>• Increase self-efficacy of performing behavior</li> <li>• Support for behavior change</li> <li>• Environmental reengineering</li> <li>• Reinforcement management</li> </ul>	Oral health providers are confident in their ability to: <ul style="list-style-type: none"> <li>• Identify oral manifestations of disordered eating behaviors</li> <li>• Approach a patient suspected of disordered eating behavior</li> <li>• Provide specific home dental care</li> <li>• Refer patient for assessment and treatment</li> </ul>
<b>Maintenance</b>	Has changed overt behavior for more than six months	Plan for relapse	Oral health providers have procedures in place for institutionalizing: <ul style="list-style-type: none"> <li>• Identification of oral manifestations</li> <li>• Oral treatment</li> <li>• Patient approach</li> <li>• Patient referral</li> <li>• Case management</li> </ul> Oral health providers have developed positive relationships with other treatment providers

This model has been used for behavior change programming with a variety of health behaviors and target populations. Common applications include the development of tailored messages and programs that match the various stages, thereby enhancing progression through stages toward consistent adoption.<sup>11</sup> Recently, the Transtheoretical Model has been applied in oral health with regard to oral self-care.<sup>12,13</sup> The current study utilized the framework of the Transtheoretical Model to assess readiness among dentists and dental hygienists to perform criterion-specific secondary prevention behaviors regarding identification of oral manifestations of disordered eating, addressing concerns to the patient, prescribing oral treatment, patient referral, and case management.

## **Methods and Materials**

### ***Design***

This study employed a randomized cross-sectional study. Data were collected using a self-administered paper and pencil questionnaire mailed to subjects.

### ***Subjects***

Subjects consisted of 1,000 dentists randomly selected from the membership list provided by the American Dental Association (ADA) and 1,000 dental hygienists randomly selected from the membership list provided by the American Dental Hygienists' Association (ADHA). Sample size was determined based on statistical significance, available resources, and adequate representation of the population. For a confidence level of 95% and a margin of error of +/-5%, a sample size of 385 would be the minimum sample size for statistical significance.<sup>14</sup>

Two hundred and seventy-four randomly selected participants (111 dentists and 163 dental hygienists) were ineligible to participate because they were listed with incorrect address or were currently not practicing as dentists or dental hygienists, leaving a total of 1,726 eligible participants. Out of the 1,726 eligible dental providers who were selected to participate in the study, 576 returned questionnaires, yielding an overall response rate of 33%. More specifically, of the 889 randomly selected dentists, 207 responded to the survey, resulting in a response rate of 23% for dentists. Of the 837 eligible dental hygienists, 369 responded to the survey, resulting in a 44% response rate among dental hygienists. These response rates are reasonable for this type of survey.<sup>15</sup>

### ***Variables***

The questionnaire included constructs from the Transtheoretical Model in addition to demographic variables (gender, race, age, occupation, degrees, degree-granting institution, and location of employment).

Reed and colleagues suggest that assessment of behavioral readiness represented by current stage of behavior is best assessed by the use of a four-item algorithm corresponding to a particular criterion behavior.<sup>16</sup> As such, individuals are then placed in either the pre-contemplation stage (not planning to perform criterion behavior in the next six months), contemplation stage (intending to adopt the behavior, but not having made a commitment), action stage (practicing criterion behavior for six months or less), and maintenance stage (practicing criterion behavior for more than six months). The criterion behaviors for this study included assessing patients for oral manifestations of disordered eating; providing patient-specific home dental care instructions; arranging for a more frequent recall program; referring the patient suspected of disordered eating behaviors for assessment and treatment; and communicating with the patient's primary care provider.

Table II depicts an adaptation of questions and Transtheoretical Model-framed four-item answer categories contained in the survey representing the above-mentioned criterion behaviors. For each criterion-specific behavior, dentists and dental hygienists were instructed to pick the statement that best reflected their current level of routine practice behavior.

**Table II. Secondary Prevention Behaviors as Assessed by Transtheoretical Model\***

**Among the following statements, please check the one that best describes your current activity:**

- I am not currently assessing dental patients for disordered eating, and I do not intend to start in the next 6 months
- I am currently assessing dental patients for disordered eating, but only sometimes.
- I am currently assessing dental patients for disordered eating, and have been for at least 6 months.
- I am currently assessing dental patients for disordered eating, and have done so for longer than 6 months.

**Among the following statements, please check the one that best describes your current activity:**

- I do not currently provide patient specific preventive home-dental care instructions for dental patients suspected of disordered eating, and I do not intend to start in the next 6 months.
- I am currently providing patient specific preventive home-dental care instructions for dental patients suspected of disordered eating, but only sometimes.
- I am currently providing patient specific preventive home-dental care instructions for dental patients suspected of disordered eating, and have been for at least 6 months.
- I am currently providing patient specific preventive home-dental care instructions for dental patients suspected of disordered eating, and have done so for longer than 6 months.

**Among the following statements, please check the one that best describes your current activity:**

- I am not currently arranging a more frequent recall program for dental patients suspected of disordered eating, and I do not intend to start in the next 6 months.
- I am currently arranging a more frequent recall program for dental patients suspected of disordered eating, but only sometimes.
- I am currently arranging a more frequent recall program for dental patients suspected of disordered eating, and have been for at least 6 months.
- I am currently arranging a more frequent recall program for dental patients suspected of disordered eating, and have done so for longer than 6 months.

**Among the following statements, please check the one that best describes your current activity:**

- I do not currently make a referral for treatment for dental patients suspected of disordered eating, and I do not intend to start in the next 6 months.
- I currently make a referral for treatment for dental patients suspected of disordered eating, but only sometimes.
- I am currently making a referral for treatment for dental patients suspected of disordered eating, and have been for at least 6 months.
- I am currently making a referral for treatment for dental patients suspected of disordered eating, and have done so for longer than 6 months.

**Among the following statements, please check the one that best describes your current activity:**

- I am not currently communicating with the primary medical care provider of dental patients suspected of disordered eating, and I do not intend to start in the next 6 months.
- I am currently communicating with the primary medical care provider of dental patients suspected of disordered eating, but only sometimes.
- I am currently communicating with the primary medical care provider of dental patients suspected of disordered eating, and have been for at least 6 months.
- I am currently communicating with the primary medical care provider of dental patients suspected of disordered eating, and have done so for longer than 6 months.

\*Adaptation of questionnaire utilized in the current study

### **Data Collection**

Each selected dentist and dental hygienist received an invitational letter explaining the study, a consent form, and a questionnaire with an accompanying self-addressed, stamped envelope. To increase the response rate, a follow-up letter and additional questionnaire were mailed to non-responders two to three weeks after the initial survey. For subjects who did not respond to the initial or second mailing, a third reminder postcard was mailed three weeks after the initial follow-up. Institutional review board approval was granted prior to study implementation.

### **Data Analysis**

Data were analyzed using Statistical Package for Social Scientists Software (SPSS v.10, Chicago, IL). In addition to descriptive statistics, response variables regarding stage of behavior regarding intention to perform behavior were compared to assess significant differences between dental hygienists and dentists using a chi-square test.

### **Results**

Table III depicts the demographic characteristics of study participants. The participant profile included 207 dentists (78.3% male, 19.3% female) and 369 dental hygienists (1.4% male, 98.1% female). The majority of both dentists (86%) and dental hygienists (90.5%) reported themselves as Caucasian. A large number of dentists reported currently practicing in the South or Southeast (27.1%), the Midwest (22.2 %), and the Southwest (20.3 %). The majority of dental hygienists reported

practicing in the Southwest (29.3%) and the Midwest (20.9%), followed by the South and Southeast (17.9%) and Northeast (16.8%). The mean age of responding dentists was 49 years, and the mean age of responding dental hygienists was 41 years. Dentists reported practicing an average of 24 years, while dental hygienists reported practicing an average of 16 years.

**Table III. Demographic Characteristics for all Oral Health Providers (n = 576)**

Variable	Dentists (n = 207) f(%)	Dental Hygienists (n = 369) f(%)	Total (n = 576) f(%)
<b>Gender</b>			
• Male	162(78.3)	5(01.4)	167 (29.0)
• Female	40(19.3)	362(98.1)	402 (69.8)
<b>Race</b>			
• White	178(86.0)	334(90.5)	512 (88.9)
• African American	1(00.5)	5(01.4)	6 (01.0)
• Asian	11(05.3)	8(02.2)	19 (03.3)
• Hispanic	7(03.4)	8(02.2)	15 (02.6)
• Other	3(01.4)	8(02.2)	11 (01.9)
<b>Region of Practice</b>			
• Northeast	19(9.2)	62(16.8)	81(14.1)
• South/Southeast	56(27.1)	66(17.9)	122(21.2)
• Midwest	46(22.2)	77(20.9)	123(21.4)
• Southwest	42(20.3)	108(29.3)	150(26.0)
• Northwest	33(15.9)	47(12.7)	80(13.9)
<b>Variable</b>			
	<b>Mean ± SD</b>	<b>Mean ± SD</b>	<b>Mean ± SD</b>
<b>Age</b>	49.33±11.21	41.31±10.20	44.19±11.24
<b>Years of practice</b>	24.18±11.44	16.38±11.68	19.31±12.18

***Stages of Behavioral Adoption***

Readiness to adopt the five criterion-specific secondary prevention behaviors was assessed among dentists and dental hygienists. Table IV depicts the percentage of responding dentists and dental hygienists within each stage of behavioral adoption with regard to the following criterion-specific secondary prevention behaviors: assessing disordered eating; providing specific preventive home dental care instructions for patients suspected of disordered eating; arranging a more frequent recall program for patients suspected of disordered eating; currently making referrals for treatment for patients suspected of disordered eating; and currently communicating with the primary medical care providers of patients suspected of disordered eating.

Table IV. Stages of Change Among Oral Health Providers (n = 576)

Variable	Dental Provider	Stage of Current Behavior				P value
		Pre-contemplation n (%)	Contemplation n (%)	Action n (%)	Maintenance n (%)	
Assessing dental patients for disordered eating	Dentists†	83(40.1)	56(27.1)	1(00.5)	67(32.4)	.006*
	Dental Hygienists‡	107(29.0)	104(28.2)	8(02.2)	150(40.7)	
Providing specific home dental care instructions for patients suspected of disordered eating	Dentists	71(34.3)	749(23.7)	6(02.9)	81(39.1)	.766
	Dental Hygienists	119(32.2)	88(23.8)	20(05.4)	142(38.5)	
Arranging a more frequent recall program for dental patients suspected of disordered eating	Dentists	117(56.5)	48(23.2)	4(01.9)	38(18.4)	.853
	Dental Hygienists	201(54.5)	97(26.3)	13(03.5)	58(15.7)	
Currently making a referral for treatment for dental patients suspected of disordered eating	Dentists	116(56.0)	50(24.2)	4(01.9)	37(17.9)	.254
	Dental Hygienists	223(60.4)	84(22.8)	10(02.7)	52(14.1)	
Currently communicating with primary care provider of patient suspected of disordered eating	Dentists	126(60.9)	55(26.6)	2(01.0)	24(11.6)	<.001*
	Dental Hygienists	288(78.0)	54(14.6)	6(01.6)	21(05.7)	

\*statistically significant if  $p < .05$   
 † n=207 dentists  
 ‡ n=369 dental hygienists

As depicted in Table IV, the majority of responding dentists in the study were observed to be in the pre-contemplation or contemplation stages of readiness concerning the five criterion-specific secondary prevention behaviors. With regard to the secondary prevention behaviors of assessing patients for oral manifestations of eating disorders and providing patient-specific home dental care instructions, the majority of dentists were observed to be distributed among three different stages of readiness-pre-contemplation, contemplation, and action. Approximately 40% of responding dentists indicated "not assessing dental patients for oral manifestations of eating disorders and do not intend to start," 27% stated "assessing dental patients for oral manifestations of eating disorders sometimes," and about 32% stated "assessing dental patients for oral manifestations of eating disorders for over six months." With regard to providing patient-specific home dental care instructions for patients suspected of eating disorders, approximately 34% of responding dentists reported "not providing home dental care instructions, and do not intend to," 24% indicated "providing home dental care instructions sometimes," and 39% indicated "providing home dental care instructions for six months or longer."

Less variation in readiness was observed among responding dentists with regard to arranging a more frequent recall program, making referrals, and communicating with patients' primary care providers. With respect to these criterion-specific secondary prevention behaviors, the majority of dentists reported not practicing the behavior with no intention of practicing (pre-contemplation), while others reported practicing the behavior sometimes (contemplation). For example, approximately 57% of dentists reported "not arranging a more frequent recall program, and do not intend to," and 23% reported "arranging a more frequent recall program sometimes." Fifty-six percent reported "not referring patients suspected of eating disorders and did not intend to," while 24% reported referring patients sometimes." Sixty-one percent of dentists reported "not communicating with the patient's primary care provider, and did not intend to," while 27% reported "sometimes communicating with the patient's primary care provider."

A similar pattern of readiness was detected among responding dental hygienists, as three different stages of readiness were observed concerning assessing patients for oral manifestations of disordered eating and providing patient-specific home dental care. Twenty-nine percent of dental hygienists reported "not assessing dental patients for oral manifestations of eating disorders and do not intend to start," 28% reported "assessing dental patients for oral manifestations of eating disorders sometimes," and about 41% stated "assessing dental patients for oral manifestations of eating disorders for over six months." With regard to providing patient-specific home dental care for patients suspected of eating disorders, approximately 32% of responding dental hygienists reported "not providing home dental care instructions, and do not intend to," 24% indicated "providing home dental care instructions sometimes," and 39% indicated "providing home dental care instructions for six months or longer."

As with dentists, the majority of dental hygienists in this study indicated either "not practicing" or "sometimes practicing" two of the secondary prevention behaviors. Approximately 55% of responding dental hygienists reported "not arranging a more frequent recall program, and do not intend to," while 26% reported "arranging a more frequent recall program sometimes." Sixty percent of dental hygienists reported "not referring patients suspected of eating disorders and did not

intend to," while 23% reported referring patients sometimes." However, the majority of dental hygienists (78%) reported "not communicating with the patient's primary care provider, and did not intend to."

Although these study results indicate that the majority of dentists as well as dental hygienists in this study were observed to be in a low state of readiness with regard to the five criterion-specific secondary prevention behaviors, statistically significant differences were observed between responding dentists and dental hygienists concerning two secondary prevention behaviors. Study results indicate that a greater number of dental hygienists (42.9%) than dentists (32.9%) indicated being in the action or maintenance stages for assessment of patients for oral manifestations of disordered eating ( $p = .006$ ). In addition, a greater number of dentists (12.6%) than dental hygienists (7.3%) reported currently communicating with the primary care providers of patients indicating disordered eating behaviors ( $p < .001$ ). As depicted in Table IV, no statistically significant differences were observed between dentists and dental hygienists regarding providing patient-specific home dental care instructions for patients suspected of disordered eating ( $p = .766$ ), arranging a more frequent recall program for their patients suspected of disordered eating ( $p = .853$ ), and making referrals for treatment for their patients suspected of disordered eating ( $p = .254$ ).

## **Discussion**

Prevention of eating disorders requires interdisciplinary primary and secondary prevention studies, in addition to the incorporation of multi-level strategies requiring systemic changes at the public policy, institutional, familial, and individual levels.<sup>5</sup> Research in the assessment of secondary prevention of eating disorders requires the application of theoretical frameworks, rationale, and target populations at each level.<sup>5</sup> The purpose of this study was to apply the Transtheoretical Model among oral health providers (at the institutional level) to assess readiness with regard to behavioral adoption of secondary prevention behaviors specific to eating disorders.

The results of this study indicate that, in general, the majority of oral health providers are in a low state of readiness with regard to adopting secondary prevention behaviors specific to eating disorders. This study supports the previous work by DiGioacchino, Keenan, and Sargent, who found that the majority of dentists and dental hygienists in their study were not involved in the secondary prevention of disordered eating.<sup>10</sup> Additionally, the results of this study indicate that a similar state of readiness exists among responding dentists and dental hygienists with regard to secondary prevention behaviors (the majority being in the pre-contemplative or contemplative stages).

However, differences were observed concerning assessment and communication with patients' primary care providers. The current study observed that more responding dental hygienists than dentists are assessing patients for oral manifestations of eating disorders, and that more dentists than dental hygienists are communicating with patients' primary care providers. These differences in assessment and contact with primary care providers are not surprising, in that the standard practice protocol may be for the dental hygienist to identify and communicate oral manifestations to the dentist, as the dentist is the contact to the patient's primary care provider.

Moreover, the lack of dentists and dental hygienists who refer their patients and participate in case management may be explained by the existing literature that suggests providers are uncertain about how to approach patients they suspect of disordered eating.<sup>17</sup> Approaching a patient about oral manifestations of disordered eating may be perceived as a sensitive topic, and oral health providers may be fearful of patient reaction.

## **Limitations**

The authors recognize the limitations of the current study. The cross-sectional design employed by this study is descriptive in nature. The use of subjects who are members of the ADA and the ADHA exclude oral health care providers who are not members, thus limiting generalizability of the findings. However, random selection of participants and large sample size may decrease potential bias and increase the potential reliability of descriptive findings.

## **Ramifications**

Engaging oral health care providers in secondary prevention of eating disorders is important for decreasing the potential for further damage to the teeth and oral cavity, as well as improving patients' overall health and quality of life. As two of the first health professionals to identify oral manifestations associated with eating disorders, the dentist and dental hygienist are charged with the important task of assuring that the patient receives treatment. Moving dentists along the continuum of low readiness to behavioral adoption of secondary prevention behaviors specific to eating disorders necessitated the application of various processes of change as described in Table I.

Predisposing processes of change are factors antecedent to the behavior that support the motivation and rationale for behavioral adoption, thus creating movement from pre-contemplation to contemplation.<sup>18</sup> As depicted in Table I, predisposing processes include increasing oral health providers' knowledge of oral and physical manifestations of disordered eating behaviors; knowledge and understanding of the complexities of this multi-faceted illness; perception of the severity of disordered eating regarding systemic health issues and well-being; belief in the crucial role they play in the secondary prevention of disordered eating; and belief of the value of secondary prevention of disordered eating.

To effectively assist patients with oral manifestations suggestive of disordered eating, dentists and dental hygienists must have an understanding of eating disorders and establish strong rapport and trust with their patients.<sup>9,19,20</sup> Fear of disapproval from patients may be a primary barrier to patient approach and secondary prevention of disordered eating. Although patients may initially deny their behaviors and their disorders, continued dialogue between patients and oral healthcare providers may elicit disclosure from patients.<sup>6,20</sup> Therefore, it is important that oral health providers be well versed in the psychological complexity of this disorder and mechanisms for referrals, in addition to anticipating difficulties in patient cooperation.<sup>6</sup>

To generate movement among oral health providers from contemplating behavioral adoption of secondary prevention behaviors specific to eating disorders to behavioral adoption, enabling factors must be addressed.<sup>18</sup> These enabling factors include increasing oral health providers' skills and self-efficacy in identification of oral manifestations of disordered eating, patient approach, and communication with primary care providers; decreasing the barriers to secondary prevention behaviors among oral health providers; and providing oral health providers with prepared resource lists and eating disorder-specific home oral health care instruction handouts (Table I). These processes may include the development of specific didactic and experiential course curriculum and continuing education seminars, secondary prevention toolkits, practice protocols, and secondary prevention algorithms.

Lastly, to attain consistency among oral health care providers with regard to eating disorder-specific secondary prevention behaviors, reinforcing factors must be addressed. These processes of change which enable movement from action to maintenance consist of factors that follow the behavior that provide the continuing reward or incentive for behavioral consistency.<sup>18</sup> As described in Table I, reinforcing factors include improved communication among oral health care providers and establishing practice protocol for those identified with oral manifestations of disordered eating behaviors. In addition, improved communication between oral, physical, and mental health care providers is warranted to enable case management and aid with the recovery process.

## **Conclusions**

It is evident from the current study that more oral health care providers are assessing and providing patient-specific home oral health care instructions, but the bridge between assessment to referral and case management is not yet occurring. As previously stated, secondary prevention of eating disorders requires not only identification of oral manifestations and restorative care, but also referral and case management to monitor progression and prevent relapse of eating disorder-specific behaviors.

According to the results of this study, oral health care providers are in a low state of readiness for the adoption of secondary prevention practices specific to eating disorders. Increasing readiness and, ultimately, adoption of eating disorder-specific secondary prevention behaviors among dentists and dental hygienists will involve movement along the continuum of

stages (pre-contemplative to contemplative to action to maintenance), while also understanding that movement may take time and involve regression along the way.

The success of secondary prevention of eating disorders is reliant upon theory-based interdisciplinary research and practice targeted at multiple levels of change (intrapersonal, interpersonal, institutional or organizational, community, and policy). Further institutional level research among oral health care providers should be conducted to support the design, implementation, and evaluation of the previously described Transtheoretical Model processes of change within dental and dental hygiene curricula, continuing education workshops, and oral health practice protocol, so as to increase the number of dental and dental hygiene providers who regularly engage in the secondary prevention of eating disorders.

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## **Notes**

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## The Utilization of Dental Hygiene Students in School-Based Dental Sealant Programs

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*Early detection of childhood caries is important to childrens' overall health. Untreated childhood caries can lead to pain, as in abscesses from prolonged neglect; altered dietary intake; and delays in the development of the permanent teeth if the primary teeth are prematurely lost. In the summer of 2000, funds were provided to various oral health care provider organizations by the Illinois Department of Public Health, Division of Oral Health, to purchase portable equipment to deliver preventive services (i.e., exams, sealants, and oral hygiene education) to second-grade and sixth-grade children who qualified for Medicaid and/or free and reduced-cost lunch programs. The Dental Sealant Grant Program at Southern Illinois University in Carbondale was a unique program that utilized dental hygiene students as the primary human resource. Within the state, the Dental Sealant Grant Program was, at the time of this report, the only grantee sponsored by a stand-alone dental hygiene program (not affiliated with a dental school). Other positive aspects of the dental hygiene-sponsored sealant program were that the supervising dentist was the primary Medicaid provider and a member of the dental hygiene faculty; dental hygiene faculty participated actively as site coordinators and clinicians; and dental hygiene students were given the opportunity to volunteer for the program as a service-learning option.*

**Keywords:** School-based dental sealant programs, access to care, preventive oral health care, service-learning

### Introduction

Tooth decay continues to be of primary concern for children living in families that are at or below poverty level. According to the U.S. National Library of Medicine (NLM), of the National Institutes of Health, "tooth decay is one of the most common of all disorders, second only to the common cold. It usually occurs in children and young adults but can affect any person. It is the most important cause of tooth loss in younger people."<sup>1</sup> Dental caries is defined as "an infectious, communicable disease resulting in destruction of tooth structure by acid-forming bacteria found in dental plaque, an intraoral biofilm."<sup>2</sup>

The loss of masticatory function may be one result of early tooth extractions due to gross carious lesions. When dental caries goes undetected and untreated, it can potentially lead to systemic health problems, time lost from work by parents who must remain home with sick children, and time lost from school by children in dental distress. Moreover, abscesses from pulpal infections resulting from untreated decay can lead to bone destruction, and the infection can spread into the bloodstream.<sup>3</sup>

According to the NLM: "Although significant progress has been made in reducing and controlling dental caries, the disease still remains a problem for many children and adults in the United States. Almost 20% of children between the ages of 2 and 4 years have had dental caries, and by age 17 nearly four of five youngsters have had at least one carious lesion (cavity) or restoration (filling). More than two thirds of adults ages 35 to 44 years have lost at least one permanent tooth, and about one of every two persons 75 years or older has had root caries affecting at least one tooth."<sup>2</sup>

Understanding that the prevalence of dental caries was and is still a significant problem, in March 2001, the National Institutes of Health (NIH) hosted the Consensus Development Conference on Diagnosis and Management of Dental Caries Throughout Life, in Bethesda, Maryland. The purpose of this landmark meeting was to seek answers to six specific questions<sup>4</sup>:

What are the best methods for detecting early and advanced dental caries?

What are the best indicators for an increased risk of dental caries?

What are the best methods available for the primary prevention of dental caries initiation throughout life?

What are the best treatments available for reversing or arresting the progression of early dental caries?

How should clinical decisions regarding prevention and/or treatment be affected by detection methods and risk assessment?

What are promising new research directions for the prevention, diagnosis, and treatment of dental caries?

Finally, baseline data in *Healthy People 2010* stated that 52% of children aged 6 to 8 had a dental caries experience from 1988 to 1994.<sup>5</sup> Data for the children older than 13 were equally as discouraging. Twenty percent of adolescents had untreated dental decay in the same time period.<sup>5</sup>

### ***The Importance of Pit and Fissure Sealants in Caries Prevention***

As a method for preventing dental caries, pit and fissure sealants are effective; however, they are not being used or prescribed as frequently as they should be.<sup>6</sup> Not only are pits and fissures in posterior teeth "a haven for food debris and decay-causing bacteria," but posterior teeth are the first and most frequently affected by decay in both children and adolescents.<sup>3</sup> Properly placed pit and fissure sealants can ensure caries reduction. When access to preventive services is limited, however, an increase in the decay rate is likely to occur.

Since the 1983 NIH Consensus Development Conference on Dental Sealants, it has been widely accepted that pit and fissure sealants are highly effective in preventing dental caries, regardless of whether they are applied by appropriately trained dentists, dental hygienists, or dental assistants. Moreover, teams of dental hygienists and dental assistants have been highly effective in public health settings.<sup>4,7</sup> Given these results, partnerships between community entities and state or local health departments may generate the funds necessary to provide the aforementioned services to uninsured or underinsured individuals.

### ***The Importance of School and Community-Based Dental Sealant Programs***

An oral health survey conducted by the Ohio Department of Health among schoolchildren found that "targeted, school-based dental programs can substantially increase the prevalence of dental sealants. Providing sealant programs in all eligible, high-risk schools could reduce or eliminate racial and economic disparities in the prevalence of dental sealants."<sup>8</sup> The study compared the results from a random sample of 1,857 schools (N = 335) representing 87 of 88 counties.

Significant results indicated that a greater percentage of third-grade children received sealants in schools with sealant programs as opposed to those who attended schools without sealant programs. A race comparison revealed that a significantly greater percentage of white children (61.6%) received sealants than black children (50.8%) in schools that had active sealant programs.<sup>8</sup> An additional editorial note in the Ohio study stated that, in spite of limitations that could have had an effect on the data analysis, "among students who participated, the use of appropriately targeted school-based programs

increases the prevalence of dental sealants among children from low-income families and reduces the racial and income disparity in sealant prevalence among elementary school students."<sup>8</sup>

An independent Task Force on Community Preventive Services conducted a review that found strong evidence that school-associated sealant delivery programs are effective. Compared to those who did not receive sealants, those who did experienced a median decrease of 60% in dental caries.<sup>9</sup> Based on evidence from their review, the task force recommended school-based or school-linked pit and fissure sealant delivery programs.

### ***The Role of Dental Hygiene Students in School and Community-Based Preventive Programs***

The many reports that document the effectiveness of collaborations of community entities and local dental or dental hygiene programs support strategies outlined in *Oral Health in America: A Report of the Surgeon General*.<sup>3</sup> In the description of "the nature of community health programs," the primary focus is on a group in need. In the case of school-based programs, the focus is to decrease disparities in health care, particularly among low-income and minority families, and those with limited access to oral health care facilities. Typically, organizations such as government agencies, charities, schools, or religious groups "spearhead such programs, tapping into the expertise, enthusiasm, and knowledge of community values of staff and volunteers. Some programs are sponsored by national, state, and local dental societies and their members."<sup>3</sup> This comparison of such programs begins with those using dental hygiene students as volunteers.

One such entity recognized the potential of the dental hygiene program at the University of Arkansas for Medical Sciences (UAMS) to provide much-needed preventive services to elementary schoolchildren living below the poverty level, as nearly 90% of Arkansas school children qualified for the free lunch program.<sup>10</sup> According to DeAngelis and Warren, Children International established the Little Rock Share America Program in 1994. The program provided a variety of services to those who would be considered "at-risk" children who scored below 50% on nationwide standardized tests. Dental care was included among medical and psychological care, as were backpacks, shoes, clothes, toys, and items for personal hygiene.<sup>10</sup>

The Little Rock Share America Program sought the services of the dental hygiene program at UAMS. Because there are no dental schools in Arkansas, the dental hygiene clinic served as a site to serve underprivileged children, and the dental hygiene students provided the bulk of preventive services.<sup>10</sup>

At Lewis and Clark Community College in southwest Illinois, the dental hygiene students conducted the sealant program for the local health department. Children eligible for Medicaid or free or reduced-cost lunch programs were targeted. Six dental hygiene students, working in pairs, and a clinical dentist rotated among participating schools. The children's parents were given a list of dentists participating in Medicaid, or they were referred to the nearby dental school for any indicated treatment. The students completed a rotation evaluation form at the end of the experience (Michelle Singley, RDH, MS, personal communication, November 2003).

At the University of Missouri Kansas City (UMKC), dental hygiene students participated in the seasonal program as part of a community dental health course incorporating field experiences. Because the students participated in the sealant program as part of a course, supplies were purchased as part of that course's expenses. One faculty member accompanied students to the school sites. The students also served as the clinicians and were given course credit. One dentist screened the children, and the dental hygiene students returned to the school sites to complete the sealants. The faculty received help from a custodian in moving equipment back and forth with a van provided by the university. Students completed a self-reflection form and the faculty conducted a group discussion at the end of the semester to talk about the process (Bonnie Branson, RDH, PhD, personal communication, November 2003).

Finally, the Indiana University (IU) School of Dentistry sealant program, SEAL INDIANA, operated out of a mobile unit that was funded by the Indiana State Department of Health. The long-term goal of the program was to provide a service-learning opportunity for the dental students, while also improving access to oral health care in areas of the state most in need.<sup>11</sup> Karen Yoder, RDH, PhD, director of community dentistry at IU and co-director of SEAL INDIANA, said

that "dental hygiene students from the IU South Bend campus volunteered for services when the mobile clinic visited Goshen [Indiana] ... The students gave the Seal Mobile rave reviews [and] they found it to be a good experience."<sup>11</sup>

## **Description of the Program**

### ***Brief History of the Illinois Dental Sealant Grant Program***

The Illinois Dental Sealant Grant Program (DSGP) began in 1987. According to the Illinois Department of Public Health (IDPH), the state dental director at that time wanted to create a statewide, school-based sealant program to decrease the rate of dental caries occurring in children of low socioeconomic status by increasing the use of dental sealants by this population. To date, the DSGP has served more than 181,000 children. In 2001 alone, more than 50,000 dental sealants were placed on the teeth of more than 21,000 children.<sup>12</sup>

The IDPH secured funds from the Maternal and Child Health Preventive Block Grant that allowed county health departments and communities to compete for available money to purchase portable equipment and provide dental examinations and sealants for children eligible for Medicaid and free or reduced-cost school lunch programs.<sup>13</sup> The DSGP specifically targeted children in the second and sixth grades, which the program suggests is the most efficient way to seal as many first and second molars as possible after eruption. At the time of this report, there were 61 grantees providing services in their respective communities throughout the state.<sup>12</sup> The grantees were reimbursed for services at the current Medicaid rates.

### ***Significance of the Dental Sealant Grant Program at Southern Illinois University in Carbondale, Illinois***

The Southern Illinois University in Carbondale (SIUC) Dental Hygiene Program endeavored to do its part in assisting IDPH in meeting objectives stated in the oral health section of *Healthy People 2010*,<sup>5</sup> in addition to the policies and recommendations in *The Illinois Oral Health Plan and the Community Oral Health Infrastructure Development Project* (IOHP),<sup>14</sup> and *Oral Health in America: A Report of the Surgeon General*.<sup>3</sup>

In FY 2000-2001, grant funds were provided by the IDPH Division of Oral Health (DOH) to initially purchase portable equipment to deliver preventive services (i.e., exams, sealants, and oral hygiene education) to second-grade and sixth-grade children who qualified for Medicaid and/or free and reduced-cost school lunch programs. These children were targeted according to the typical eruption sequence of the six-year and 12-year permanent molars and because they represented the population who would be the most at-risk or susceptible to dental caries with respect to socioeconomic status. The DSGP at SIUC was unique in that, within the state, it was the only grantee that was sponsored by a dental hygiene program. Therefore, dental hygiene students were the primary clinicians placing the sealants.

One of the policy goals of the IOHP was to "increase the number and types of community-based experiences that benefit both communities and students of dentistry and dental hygiene."<sup>14</sup> Grant funds were initially provided to purchase portable equipment, and remaining and subsequent funding was used for preventive dental hygiene services, including dental examinations, pit and fissure sealants, and oral hygiene instruction.

Although the DSGP specifically targeted second-grade and sixth-grade students eligible for Medicaid and/or enrolled in the free and reduced-cost school lunch program, students in other grades, as well as children who had a third-party payment provider, were eligible to participate. In other words, no child returning a permission slip was turned away. In addition to the first and second molars being treated, premolars were also sealed wherever indicated. Traditionally, children were treated in the school setting during the academic year. More recently, however, children were examined and treated through a church-sponsored summer lunch program and during Vacation Bible School activities.

In addition to providing services to meet the *Healthy People 2010* oral health objectives, the DSGP attempted to increase access to preventive oral health services among low-income children, a goal consistent with the surgeon general's report. Not only did the grant allow the dental hygiene program to be the sponsoring agency, but it also provided a viable

service-learning opportunity for the dental hygiene students and allowed them to see firsthand some of the potential barriers to frequent oral health care visits.

Dental hygiene students volunteered to participate in the service-learning activity and to obtain credit either in a rural health or community oral health course, or as clinic requirements. Senior dental hygiene students were assigned to the DSGP as one of several rotations in a multicultural course as part of the curriculum. A short form was developed by the junior clinic supervisor to use at the sites to monitor the number and quality of dental sealants placed by dental hygiene students. Faculty, who used the same competency criteria as in the dental hygiene clinic, evaluated sealant quality at the completion of each to ensure its retention, and that the sealant was free of voids. Each patient's sealants were also evaluated for possible occlusal interferences.

In the spring of 2003, a graduate student who was also a licensed dental hygienist participated on site and helped with grant management. In the previous two years of the program, a full-time dentist on faculty had integrated the sealant program into his clinic-teaching schedule. This proved to be a positive aspect of the program, in that time spent recruiting dentists became non-problematic. Before this arrangement, the legal requirement of a dentist to be physically present during treatment had posed difficulties. Further, the dentist had good rapport with the students and faculty. The dental hygiene students were comfortable with the dentist, which helped to alleviate stress in some students with little experience with youngsters. In addition, two other dental hygiene faculty members incorporated this activity as a community service component of their three-pronged research, scholarly activities, and service requirements for tenure and promotion.

Although having one half-day set aside for this activity helped in scheduling the schools and the dental hygiene students, it was somewhat of a hindrance, mainly because of the restrictive supervision laws for dental hygiene practice that required a dentist to be present during treatment. As of August 2004, however, dental hygienists may practice under the general, rather than direct, supervision of a dentist, thus allowing the potential expansion of hours at the school sites. This supervision change has already led to an increase in the number of children examined and dental sealants placed.

Most recently, one dental hygiene student managed the program over two academic semesters via independent study with a dental hygiene faculty member. As part of the requirements for earned credit hours, the student created and maintained a procedure manual, managed dental hygiene students at the school sites, prepared the necessary paperwork for monthly state reports, gathered equipment and supplies to facilitate transport to the sites, created a program photo scrapbook, and established a patient database (Table I). In a reflective essay of her experiences, the student offered helpful suggestions for improvement, such as organizing the required paperwork for state reports in a more user-friendly manner and establishing a better system of storing equipment and supplies. The student also indicated that she felt more confident to work with public health-related programs upon her graduation in May 2004.

**Table I. Sample Demographic and Clinical Database Sheet\***

‡Record#	*Race	Age/YOB	Gender	Exam	Gde	ME	F/RL	#DPT	#FPT	#SPT	#ddt	#fdt	#sdt	†New Sealant
1-01	AA	1988	M	Y	6	N	Y	0	4	2	0	0	0	0
2-01	A	1989	F	Y	6	N	Y	0	0	0	1	0	0	5
3-01	C	1988	F	Y	6	N	Y	0	0	0	0	0	0	8

\*Additional database includes patients' names to track multiple encounters, and names for retention checks.

‡Records were number sequentially, followed by the year the child was examined.

†= Sealants placed on treatment day

YOB = Year of birth

Gde= Grade in school

ME= Medicaid Eligible

F/RL = Free/Reduced Lunch

DPT = Decayed Permanent Teeth

FPT= Filled Permanent Teeth

SPT= Sealed Permanent Teeth

ddt= decayed deciduous teeth

fdt= filled deciduous teeth

sdt=sealed deciduous teeth

\*Race was coded: A=Asian; AA=African American; H=Hispanic; C=Caucasian; BNH=Black, Non-Hispanic; AI=American Indian; AN=Alaska Native; O=Other

Initially, junior and senior dental hygiene students were given the opportunity to volunteer to participate in the DSGP as their class schedules permitted, and approximately 24 students volunteered. Generally, two students per portable unit, of which there were two, worked together for efficiency, incorporating the concept of four-handed dentistry. More importantly, students had the opportunity to apply skills learned in the dental hygiene clinic directly to providing much-appreciated services to a population in need.

The students also gained practical experience working with young children. During on-campus scheduled clinic hours, the students primarily treated adults because normal clinic hours often conflicted with school schedules.

Offering the management of the DSGP as an independent study experience continued for the fall 2004 and spring 2005 semesters. The dental hygiene students were each given four hours of college credit for the independent study, and they gained real-world experience as an added benefit. The students continued maintenance of the tasks previously mentioned, ordering supplies for the program, and expanding the database to include information from dental examinations as it related to the level of care indicated (i.e., "routine," "preventive," and "urgent," or "no treatment required") based on the choices from the forms used in the program (Table II). The data were later analyzed to determine if the need (decrease in incidence of decay) was being met.

**Table II. Levels of Dental Status of Patient**

- Urgent: abscess formation, nerve exposure, advanced disease state including handicapped individuals
- Routine dental care needed: alloys, composites, stainless steel crowns, etc.
- Preventive dentistry only needed: prophylaxis, fluoride treatment, sealants, etc.
- No treatment required
- Other (space is allowed to indicate other options)

Note: the form also contains areas to note pathology on the hard or soft tissues, malocclusion, and whether or not the child will need orthodontic intervention.

Some of the positive aspects of the dental hygiene-sponsored dental sealant program were: 1) the dental hygiene students represented the main human resource; 2) the supervising dentist was the primary Medicaid provider and member of the dental hygiene faculty; 3) the dental hygiene faculty participated actively as site coordinators and clinicians and, 4) dental hygiene students were (initially) given the opportunity to volunteer for the program as a service-learning option. Other positive aspects were that the DSGP reported directly to Doral Dental Services, which provided reimbursements for the state and was separate from the on-campus public aid clinic that provided services for adults and children, also sponsored by the SIUC Dental Hygiene Program.<sup>15</sup> In addition to the DSGP, the students in the dental hygiene program also staffed the Community Dental Center (CDC). The CDC (formerly the SIUC Heartland Dental Clinic) served as a place to refer children who were Medicaid-eligible and required additional dental treatment, based upon the data collected relative to the levels of dental status of children seen in the DSGP. Because the supervising dentist in the DSGP was also one of three providers with the CDC, some continuity of care was expected.

## **Conclusion**

Today's dental hygiene students are in a great position to learn about the opportunities available to them in public health. They have the opportunity to be participants in programs that benefit the community by offering skills they learn while in school. In order to foster the desire within dental hygiene students to work with underserved populations and to be a solution to access-to-care issues, it is recommended that dental hygiene program administrators and faculty teach students to:

Maintain relationships with their state and local health departments.

Be familiar with ever-changing trends that affect national health care.

Be knowledgeable about their particular states' dental practice acts.

Stay abreast of legislation that may change the nature of dental hygiene practice.

Keep an open mind about advancing the practice of dental hygiene with expanded functions.

Remain aware of the specific health needs within their own communities.

Be prepared to be a spokesperson or advocate for the support of programs designed to decrease the disparities in overall health care, including oral health care.

Volunteer their time and services to local schools by offering to deliver oral health education programs to increase the public's oral health IQ.

Upon graduation from an accredited dental hygiene program, secure and sustain membership in professional associations or organizations as well as local groups that provide networking with other like-minded individuals.

With more states relaxing practice restrictions as they relate to the utilization of dental hygienists, this valuable oral health professional will become a greater asset as the nation prepares to face access to oral health care head-on. Therefore, it is imperative that dental hygiene students be taught to meet the challenges that await them while they are still in school.

## **Acknowledgements**

## **Notes**

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## Implementation of a Peer-Evaluation Process

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***Purpose.*** Traditional dental hygiene education has focused on faculty evaluation of students. Recently, self-evaluation has been encouraged to assist students in enhancing their technical and problem-solving skills. No published studies were found on the use or effectiveness of peer evaluators in dental hygiene education. Peer evaluation was initiated to develop assessment skills without the inherent bias of self-evaluation. The purpose was to enhance clinical skills and evaluative abilities and document continued competence in selected clinical skills throughout the program. This study assessed students' attitudes toward the peer-evaluation process. Students often receive feedback from other students more positively than from faculty and learn by observing others in the same stage of learning.

***Methods and Materials.*** Students in their first clinical semester evaluated classmates on oral hygiene instruction, unit disinfection, polishing, and fluoride administration. Peer evaluators did not assign grades; they indicated only a "satisfactory" or "unsatisfactory" judgment on each item. At an orientation session, students were introduced to the concept of peer evaluation, given copies of the forms, and informed that their evaluations would have no impact on the course grade of the student being evaluated.

***Results.*** Over the course of the semester, 23 peer evaluators marked all items as "satisfactory"; only nine marked any items as "unsatisfactory." Number of U's given ranged from 0 to 13 per evaluator. For the semester, a total of 32 U's were given: 69% on unit disinfection, 16% on oral health instructions, 9% on polishing, and 6% on fluoride administration. The number of U's received ranged from 0 to four per sheet. At the end of the semester, students completed a 12-item questionnaire on attitudes and experiences as both a peer evaluator and the subject of peer evaluation. Using the Binomial Test, significantly more ( $P < .05$ ) students considered the process enriching and learned much about their own clinical skills. Significantly more ( $P < .05$ ) students were comfortable with the peer-evaluation process.

***Conclusion.*** This process was found to be valuable for the students, both as peer evaluators and as subjects of peer evaluation.

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## Preparing Students for Alternative Practice: Rewards and Barriers in Service Learning

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*Throughout the United States, an emphasis has been placed on: 1) access to oral health care with the publication of the Surgeon General's report on oral health in America and Healthy People 2010, 2) decreasing restrictive supervision laws as they relate to the practice of dental hygienists, and 3) service learning. Southern Illinois University in Carbondale (SIUC) defines service learning as a form of experiential education in which students engage in activities that address human and community needs, with structured opportunities intentionally designed to promote student learning and development. Junior and senior dental hygiene students participated as part of clinical and service learning requirements in a grant-funded dental sealant program. Serving as the sponsoring agency, the SIUC Dental Hygiene Program received funds from the Illinois Department of Public Health/Division of Oral Health (IDPH/DOH) to provide dental examinations and pit and fissure sealants for school-aged children who qualified for free or reduced-cost lunch or Medicaid/Kidcare. Initial funds were used to purchase portable equipment and supplies. The grant is currently in its second renewal period and SIUC is the only grantee that is operating within a dental hygiene program in the state. A major advantage of working from within a dental hygiene program is that the students serve as the largest human resource, along with a supervising staff dentist, one dental hygiene faculty member, and a graduate student assistant. The purpose of this activity was to not only provide sealants and preventive dental education to underserved elementary school children, but also to enhance the dental hygiene students' experiences working outside a formal clinical setting. This experience provided a snapshot of one aspect of dental hygiene practice in public health and community outreach settings. Since April 2001, the SIUC sealant program has had an overall sealant retention rate of 84.22%, based on the total number of teeth sealed divided by the total number of retained sealants. Feedback was solicited from students regarding their experiences with the program from a short three-item survey. All self-reported responses are based on 19 total students representing 32% of the population eligible to participate in the service learning activity, but constitute a 100% return rate. A total of 47.3% (n = 9) gained self-confidence from the experience working as a team and providing caring and compassionate care. Approximately 80% (n = 15) noted that they felt proficient in applying sealants in an environment other than the dental hygiene clinic. Students cited that providing care for children was rewarding; they were not just "scaling teeth" and enjoyed working in a non-formal setting. Barriers to this learning opportunity included the fact that not all dental hygiene students and elementary school students were able to participate, the need for advanced planning, and the dental supervision requirement. Further opportunities need to be developed to augment service learning that focuses on access to care issues.*

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## Project Mouthguard

Faith Y Miller, Ronda DeMattei, Dwayne G Summers and Amy Carrico

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*Project Mouthguard was funded by the Illinois Department of Public Health to change the policy concerning the wearing of protective custom mouthguards by children in grade school through high school, regardless of socioeconomic status. Under the stipulations of the grant, the program was to be eventually extended to reach children in programs that sponsor sporting events within the community. The sponsoring agency was the Southern Illinois University at Carbondale (SIUC) Dental Hygiene Program, which looked at the possibility of implementing Project Mouthguard as an additional opportunity for students to learn and work through a grant-funded program. Program funds were utilized to purchase equipment and supplies, with the intent to provide treatment at various sites. A private practitioner provided a venue away from the dental hygiene clinic. Project Mouthguard is in its initial phase of implementation within the SIUC Dental Hygiene Program; therefore, determination of its success is anecdotal. Dental hygiene students were able to participate in the program by assisting with the taking and pouring of impressions, as well as the fabrication of the appliances. Advantages for the dental hygiene students included gaining practical experience working with dental materials such as alginate, gypsum products, and mouthguard materials beyond the classroom or laboratory. As an incentive, students were given clinical credit, and some students received credit for community service through their respective fraternal organizations. Project Mouthguard was expanded to meet the needs of children that participated in the Give Kids a Smile Program, sponsored locally by the SIUC Dental Hygiene Program, and nationally by the American Dental Association. During the special program, dental technology faculty and students assisted with the fabrication of the appliances. Children receiving the appliances on the same day not only had a quality, custom mouthguard made with the best in modern equipment and current technology, but it was also an exemplary demonstration of what collaboration between two separate entities within the dental profession could accomplish in a short time frame. Another advantage for the dental technology students was that they further gained applied experience beyond their laboratory setting, and the dental technology faculty could apply this to service to the community for merit. Furthermore, Project Mouthguard will serve as a mechanism for future collaborations between dental hygiene and dental technology faculty and students. To date, a total of 24 of 31 children (77.4%) have actually received mouthguards from the grant-funded program. The children ranged in age from 8 to 18, and all of them indicated participation in at least one sport. Currently, the Illinois Department of Public Health has no data collection system employed for monitoring the use of mouthguards in sporting activities, and it would welcome any input gathered from its grantees. The dental hygiene program has now been provided the impetus for adding to the existing body of knowledge as it relates to attitudes and perceptions of athletic coaches regarding the wear of protective mouthguards, and for coaches to evaluate existing policies or to create new policies that pertain to this preventive measure.*

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## **Collaborative Project in Web Site Development**

Kami Hanson, Susan Alexander, Staci Stout, Jessica Lords, Christie Balch, Lisa Gove, Shannon Bingham, Summer Anderson, Christianne Griffin and Holly Christianne

*Kami Hanson, RDH, BS, is an assistant professor at Weber State University; Susan Alexander, RDH, BS, is an instructor at Weber State University. Staci Stout, Jessica Lords, Christie Balch, Lisa Gove, Shannon Bingham, Summer Anderson, Christianne Griffin, and Holly Cook are students at Weber State University.*

*The Internet has had a tremendous impact on society. It has become not only an initial source for information, but also a venue for capitalism, commercialism, and consumerism. Consequently, new graduates need to be savvy in the use and aware of the advantages of the Internet. The purpose of this project was to 1) introduce to the students the use and advantages of the Internet, 2) establish a collaborative effort among the faculty and students to design a project for the Internet, 3) introduce and identify the benefits of an online Web site for the students in the dental hygiene program at Weber State University, 4) decide on type, content, quantity, and quality of the Web site(s), 5) learn and create a Web site using Web site development software. The result of this project was the creation of two Web sites: a student site for those in the dental hygiene program and a site for the program's clinic manual that could be accessed chairside and at off-site facilities. The student Web site has pages that include a student registry, calendar of events, a listing of first- and second-year courses with links to course Web sites, a SADHA page, and a dental related links page. The clinic manual site has the entire program clinic manual hyperlinked and organized for easy navigation. During the development process of the project, the students negotiated and signed contracts with the faculty regarding expectations and outcomes. The group, as an assessment tool of the final project, created a rubric. The rubric covered information regarding the overall general design, text, navigation, links, and graphics of the Web sites. Once the architectural frameworks of the sites were created, they were launched with URL addresses. The group met weekly to evaluate and discuss the two sites' need for improvement. Evaluation was done by the solicitation of anecdotal feedback from student peers, an observation of the "hit" counters that were on each site, and the developed rubric combined with the opinion of the students and faculty who worked on the project. The results of this evaluative process revealed the student site to be informative and user-friendly. A new webmaster position was created within SADHA to provide for future maintenance of the student site. In addition, the clinic manual, while helpful and convenient in its current form, needed further organizational management. This was achieved through the incorporation of pages with frames for the heavily text-laden components of the manual. As with anything that is technology related, evaluation for content and relevancy will continue to be ongoing. This project has been fulfilling and beneficial for both the students and the faculty. In the future, Weber State dental hygiene faculty and students will continue to work collaboratively to create innovative projects using technology.*

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## **Salivary Mutans Streptococci and Caries Incidence in Middle School Children in Rural Washington State**

Kimberly K Mathieu, Marilyn C Roberts, Norma J Wells and Beverly A Dale

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*Funding for this project was provided by the National Institute of Dental and Craniofacial Research, National Institutes of Health, Grant #U54 DE14254.*

***Purpose.** Streptococcus mutans is the primary organism associated with dental caries, an infectious, bacterial, and multi-factorial disease that remains the world's most common biofilm-related dental disease. However, the relationship between caries experience and the salivary mutans streptococci (MS) load is controversial. By understanding this relationship, we might better link caries activity to microbial diagnostic tests and improve caries management. This study aims to determine if caries experience in children is associated with salivary bacterial load of MS.*

***Methods and Materials.** We acquired adult institutional review board consent from parents and consent from their children to conduct oral examinations and collect buccal and salivary samples. A total of 149 children (88 female, 61 male; 11-15 years) were recruited. Overall, the children were healthy, with 91.8% having no history of major disease. Most children had permanent dentition (80.4%). The children presented with no decay (35%), low decay (32%, <3 D+F), and high decay (33%, =3 D±F) surfaces. From the 149 children, 20 with high caries experience and 20 with no caries were selected for study of salivary MS levels. The estimation of bacterial load in saliva was determined by radio-labeled ribosomal RNA probes using 10-fold dilutions of saliva samples. The lowest dilution at which salivary MS was detected was scored for correlation with caries experience. These data will be analyzed using the student's t test once all samples are assayed.*

***Results.** To date, 29 samples have been assayed, 16 from the high-caries group and 13 from the no-caries group. The high-caries children showed detectable salivary MS at dilutions of 102 and 103, while the no-caries group showed a wide distribution of detection ranging from 102 to 106. Thus, the high-caries group had lower levels of salivary MS than the group with no caries. One possible explanation for this surprising result is that MS in high-caries children may have greater adherence to teeth and, therefore, have low concentrations in saliva.*

***Conclusion.** These results emphasize the multi-factorial nature of the dental caries process in which bacteria, diet, oral hygiene, and genetic factors all contribute to the overall risk for caries.*

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## **The Effects of Relaxation Training on Dental Anxiety and Pain Perception During Dental Hygiene Treatment**

Lynne C Hunt, Mary George, Rebecca Wilder, William Maixner and Susan Gaylord

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*This study was funded by the ADHA Institute for Oral Health.*

***Purpose.** Dental anxiety affects a significant proportion of the population and can lead to avoidance of dental care. Anxiety levels are strongly correlated to pain perception during dental and dental hygiene treatment. Relaxation training has been shown to reduce anxiety and pain perception during dental treatment. The primary purpose of this exploratory study was to examine the effects of a short, simple relaxation intervention on dental anxiety and pain perception during a dental prophylaxis.*

***Methods and Materials.** A convenience sample of 17 (nine females, eight males) dentally anxious (Corah's Dental Anxiety Scale/DAS), healthy subjects between the ages of 18 and 60 were recruited by advertisement in two local newspapers and flyers distributed throughout the campus of the University of North Carolina. Institutional review board approval was granted in April 2002. Subjects were allocated by block randomization into the experimental group (relaxation training) and the control group (standard treatment). All subjects received quadrant scaling divided among three visits, with the experimental group receiving the relaxation training at the second visit. Blood pressure and reported pain perception was recorded prior to scaling, at midpoint, and after scaling at all three visits.*

***Results.** For the control group, no indication of statistically significant differences in blood pressure occurred between visits 1 and 2, 1 and 3, and 2 and 3 ( $P > .06$ ). For the experimental group, statistically significant differences occurred between visit 1 and 2, 1 and 3 ( $P < .05$ ), but not 2 and 3. This trend was consistent for all timings of blood pressure recording. Average pain expectation scores (0-100 scale with 100 = most painful) for the control group was 43 (SD = 29), 32 (SD = 18), 21 (SD = 19) and 62 (SD = 29), 41 (SD = 27), and 33 (SD = 27) for the experimental group. Expected pain repeated measures ANOVA analysis revealed no statistical difference between groups. Average DAS for the control group prior to the first visit was 15.22 (SD = 1.7) and, after the final visit, 11.44 (SD = 2.5); and for the experimental group 14.6 (SD = 2.3) prior to the first visit, and 10.87 (SD = 2.8) after the final visit.*

***Conclusion.** Subjective impressions of the principal examiner and the consistency in the direction of change after relaxation training indicated the training did have an effect on blood pressure. Both groups reported reductions in expected pain scores between visits and DAS scores between screening and post-treatment visits.*

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## **Obstetricians' Knowledge of and Practice Behaviors Concerning Periodontal Disease and Preterm Low Birth Weight**

Christina B Robinson, Susan Lieff, Rebecca Wilder, Kim Bogges and Salli Benedict

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*Funding for this project was provided by the ADHA Institute for Oral Health.*

*Purpose. Recent evidence has shown that periodontal disease may be a risk factor for preterm low birth weight (PTLBW). This study assessed obstetricians' knowledge and practice behaviors concerning periodontal disease and its possible effect on preterm low birth weight.*

*Methods and Materials. One hundred ninety-four practicing obstetricians in a five-county area in central North Carolina were surveyed. Second and third mailings were sent to non-respondents. Descriptive statistics, chi square, and Fisher's exact tests were calculated using SAS software (Cary, NC). Fifty-five obstetricians in the population were ineligible because they had retired, were no longer practicing obstetrics, or were no longer in the study area.*

*Results. Of the remaining 139 eligible obstetricians, 55 responded, yielding a 40% response rate. When asked about the cause of gingivitis (95%) and periodontitis (67%) most answered correctly. When asked about risk factors for periodontal disease, most correctly indicated bacteria (94%), tooth decay (73%), aging (69%), and excess dietary sugar (51%). When asked if they looked into patients' mouths, 22% did so at the initial visit, 9% did so periodically, and 48% did so only when a problem was mentioned by the patient. When asked if they recommended dental examinations, 49% responded rarely or never. When asked about risk factors that may contribute to PTLBW, 99% responded maternal smoking, 94% responded preeclampsia, 84% indicated periodontal disease, and 79% indicated bacterial vaginosis.*

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## **Ease and Comfort of the Anterior Middle Superior Alveolar Nerve Block Using a Computer-Controlled Anesthetic Delivery System**

Robert F Nelson, Marti Pollard and JoNell M Bly

*Robert F. Nelson, RDH, MPA is an associate professor at the University of South Dakota; Marti Pollard, RDH, MS, is an assistant professor at the University of South Dakota; and JoNell M. Bly, RDH, BS, is an instructor at the University of South Dakota.*

***Purpose.*** Many dental patients have preconceived thoughts concerning pain upon the injection of local anesthetic. Dental clinicians have the task of achieving successful anesthesia with a minimum of patient discomfort. The Anterior Middle Superior Alveolar (AMSA) nerve block achieves pulpal and lingual soft tissue anesthesia for the maxillary central incisor through the maxillary second premolar, without collateral anesthesia of the face or lips. This injection is accomplished using a computer-controlled anesthetic delivery system. The purpose of this pilot study was to determine ease of administration, degree of anesthesia achieved, and perceived comfort level of the patient when the AMSA technique is utilized.

***Methods and Materials.*** A small convenience sample of nine senior dental hygiene students enrolled in the University of South Dakota Department of Dental Hygiene was selected to participate in this study. Selection criterion was limited to students who chose to complete their local anesthesia competency at one of two pre-selected operatories. Study participants administered the AMSA injection to a student partner following a brief orientation to the Dentsply Comfort Control Syringe® and the correct injection technique. Operators administered 0.9 ml of lidocaine with epinephrine 1:100,000. The operator and student partner completed separate surveys to evaluate the injection technique.

***Results.*** Using a scale of 1 to 5, respondents rated the ease of administration, comfort of the injection, and degree of anesthesia, with a score of 1 equaling a high degree of success and 5 equaling a low degree of success. Respondents rated ease of injection with a mean score of 1.56. The student partner rated the comfort of receiving this injection with a mean score of 1.75 and the degree of anesthesia with a mean score of 2.25.

***Conclusion.*** The authors of this study concluded that this injection was easy to administer, relatively comfortable to receive, and achieved effective anesthesia.

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## **Optimum Travel Distance of Dental Aerosols in the Dental Hygiene Practice**

Catherine Bowden Milejczak

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***Purpose.** Dental hygienists have a legal and ethical responsibility to prevent disease transmission. Dental aerosols are produced from mechanized instruments used in dental hygiene treatment protocols. These aerosols can contain blood, saliva, and bacteria combinations that can produce potentially harmful air contaminants (bioaerosols). Current health issues such as the continuous changes in HIV/AIDS rates, the increase in number of people infected with the hepatitis C virus, the reemergence of tuberculosis, the increase in number of people with respiratory infections, the recent outbreak of Severe Acute Respiratory Syndrome, and the number of immunocompromised individuals seeking dental care has triggered a re-evaluation of infection control procedures. The American Dental Association, the Centers for Disease Control and Prevention, and the Organization for Safety and Asepsis Procedures have issued recommendations for the reduction of dental aerosols. Though invisible to the human eye, aerosols can potentially cause severe diseases to both oral health care workers and their clients. The purpose of this study is to determine how far bioaerosols travel and if the aerosols linger beyond the client appointment time (usually one hour or less). Knowledge of the distance that these bioaerosols travel and the amount of time they remain airborne will enable the clinician to employ better aseptic techniques, employ personal protective equipment, and create a safe environment for both the dental clinician and the dental client.*

***Methods and Materials.** The operator conducted five timed mock trials of 20 minutes for each instrument type (sonic scaler, ultrasonic scaler, and air abrasive). A DataRAM Real-Time aerosol monitor designed to measure airborne particulate concentrations was used to measure the aerosols. The measurements were recorded during three phases (pre-procedure, procedure, and post-procedure) at eight specified distances (30 cm increments). The data were organized into an analysis of variance table (block design) and a factorial balanced design method (8 x 4 x 3) of analysis of variance using repeated measures (means of the means) as conducted. A repeated measures design was used to control the extraneous variation of the study (location, air/heating, air currents). The analysis was computed using the Minitab statistic analysis program. A two-way analysis of variance of the data was used to determine if there were any significant differences in the means for the distance the aerosols traveled, the length of time the aerosols remained airborne, and the concentration amounts of aerosols produced from each machine.*

***Results.** The results of the study demonstrated that particulate concentrations were present for 240 cm (nearly eight feet) and, while the greatest concentration of particles were present at the end of the procedure, a mean aerosol amount of 0.022 units was still present two hours past the procedure. The greatest amounts of aerosols were found during all time trials in the 30 to 90 cm range (1-3 ft), which is in the operators' work zone.*

***Conclusion.** The study demonstrated that the ultrasonic scaler produced more aerosols than the sonic scaler and the air abrasive instrument at each measured time. Conclusions from this study support the necessity of the dental hygiene health care provider using measures to reduce aerosols in the dental hygiene operator. This includes the use of high volume suctioning devices (large-bore suction tips, funnel shape attachments), pre-procedural rinsing, properly wearing*

***personal protective equipment, good ventilation air recirculation in the operatory, and properly disinfecting areas where splash, splatter, and aerosols may contaminate.***

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## **Access to Oral Health Care in Virginia**

Jackie S Perry, Deanne Shuman, Margaret Green and Gayle McCombs

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*Funding for this study was provided by ADHA.*

*Purpose. Multifaceted and interrelated barriers exist in attaining access to oral health care for citizens of Virginia. As a proactive effort to improve oral health care access in Virginia's underserved communities, the Virginia Dental Hygienists' Association conducted a statewide survey of licensed dental hygienists. The purpose of this study was to assess the awareness, availability, preparedness, and commitment of the dental hygiene workforce to meet the preventive oral health needs of underserved populations.*

*Methods and Materials. In May 2000, a questionnaire was mailed to 2,530 Virginia dental hygiene licensees. The self-designed questionnaire contained 23 questions divided into four categories: demographic and professional data; practices and procedures relative to primary employment setting; regulatory and health care changes; and opinion about legislative issues. Responses were close-ended with the exception of the legislative issues. Questions and results were analyzed using SPSS software (Chicago, IL) to obtain frequency distributions and percentages.*

*Results. A 42% response rate was obtained for the survey. The majority of dental hygienists were employed in private, general practices under direct supervision. Fee-for -service was the majority payment mechanism accepted at the respondents' primary place of employment. The majority of dental hygienists, 93%, believed that the following populations were in need of increased access to care: indigent children and adults, the uninsured, the elderly, the homeless, the mentally and physically challenged, the homebound, nursing home residents, and underserved rural area residents. Respondents indicated that if they could receive direct reimbursement for services, they would be willing to seek employment in other settings such as schools, assisted living residences, long-term care facilities, hospitals, day care centers, rural and urban health care facilities, and health departments.*

*Conclusion. It could be concluded from this study that the majority of the respondents are aware of the dentally underserved populations in Virginia and are prepared to meet the needs of these groups if reimbursement for their services was available.*

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## **Survey for Teaching Patient Education in the Dental Hygiene Curriculum**

Nancy Kane Mann and Patricia A Sellers

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***Purpose.** The primary objective of this descriptive study was to assess if and when dental hygiene curricula provide practice opportunities to students in teaching patient/client oral health self-care techniques and whether that experience was prior to their first clinical experience.*

***Methods and Materials.** The survey collected data through the use of descriptive research utilizing a two-page questionnaire containing some open-ended items. The survey was mailed to all 255 accredited dental hygiene programs in the United States and Puerto Rico in August 2000, and 174 were returned. There was no pilot testing. The primary mailing resulted in a 68.2% return rate, so a second mailing was not considered necessary. Program administrators were asked to fill in their responses or pass the survey to the faculty in the program who taught preventive dentistry. The participating respondents were asked to describe the preventive dentistry portion of their curriculum by checking lists in the survey and/or by writing in responses in the space provided. Specifically, respondents were asked to indicate how their program evaluated students on teaching patients self-care techniques in a preclinical and clinical setting.*

***Results.** Almost half of the responding dental hygiene programs reported providing a preventive dentistry course. The other half incorporated the appropriate information in a preclinical course. Approximately 80% of programs responding offered a unit in their curriculum that focused on patient education, and almost 80% evaluate students' patient education technique before they begin working in a clinical setting. The results of the survey revealed that nearly all programs view patient education as highly important and would strongly agree that patients should be able to demonstrate mastery of their newly learned techniques.*

***Conclusions.** The results indicate that competency in students' teaching patient/client oral health self care techniques is a priority for dental hygiene programs. The data collected in this descriptive study suggests that a majority of dental hygiene programs are offering patient education units in their curriculum and requiring practice opportunities for students before their initial clinical experience. Programs that do not focus as much on patient education proficiency may wish to review their curricula in order to offer such opportunities to better prepare their students prior to clinical experiences. In fact, it is recommended in the Accreditation Standards for Dental Hygiene Education Programs (Sections 2-16) that "sufficient practice time and learning experiences should be provided during preclinical and clinical courses to ensure that students attain clinical competence. The number of hours devoted to clinical practice time should increase as the student's progress toward the attainment of clinical competence."*

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## **Effects of Daily Oral Care with 0.12% Chlorhexidine Gluconate and a Standard Oral Care Protocol on the Development of Nosocomial Pneumonia in Intubated Patients: A Pilot Study**

Michelle Bopp, Michele Darby, Karin Loftin and Sharon Broschious

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***Purpose.*** The purpose of this pilot study was to determine if nosocomial pneumonia rates differ among intubated patients who received twice-daily oral hygiene care with a 0.12% chlorhexidine gluconate (CHX) agent and those who received the standard oral care six times daily while in the critical care unit (CCU).

***Methods and Materials.*** Twice-daily oral hygiene care consisted of brushing the cheeks, teeth, and endotracheal tube with a suctioning toothbrush, using a 0.12% CHX antimicrobial agent with the experimental group (two intubated patients in the CCU). The control group (three intubated patients in the CCU) received the standard oral care with a soft foam swab and half-strength hydrogen peroxide. Oral care was performed by the nursing staff.

***Results.*** Results revealed that one person in the control group developed nosocomial pneumonia. None of the subjects receiving the CHX protocol developed nosocomial pneumonia.

***Conclusions.*** Findings suggest that twice-daily oral hygiene care with a 0.12% CHX agent may reduce the risk of nosocomial pneumonia in intubated patients more than the six-times-daily standard oral care protocol, which does not include the use of an antimicrobial solution. Twice-daily oral hygiene care with 0.12% CHX as a nosocomial pneumonia reduction strategy within hospital critical care units requires further testing on a larger sample.

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## **Comparison of the Use of a Toothpick in a Toothpick Holder to Dental Floss in Improvement of Gingival Health**

Maurice W Lewis, Robert J Selders, Cassandra Holder-Ballard, Mark Scarbecz and Edgar W Turner

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***Purpose.*** *In light of the current trend toward host modulation of inflammatory response in periodontal therapy, it is important to control the bacterial challenge to the host immune system through conventional therapy and improvement of personal oral hygiene. Toothbrushing and flossing are currently the standard methods for achieving adequate plaque control. While studies show that people are generally compliant with daily toothbrushing, they are less likely to use dental floss daily. This purpose of this study was to compare the effect of dental floss and the use of a toothpick in a toothpick holder as determined by chance in specific indices used to measure gingival health.*

***Methods and Materials.*** *Potential subjects were solicited from the University of Tennessee Health Science Center's faculty, students, staff, and dental school patient population. Those with clinical gingivitis or mild periodontitis were included in the study sample. O'Leary Plaque Index, Interproximal Plaque Index (IPI), and Eastman Interdental Bleeding Index (EIBI) scores were recorded at baseline and at each following appointment. Fifty-five subjects (42 females, 13 males) ranging in age from 18 to 50 were randomly assigned to either a dental floss group or a toothpick in a toothpick-holder group. Subjects were individually instructed in the use of the assigned plaque removal device and were examined at weeks two, six, and 12 from baseline.*

***Results.*** *At 12 weeks, 27 floss users and 20 toothpick in a toothpick-holder users completed the study. For both groups, plaque index scores were lowered as the study progressed. Mean O'Leary Plaque Index scores decreased significantly for both methods from baseline to week 12 ( $P < .05$ ). The EIBI and IPI mean scores decreased over time for each method ( $P < .05$ ).*

***Conclusions.*** *The results of this study suggest that dental floss users and toothpick in a toothpick holder users were both effective in removing plaque and in decreasing gingival bleeding scores. The use of either could result in improving gingival health.*

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## Frequency of Dental Prophylaxis and Glycemic Control in Type 2 Diabetes

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*This study was supported by a National Institute of Dental and Craniofacial Research, National Institutes of Health, Grant #R01DE13796.*

***Purpose.** Both diabetes and periodontal disease are common chronic diseases. It has been established that diabetes adversely affects periodontal health. Evidence is also increasing to support treating periodontal infection to improve glycemic control in people with diabetes. This evidence comes from reports of intervention studies evaluating the effect of treating patients with varying periodontitis severity in controlled settings. Reports on the relationship between frequency of dental prophylaxis and glycemic control are sparse. The purpose of this analysis was to test the hypothesis that people who report more frequent or more recent dental prophylaxes are more likely to have better glycemic control.*

***Methods and Materials.** We analyzed screening data from 240 university hospital clinic and HMO subjects with type 2 diabetes, who were recruited for an ongoing clinical trial to investigate whether recency of dental prophylaxis appointments was associated with glycemic control as measured by level of hemoglobin A1c (HbA1c). Bivariable analysis and multiple regression modeling were conducted to evaluate associations of HbA1c with continuous and categorical variables collected from interviews and clinical examinations. The primary explanatory variables of interest were responses to interview questions on time elapsed since dental prophylaxis appointments.*

***Results.** In bivariable analysis of numerous demographic, medical, and behavioral variables, only oral diabetes medication/insulin usage status ( $P = .03$ ) and doctor-recommended frequency of checking blood glucose levels ( $P < .01$ ) showed statistically significant associations with HbA1c. Results from multiple regression modeling indicated that race/ethnicity, education level, and doctor-recommended frequency of checking blood glucose levels were significant predictors ( $P < .05$ ), while diastolic blood pressure, low activity level, and current tobacco use were marginally non-significant predictors ( $P > .05$ ). Time elapsed since dental prophylaxis appointments showed a positive but statistically non-significant association with HbA1c in both bivariable ( $P > .25$ ) and regression analysis ( $P = .2$ ).*

***Conclusion.** Further, more rigorous investigation of predictors of HbA1c is needed to determine if recency and frequency of dental prophylaxis contribute to glycemic control in subjects with diabetes.*

## **Predictors of Student Success in an Entry-Level Baccalaureate Dental Hygiene Program**

Mohammad J Alzahrani, Evelyn M Thomson, Deborah Bauman and Deanne Shuman

*Purpose.* The purpose of this study was to measure the utility of various predictors that have been used by the Old Dominion University Gene W. Hirschfeld School of Dental Hygiene baccalaureate degree dental hygiene program in selecting dental hygiene students who are most likely to graduate and be successful in passing the National Board Dental Hygiene Examination (NBDHE). The following factors were examined: incoming grade point average; grade point average in prerequisite science courses; admissions criteria points (ACP); final grade in prerequisite science courses, including chemistry I and II, human anatomy, physiology I and II, and microbiology; final grades in first-year dental hygiene courses, including oral anatomy and histology, and oral pathology; multiple attempts to achieve a passing final grade in prerequisite science courses; and the academic setting where these prerequisite science courses were completed. The ACP is a custom-designed rating program used by the Old Dominion University Gene W. Hirschfeld School of Dental Hygiene to organize data submitted by prospective students on applications for admission. This instrument assigns quantitative numbers to the required admissions data and tallies the numbers into a total score. This total score is utilized to assist the admissions committee with selecting applications.

*Methods.* The sample selected for study consisted of the academic records of dental hygiene students who were admitted to the Old Dominion University Gene W. Hirschfeld School of Dental Hygiene for the academic years 1998 to 2002 ( $N = 235$ ), who would have been eligible to take the NBDHE during the years 2000 to 2004. Prior to initiation of the study, a proposal was submitted to the Old Dominion University Institutional Review Board to obtain approval. Data were obtained from admissions documents and department records. Data were analyzed using multiple logistic regression with a pre-determined level of significance ( $P = .05$ ) to determine whether or not these variables predicted success in this entry-level baccalaureate dental hygiene program as measured by graduation from the program. When the NBDHE was a criterion variable, data were analyzed using the multiple linear regression with a pre-determined level of significance ( $P = .05$ ) to determine whether or not these variables predicted successful entry into the profession as evidenced by passing the NBDHE.

*Results.* Data analysis revealed that final course grade in oral pathology was a significant predictor of success when graduation was used as the indicator of success ( $P = .0008$ ). Variables that predicted success on the NBDHE included the final course grade in oral pathology; final course grade in oral anatomy and histology; and the ACP rating ( $P < .0001$ ,  $P < .0001$ , and  $P = .0245$  respectively). There was no statistically significant relationship between final grade in prerequisite science courses; multiple attempts to achieve a passing final grade in prerequisite science courses; and the academic setting where these prerequisite science courses were completed and success in the dental hygiene program.

*Conclusion.* Results from this study add to the body of knowledge that attempts to identify variables with the potential to predict success in dental hygiene educational programs. These findings may allow academic institutions and dental hygiene educators to evaluate admissions criteria and possibly identify those criteria most likely to predict success. While most of the variables under investigation in this study were not found to be predictors of success when tested alone, when these variables were combined into a cluster of variables (ACP), they proved significant at predicting success. The significance of the ACP to predict success might prove that combined variables rather than one variable are more likely to predict success. Results may generate debate among admission committees concerning what

***combination of variables should be collected on student applications. In addition, dental hygiene coursework (oral pathology, and oral anatomy and histology) after admission to the program can significantly predict graduation and NBDHE success, suggesting that educators look to improving student performance after admission to the program to improve the likelihood of success.***