Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Moving Research Forward; Moving Dental Hygiene Forward

Rebecca S Wilder, RDH, BS, MS

*Rebecca S. Wilder is an associate professor at the University of North Carolina Chapel Hill School of Dentistry and Director of the Master of Science Degree Program in Dental Hygiene Education. She is the current editor-in-chief of the Journal of Dental Hygiene.*

This issue of the *Journal of Dental Hygiene* is especially exciting for ADHA and for me. The first news is that you will see the results of the first ever ADHA/Sigma Phi Alpha Journalism Award Competition. The award is intended to honor a student who has written a review or original research paper that contributes to the dental hygiene body of knowledge and is of the quality to be published in the *Journal of Dental Hygiene*. Students enrolled or within 6 months post-graduation from a baccalaureate, degree completion bachelor's program, master's, or doctoral-level program were eligible to apply. All of the papers were to be linked to the National Dental Hygiene Research Agenda. The recipient of the award received $1000 and had her paper published in the *Journal of Dental Hygiene*.

The *Journal* received several papers for the competition. The papers were blinded and sent out for peer review by 4 members of the editorial review board. The criteria were very objective and each reviewer had to rate and rank the papers.

The winner of the competition was Carrie Bigelow, RDH, MS who graduated with a Master of Science Degree in Dental Hygiene Education from the University of North Carolina Chapel Hill School of Dentistry in May, 2007. The title of Carrie's paper is "North Carolina Dental Hygienists' Views on Oral Cancer Control." Her thesis committee consisted of Dr. Lauren L. Patton, DDS, Director, General Practice Residency and Professor, Department of Dental Ecology; Ronald P. Strauss, DMD, PhD, Distinguished Professor and Chair, Department of Dental Ecology; and Rebecca S. Wilder, RDH,

MS, Director, Graduate Dental Hygiene Education and Associate Professor, all in the Department of Dental Ecology. Carrie received a plaque along with a check for $1000. Her entire paper is published in this issue of the *Journal*.

Honorable mention was extended to 2 other candidates. Danielle Furgeson, RDH, MS, also graduated in May 2007 from the master's program at UNC. Her paper is entitled, "The Role of the Student Professional Association in Mentoring Dental Hygiene Students for the Future." Danielle's paper has also been accepted and is scheduled for publication in the winter issue. Mary E. Cosaboom-FitzSimons, RDH, BS, MS, is a May 2007 graduate from the Master of Science in Dental Hygiene program at Old Dominion University Gene W. Hirschfeld School of Dental Hygiene Health Sciences in Norfolk, Va. Her paper, "Community-Based Collaborations by Nurse Practitioners and Dental Hygienists," is currently being reviewed for possible publication in the *Journal*.

The story does not end here. NONE of these students knew how to conduct original research or write a publishable paper prior to entering into their graduate studies. None of them entered their program with an exact idea of what they wanted to do for their thesis work. But, look what they have accomplished. All of them had mentors who facilitated their development and guided them through the process. They now have an obligation to continue their work, further develop in their career, and become the future leaders of our profession. I have no doubt that they will.

The other exciting section of the *Journal* in this issue is the list of abstracts that were presented at the ADHA Annual Session in New Orleans, La. Thirty-one abstracts were presented on topics that ranged from tooth whitening to evaluation methods to patient knowledge of the link between diabetes and periodontal disease. Most of the topics were directly connected to the National Dental Hygiene Research Agenda. Many were presented by academicians of dental hygiene programs but several were presented by students and practicing clinicians. An invitation has been sent to those who presented their research to submit a paper to the *Journal of Dental Hygiene* for possible publication in our peer-reviewed research journal. Having a published abstract is important but the work needs to be finished. It is not finished until it is prepared in the format of a peer-reviewed journal, submitted for publication, critiqued by experts in the field, accepted, and published in a journal that is Medline accessible.

Enjoy this issue of the *Journal of Dental Hygiene*. Our research is something to be proud of and shared with the world. I am extremely proud of all who contribute their time, energy, and desire to see our profession progress. Many of those names are listed in this issue of the *Journal of Dental Hygiene*.

Have a wonderful fall!

Sincerely,

Rebecca Wilder, RDH, BS, MS

Editor-in-Chief, *Journal of Dental Hygiene*

RebeccaW@adha.net

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Upfront

Katie Barge

*Katie S. Barge is staff editor of the Journal of Dental Hygiene and staff writer for Access*

## First Drag of Cigarette May Lead to Addiction

Teens may become addicted to smoking after their first drag of a cigarette, reported researchers in the October issue of *Pediatrics*. Almost one-third of the kids interviewed for this study said their first cigarette made them feel relaxed-and two-thirds of those kids went on to be smokers.

"This provides further support for the idea that dependence begins with the first cigarette," said study lead author Dr. Joseph DiFranza, a professor in the department of family medicine and community health at the University of Massachusetts Medical School in Worcester, Mass.

While previous research has identified many psychological factors that increase the risk of smoking, this study sought to identify factors that determine susceptibility to nicotine dependence. The researchers evaluated the roles of personality, environment, and the subjective response to nicotine in determining which youths get hooked once they have exposed their brains to nicotine by inhaling from a cigarette.

Between 2002 and 2006, the researches tracked the smoking habits of 217 sixth-graders, averaging 12 years of age, from 6 schools in Massachusetts. Nearly 75% of the teenagers were non-Hispanic whites, and all reported having inhaled a cigarette at least once. Over the course of the 4-year study, 11 in-person, 20-minute interviews were conducted. The participants also completed psychological evaluations while describing their history of tobacco use.

Tobacco-dependence was assessed based on several criteria including the following: cravings, compulsion to smoke, changes in tolerance, time devoted to the pursuit of smoking, and inability to quit. The participants were also asked questions regarding basic personality traits, attitudes and beliefs, their social environment, and their involvement with their family and community.

The researchers found that once a teen had tried cigarettes, very little they did afterward impacted whether they became addicted or not.

Almost 29% of the participants reported feeling "relaxed" immediately after the first puff of a cigarette, which was the leading predictor of becoming dependent on cigarettes and being unable to quit. Another factor that appeared to up the risk for nicotine dependence was having seen an ad with Joe Camel-the Camel cigarette brand.

Of the 217 ever-inhaling participants, just over 38% went on to develop a clinical dependence on cigarettes. By the end of the study, dependence had developed in 67% of subjects who had a relaxed first reaction compared with 29% of subjects who did not.

According to the researchers, post-inhale relaxation was the biggest risk factor for being unable to quit smoking. In fact, 91% of teens who claimed such feelings also said they were unable to kick the habit.

The researchers suggest that the physiological addiction triggered by a first cigarette may be even more of a risk factor for smoking dependence than personality-driven factors. Based on the study results, DiFranza and his coauthors advocate an all-out ban on tobacco advertising to lower teens' likelihood of experimenting with cigarettes. DiFranza also suggested that more be done to educate young people of the dangers of the first cigarette.

"You've never seen a commercial on TV warning that you can get hooked from the first cigarette," said DiFranza. "And, to my knowledge, this has not yet been taught in classrooms. This is not a message that we've ever used in our public health programs. So, probably 99% of kids you asked probably think it's safe to try it once. What could be the problem with that? But there is a big risk to even trying it just once. And that should be the message that we give to our kids."

## Breast-Feeding Doesn't Contribute to Dental Caries

Breast-feeding does not increase the risk of toddler tooth decay, reported researchers in the October issue of *Pediatrics*. Dental caries affect one in 4 children, but the contributing factors are more likely to be smoking during pregnancy, being poor, or being Mexican-American.

The American Academy of Pediatrics (AAPD) recommends breast milk for all infants for the first year of life. Health experts have long been concerned about tooth decay once baby teeth come in, especially for infants who nurse all night.

The objective of this study was to assess the potential association of breastfeeding and other factors with the risk for early childhood caries among young children in the United States. Researchers at the University of Rochester and New York University analyzed demographic details, dental health data, and infant feeding information from 1576 toddlers whose families participated in the 1999-2002 National Health and Nutrition Examination Survey.

Of the 1576 toddlers, almost 28% had at least one tooth that had been pulled or filled because of a cavity, and one in 10 had severe early childhood caries. Just over 40% of Mexican-American children had at least one cavity. Forty-one percent of children living below the federal poverty level had at least one cavity and 19% had severe early childhood caries. Children born to mothers who were 19 or younger were also at increased risk of early childhood cavities.

The data show that breast-feeding is not protective against caries because other factors negate the positive effect of breast-feeding. "Breast-feeding was associated with 40% reduced risk for early childhood caries until we threw factors such as poverty status, maternal age at child's birth, and maternal prenatal smoking in the analyses," said study author Hiroko Iida, a dental public health resident at the Bureau of Dental Health, New York State Department of Health. Breast-fed Mexican-American children and breast-fed poor children were more likely to have cavities than other children, even when compared to those were not breast-fed, explained Iida.

Although the AAPD does not have a policy statement about breast-feeding and dental caries, spokesman Paul Casamassimo said the academy tries to educate parents to minimize the risk of cavities from any food or beverage.

"The poverty correlation with caries is longstanding, consistent, and believed to reflect a combination of lack of health knowledge, limited access to care, poor diet, perhaps poor prenatal care, and inadequate self-care," said Casamassimo. "Simply being Mexican-American reflects the fact that they are often among our poorest, and thus reflect the above factors."

Maternal smoking was also strongly tied to cavities risk in infants, but the authors did not offer insight into the root of that relationship.

Casamassimo suggested that smoking before, during, and after pregnancy may affect the child's immune system or possibly support bacteria in a mother's mouth that can be passed on to the child. "Smoking may be a surrogate measure of some factor not necessarily noted in the study. In other words, there may be a health contribution to caries susceptibility that is not measured or even know," explained Casamassimo.

The study authors conclude that the data provide no evidence to suggest that breastfeeding or its duration are independent risk factors for early childhood caries, severe early childhood caries, or decayed and filled surfaces on primary teeth. Breast-feeding aside, Iida argues that pediatric dentists and public health practitioners should direct oral health efforts toward parents in low-income households, smoking mothers, and Mexican-American households.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Carrie Bigelow Presented with 2007 ADHA/Sigma Phi Alpha Journalism Award

## Carrie Bigelow Presented with 2007 ADHA/Sigma Phi Alpha Journalism Award

Carrie Bigelow, RDH, MS, a May 2007 graduate of the Master of Science Degree Program in Dental Hygiene Education at University of the North Carolina School of Dentistry, was recently named by the American Dental Hygienists' Association (ADHA) as the winner of the 2007 ADHA/Sigma Phi Alpha Journalism Award.

This journalism award program, sponsored by Johnson & Johnson, is intended to honor a student who has written a review or original research paper that contributes to the dental hygiene body of knowledge and is of the quality to be published in the *Journal of Dental Hygiene*, the scientific, peer-reviewed journal of the ADHA. Students enrolled or within 6 months post graduation from a baccalaureate, degree completion bachelors, masters, or doctoral level program were eligible to apply. Candidates submitted their manuscripts for the competition and the papers were sent out for peer review and ranking by a selection committee.

Bigelow is currently pursuing a career in academics in Michigan.

Bigelow was the recipient of the 2006 ADHA Summer Student Internship. She spent 2 weeks at ADHA headquarters and 2 weeks at Sunstar Americas, Inc., both in Chicago, Ill.

Bigelow completed her undergraduate degree at Texas Woman's University in Denton, TX. She has practiced in Switzerland, Hong Kong and the United States.

Bigelow's winning manuscript will be published in the *Journal of Dental Hygiene*. In addition, she will receive a plaque along with a $1,000 cash award provided through the generosity of Pfizer, Inc.

Honorable mention was extended to 2 candidates for their papers. Danielle Furgeson, RDH, BA, MS, May 2007 graduate of the MS program in Dental Hygiene Education at the University of North Carolina Chapel Hill School of Dentistry, Chapel Hill, NC; and Mary E. Cosaboom-FitzSimons, RDH, BS, MS, a graduate of the MS program in Dental Hygiene from the Gene W. Hirschfeld School of Dental Hygiene Health Sciences, Old Dominion University, Norfolk, Va;

## Dental Hygienists' Views On Oral Cancer Control in North Carolina

Carrie Bigelow, RDH, MS; Lauren L. Patton, DDS, Director, General Practice Residency and Professor, Department of Dental Ecology; Ronald P. Strauss, DMD, PhD, Distinguished Professor and Chair, Department of Dental Ecology; Rebecca S. Wilder, RDH, MS, Director, Graduate Dental Hygiene Education and Associate Professor, Department of Dental Ecology. All are from the University of North Carolina School of Dentistry, Chapel Hill, NC.

***Abstract***

Many oral and pharyngeal cancers (OPC) are preventable. Early detection improves survival rates. Dental hygienists have opportunities to help reduce the oral cancer burden among their patients.

**Purpose:** The purpose of this project was to qualitatively assess North Carolina dental Hygienists' views regarding OPC prevention and early detection.

**Methods:** Sixteen practicing dental hygienists participated in 2, 8-person focus groups. Focus groups were taped, transcribed, and analyzed qualitatively for content.

**Results:** Four major themes arose: 1) The charge of the dental hygienist was not necessarily to diagnose cancer, but to recognize abnormalities and initiate referral when necessary; 2) The dental hygienist is only helpful in the tobacco cessation process if the patient has a desire to quit; 3) The dental hygienist is most effective if the patient believes the provider is genuine and truly cares about the patient's well-being; 4) There is always a need for continued education in oral cancer screenings and tobacco cessation, specifically for hands-on courses. Barriers to performing OPC exams included: financial, time, and insufficient dentist support. Barriers for dental hygienists in providing tobacco cessation counseling included: lack of patient interest, lack of patient education materials and resources, smoking parents of adolescents, personality issues, and provider-patient diversity in age, gender, ethnicity, and culture.

**Conclusions:** Dental hygienists felt their most important contribution to oral cancer control was patient education and oral cancer awareness. Professional continuing education is important and barriers need to be addressed to improve oral cancer control efforts.

**Keywords:** oral cancer screenings, dental hygienists, oral assessment, tobacco cessation

## The Role of the Student Professional Association in Mentoring Dental Hygiene Students for the Future

Danielle Furgeson, RDH, BA, MS, Mary George, RDH, MEd, Associate Professor, Department of Dental Ecology; Samuel Nesbit, DDS, MS, Clinical Associate Professor, Diagnostic Sciences & General Dentistry; Charlotte Peterson, RDH, MS, Clinical Associate Professor, Department of Dental Ecology; Diane Peterson, RDH, MEd, Consultant and Assistant Professor, Department of Dental Hygiene; Rebecca S. Wilder, RDH, MS, Director, Graduate Dental Hygiene Education and Associate Professor, Department of Dental Ecology. Furgeson, George, Nesbit C. Peterson, and Wilder are from the University of North Carolina School of Dentistry, Chapel Hill, NC. D. Peterson is from Vermont Technical College, Williston, Vt.

***Abstract***

The purpose of this study was to determine the role of the Student American Dental Hygienists' Association (SADHA) in mentoring/developing dental hygiene students for the future. This project also assessed attitudes and practices of SADHA advisors towards the utilization of SADHA as a mechanism for mentoring dental hygiene students' professional development to meet the oral health needs of the public, and the goals of the ADHA. These goals include promotion of education beyond the baccalaureate level to develop qualified faculty, encouraging dental hygiene research, and promoting leadership. The study also evaluated if geographic region and academic setting impacted the utilization of SADHA.

After IRB exemption, a pilot-tested questionnaire was administered using Survey Monkey, an online survey website, to 277 individual contacts at American Dental Association (ADA) accredited dental hygiene (DH) programs. A response rate of 68% was achieved with 186 individual responses. Eighty percent of respondents indicated offering no mentoring opportunities while incongruously, 58.3% felt they actively mentor through SADHA. When asked what the main focus of SADHA should be, SADHA advisors ranked community service/philanthropy as number one. SADHA chapters at institutions that offer a Bachelor of Science in Dental Hygiene (BSDH) degree-completion program offer more mentoring opportunities (p=<.001). Programs offering the BSDH offer a wider variety of topics from guest speakers (p=.038). SADHA chapters in western states have a higher graduate conversion rate than other regions (p=.018).

SADHA Advisors do not agree on how SADHA should be utilized. The majority of SADHA chapters are not offering mentoring opportunities outside of the traditional curriculum for leadership and career development. What is clear is that both students and advisors desire more interaction with the local ADHA components and constituents. In order to address these issues, efforts should be made to provide networking support among SADHA Advisors and increase faculty perception

of the importance of the professional association and the role of students in its future. The ADHA should consider developing a mentoring program that builds strong partnerships among all state constituent and components and SADHA.

## Community-Based Collaborations by Nurse Practitioners and Dental Hygienists

Mary E. Cosaboom-FitzSimons, RDH, BS, MS, Gene W. Hirschfeld School of Dental Hygiene Health Sciences, Old Dominion University, Norfolk, Va; Michele L. Darby, BSDH, MS, Eminent Scholar and Graduate Program Director, Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University, Norfolk, Va.

***Abstract***

Dental caries remains the most common childhood chronic infectious disease, disproportionately striking poor, minority children. Weaknesses in the existing American health care system and regulatory practices limit comprehensive, accessible, affordable oral health care to those most in need, and impede collaborative patient care among health care providers. The purpose of this paper is to outline how collaborative relationships between nurse practitioners and dental hygienists could improve access to quality, primary oral and general health care in the United States. A collaborative model of practice is proposed for nurse practitioners and dental hygienists in community-based health service programs for improving children's oral health. Integrating dental hygiene and nursing models of care could promote comprehensive, cost effective, accessible, preventive health care, which is urgently needed by millions of unserved children in the United States.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Review of: Ear, Nose, and Throat Disorders Sourcebook

Sandra L Boucher-Bessent, RDH, BS

*Reviewed by Sandra L. Boucher-Bessent, RDH, BS, public health dental hygienist; national program manager, National Children's Oral Health Foundation; adjunct faculty, University of North Carolina, Department of Dental Ecology, Chapel Hill, NC.*

**Ear, Nose, and Throat Disorders Sourcebook**

**Second Edition**

**Judd SJ (Ed)**

**Omnigraphics**

**Detroit, Mich, 2007**

**659 pages, illustrated, indexed, hardcover**

**ISBN: 0-7808-0872-X**

**$87.00**

*Ear, Nose, and Throat Disorders Sourcebook,* Second Edition, is a resource book for the general public that provides comprehensive coverage of basic up-to-date medical information about the causes, symptoms, diagnosis, and treatment of diseases and disorders that affect the ears, nose, sinuses, throat, and voice. The book is not a medical textbook, but rather serves to inform lay people about acute, chronic, and genetic diseases associated with the ears, nose, and throat. Its easy-to-read format includes information on prevention, medical statistics, risk factors, and warning signs. In several cases, it also includes discussions on alternative and homeopathic remedies.

Dental professionals may find this book useful as resource to refer to for general information. The book avoids the use of technical medical language and contains a few simple illustrations pertaining to the anatomy of the ear as well as a few simple tables necessary for clarification. It has no photographs or colored plates. The majority of the material is presented in question and answer format, much like questions a patient might ask of a health care provider. An extensive index facilitates the reader's ability to easily access information on any specific topic.

*Ear, Nose, and Throat Disorders Sourcebook* is organized into 7 sections that focus on broad areas of interest: Disorders of the Ears; Hearing Disorders; Vestibular Disorders; Disorders of the Nose and Sinuses; Disorders of the Throat and Vocal Cords; Cancers of the Ears, Nose, and Throat; and Additional Help and Information. Forty-five chapters comprise the 7 sections, covering individual topics within each area of interest. Each section ends with a well-referenced list of professional journals and other evidence-based publications the reader can turn to for more information. Web addresses for the referenced materials are also provided, facilitating the readers' pursuit for further study. The final 2 chapters furnish additional information and resources. A comprehensive glossary offers simple definitions of medical terms relative to the ears, nose, and throat and the final chapter furnishes a list containing contact information of additional resources to which the reader can refer for more detailed information and support. The information includes physical and mailing addresses, telephone numbers, fax numbers, as well as Web and email addresses.

*Ear, Nose, and Throat Disorders Sourcebook* is not a book to be read cover-to-cover. Many of the topics, symptoms, syndromes, diseases, etc, overlap and discussion is duplicated between the sections. However, this duplication of information is necessary because the book is intended to serve merely as a reference guide. Throughout the book are disclaimers that the information is not intended for use to diagnose illnesses, prescribe treatments, or substitute medical care, but rather for informational purposes. It encourages readers who may be concerned about certain symptoms or the possibility of disease to seek professional assistance from a health care provider.

The information in *Ear, Nose, and Throat Disorders Sourcebook* is compiled from US government agencies including, the Centers for Disease Control and Prevention, the National Cancer Institute, the National Institute of Allergy and Infectious Diseases, the National Institute of Dental and Craniofacial Research, National Institute on Deafness and Other Communication Disorders, National Institutes of Health, National Library of Medicine, Osteoporosis and Related Bone Diseases National Resource Center, and the US Food and Drug Administration. A wealth of copyrighted documents from multiple individuals, professional associations, research centers, and other organizations contribute to the information in the book.

*Ear, Nose, and Throat Disorders Sourcebook* is just one of 177 other sourcebooks in Omnigraphic's Health Reference Series, which cover more than 13 000 topics.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Review of: Stedman's Medical Dictionary for the Dental Professions

Heidi Emmerling, RDH, PhD

*Reviewed by Heidi Emmerling, RDH, PhD assistant professor of dental hygiene, Sacramento City College, Sacramento, Calif.*

**Stedman's Medical Dictionary for the Dental Professions**

**Lippincott, Williams & Wilkins;**

**Philadelphia Pa, 2007**

**800 pages, color photos, illustrated, vinyl bound**

**ISBN: 0-7817-6865-9**

**$43.95**

*Stedman's Medical Dictionary for the Dental Professions* will serve as a suitable resource for any dental professional's library. The text has more than 12 800 entries and over 500 illustrations. The images are of very high quality and the insert has especially useful photographs of pathological oral conditions. The limitation of the insert is the organization. The photographs do not appear to be placed alphabetically either by individual pathology or by class of pathology (ie, caries conditions are placed before abscesses; gingivitis placed before candidiasis). Thus, I was unclear of the method or reason for the organization and placement of the photographs. The text does include a CD-ROM that includes images.

In addition to the art program, another feature of the text includes pronunciation guides for each entry plus a CD-ROM that accompanies the book. Although a nice inclusion, particularly for dental hygiene students, I doubt whether the CD-ROM is of much benefit to practicing dental hygienists who have undoubtedly encountered most of the terms before. Another minor limitation is that much of the terminology will not be new for established dental hygienists. One of the General Editors was from the dental assisting field and the other from dentistry. For the purposes of a dental hygiene reference book, I was disappointed that a dental hygienist was not chosen to serve as one of the General Editors. That being said, there were 5 dental hygienist members on the 12-member consultation board.

Cross references are also provided as synonyms to the main preferred terms. The synonyms are printed in blue, signaling readers to look up the preferred term. That is, if one looks up *trench mouth*, or *Vincent Syndrome*, no definitions are provided but *necrotizing ulcerative gingivitis* is printed in blue in both entries, directing the reader to the latter, preferred term. Therefore, not only is the reader directed to the definition but is also alerted to the preferred term.

In addition to listing synonyms, the text incorporates usage notes in an effort to alert users to common errors of sense, spelling, and pronunciation. For example, under the entry for *abscess*, the usage note, which appears in italics before the definition, cautions the reader against the common misspellings *absess* and *abcess*.

The text includes "building block" symbols (using a recycle icon) indicating Greek and Latin prefixes, suffixes, and combining forms. An example is *ab-* with the definition being *from, away from, off.* These common building blocks are also listed separately under the pronunciation guide on the first page.

Etymologies are also indicated in the entries to aid in the reader's learning and understanding of dental terminology. An example includes *diplegia* (paralysis on both sides of the body), in brackets the term is broken down as such: [G. *di-*, two, + *plege*, a stroke] (171). Thus, the reader learns that the term's etymology is Greek.

What I found most helpful were the 24 appendices. Appendices I found most helpful included the Units of Measure, Affixes and Abbreviations (Common Abbreviations Used in Medical Orders, Common Abbreviations Not to Be Used), and Reference Values (Laboratory and Reference Range Values).

The resource value of this book is good; the definitions have all been approved by the Federative Committee on Anatomical Terminology to ensure accuracy. The inclusions add to the comprehensive value as a resource book. The photos and illustrations are excellent if not a bit hard to determine their organization. These photos and illustrations definitely support the terms and oral conditions. While there is probably nothing especially controversial or new to dental hygienists, the text serves its purpose as a practical reference book.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Review of: Basic Guide to Dental Instruments

Jean Tyner, RDH, BS

*Reviewed by Jean Tyner, RDH, BS, instructor, Florence-Darlington Technical College, Florence, SC.*

**Basic Guide to Dental Instruments (2006)**

**Scheller C**

**Blackwell Publishing**

**Oxford, UK, 2006**

**280 pages, 417 illustrations**

**ISBN: 1-405-3379-1**

**$39.99**

*The Basic Guide to Dental Instruments* by Carmen Scheller is a superior book for identification of dental instruments. Having taught subjects to which this book applies, I find this text to be especially thorough. The instruments are well documented and the most current technology is included. One example is the explanation of the apex locator.

Each section is dedicated to a specific discipline or division of dentistry. Especially impressive is the chapter on endodontic instruments. The colored photographs of files, broaches, and rotary instruments are as realistic as the actual items depicted.

Oral surgery forceps are more clearly printed than in any other instruments guide I have seen, including, the manufacturer's catalogs. In the chapter on dental radiography, the author reminds the reader to check the guidelines in their own region, as some guidelines change from state to state. The author also discusses the important of instrument care and sterilization.

Although dental assistants may use these instruments more often, dental hygienists would benefit from the clearly depicted and defined pages of information. Not only are the instruments named, but the function, features, and methods of use are of added value. Other varieties of the items are also listed. The companies credited with photographs are reputable and widely known.

I definitely recommend this book for students who need a knowledge of dental instruments. It is concise, comprehensive, and well designed.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Review of: Mental Health Information for Teens: Health Tips about Mental Wellness and Mental Illness

Lisa Shaw, RDH, MS

*Reviewed by Lisa Shaw, RDH, MS, residential health care coordinator at Faxton-St. Luke's Healthcare, James M. Rozanski General Practice Residency Program, Utica, New York.*

**Mental Health Information for Teens: Health Tips about Mental Wellness and Mental Illness**

**Second edition**

**Bellenir K (ed)**

**Omnigraphics**

**Detroit, Mich, 2006**

**425 pages, indexed, hard cover**

**ISBN: 0-7808-0863-0**

**$58.00**

Mental wellness is, without question, a key factor in one's ability to make healthy decisions, to handle life's stresses, to form healthy relationships, and to be able to develop and sustain positive self-esteem. While one generally thinks of mental illness as primarily affecting adults, the National Youth Prevention Resource Center notes that one in 10 children and adolescents will suffer from mental illness severe enough to cause some level of impairment. Unfortunately, however, fewer than one in 5 of such children will ever receive appropriate medical care, according to the National Youth Violence Prevention Resource Center.

*Mental Health Information for Teens: Health Tips about Mental Wellness and Mental Illness* is a Teen Health Series publication that educates teens about the specifics of mental illness and mental wellness. The book is divided into 6 parts, with Part One focusing on how teens can maintain mental wellness. Part One chapters include Defining Mental and Emotional Health, Self Esteem, Getting Along With Friends, Siblings, Parents, and Teachers, Defining Healthy Relationships, Dealing With Anger In A Healthy Way, Learning to Handle Stress, Dealing with Divorce, Working Through Grief, and If Your Parent Has a Substance Abuse Problem or Mental Illness. Of particular importance is the time spent in chapter one explaining why mental health is important, what a mental health problem is, what events and experiences can increase the risk for mental health problems, and what self-help measures can improve mental health.

Part Two deals with mood and anxiety disorders and covers a broad range of topics including, but not limited to, depression, seasonal affective disorder, the menstrual cycle and mood changes, generalized anxiety disorder, obsessive-compulsive disorder, post-traumatic stress disorder, and fears and phobias. The author moves into behavioral, personality, and psychotic disorders in Part Three, covering 10 different disorders that include those that are often teen specific such as body-focused repetitive behaviors, self-injury, eating disorders, and body dysmorphic disorder. Part Four focuses on how one can get help for mental illness and spends time describing the roles of mental health providers, what one can expect during therapy,

the different types of therapy, medications used for treating disorders, and alternative approaches to care. Part Five talks about other issues related to mental wellness in teens such as learning disabilities, tourettes syndrome, bullying, dating violence, child abuse, suicide, and substance abuse. Finally, Part Six gives the reader a wealth of knowledge regarding helplines, hotlines, Internet resources, mental health organizations, and additional reading suggestions.

The entire book is laid out well and written in language that is easily comprehended by a teenager. The text draws the reader in and makes them comfortable by taking the scare out of the subject. The author likens the cause of mental illness to that of some physical illnesses such as heart disease or diabetes with occurrences running in families-either because of genetics or family interaction styles. In addition, the author reassures the reader that some minor concerns can be solved with common sense measures like getting more sleep or spending time with people whose company you enjoy and who are a positive influence. The book also dissects each disorder by first giving a concise description of the disorder that helps the teen understand what is "normal" and then provides information that describes what is not "normal" in terms of symptoms that interfere with normal function. The author follows these definitions by explaining how each disorder presents itself in terms of signs and symptoms, what are known about the causes of these disorders, and how these disorders can be treated. The text also provides numerous insets that declare "It's a Fact!." These insets provide valuable information and source references. In addition, they offset the text and make for easier reading. Each chapter also provides ideas and references for self help.

The dental hygienist is in a unique position, depending on their patient population or practice setting, to come in contact with patients that have mental health concerns. He or she is also more likely, because of the relationships that they are able to build and sustain with their patients, to hear about mental health issues that their patients may be experiencing. Through this Teen Health Series, Bellenir has provided a valuable tool for the dental hygienist to become informed so as to be able to provide insight, education, and direction where appropriate and necessary. Mental Health Information for Teens is a well thought out and concise review of mental wellness and mental health issues

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Review of: Legal and Ethical Issues for Health Professionals

Patricia A Frese, RDH, MEd

*Reviewed by Patricia A. Frese, RDH, MEd, professor, University of Cincinnati, Raymond Walters College, Department of Dental Hygiene, Cincinnati, Ohio.*

**Legal and Ethical Issues for Health Professionals**

**Pozgar GD**

**Jones and Bartlett**

**Sudbury, Mass, 2005**

**378 pages, indexed, softcover**

**ISBN: 0-7637-2633-8**

**$63.95**

*Legal and Ethical Issues for Health Professionals* assumes the reader, whether student or practitioner, has no background in legal or ethical issues. The preface of the text guides the reader to a sample of the elements found in each chapter and how to maximize the learning from each feature. Each of the 14 chapters generally contains learning objectives, cases and questions, a chapter review, terminology list, and review questions as well as references for the chapter and/or further reading. Especially helpful for the student is a note-taking guide. It contains PowerPoint slides along with sufficient room for notes, questions, ideas for discussion, and study reminders.

The text is divided into 4 sections and concludes with a glossary of terms. Section I covers ethics and includes 4 chapters that present such topics as historical highlights, basic principles, contemporary ethical dilemmas such as abortion and human subjects research, the structure and function of ethics committees, and end-of-life issues including euthanasia and physician-assisted suicide. Sample forms for advance directives are included. The 4 chapters of Section II cover law. Topics include development of the legal system, introduction to basic law for health professionals including negligence and criminal and contract law, public policy and individual's rights, and ethics and law for organizations. Section III contains 3 chapters covering health care professionals. Included in this section are the codes of ethics for various professions, a focus on physician responsibilities, and employee rights and responsibilities. The 3 chapters of Section IV cover the patient. Parameters of patient consent, elder and child abuse, and patient rights and responsibilities are included here.

This is a clear, concise, practical guide for resolution of ethical dilemmas and accompanying legal implications. Using integrity-based thinking, the reader is guided through alternative courses of action to determine the most prudent resolution of various dilemmas of contemporary health care. It is an appropriate text for the student as well as a reference for the practitioner.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Combining Research and Dental Hygiene

Heather L Jared, RDH, BS, MS

*Heather L. Jared, RDH, BS, MS, research assistant professor, University of North Carolina School of Dentistry, Chapel Hill, NC.*

Are you interested in how periodontal disease affects the body? Do you have a theory on how a product or medicine affects the oral cavity? Do you wonder how dental-related materials and therapies work and if they are effective? Then research may be a way for you to combine your dental hygiene knowledge, satisfy your quest for more in-depth knowledge of a subject, and answer your question. This is how it happened for me while I was a student at the University of North Carolina at Chapel Hill.

The opportunity for me to combine research and dental hygiene began in the baccalaureate program through a specialty track focused on research. Students were connected with faculty members and together they developed and executed a research project. My first research project was to study the relationship between oral lichen planus and squamous cell carcinoma. This project piqued my interest and began my love of research. I have now celebrated my 10-year anniversary in research.

My experiences in research have been varied and meaningful. I participated in one of the landmark studies on periodontitis and pregnancy while earning my master's degree, which better prepared to pursue my career in research. My first job, an entry-level position, was as a research dental hygienist collecting study data on the relationship of periodontitis and its effects on pregnancy outcomes. This position increased my knowledge about research and I was given the opportunity to write regulatory documents, complete Internal Review Board application, and learn how to coordinate all aspects of a study. This interdisciplinary study required coordination with the research staff, physicians, nurses, and other health care providers without compromising patient care. During this study I began mentoring other dental hygienists who were interested in working in research.

My next position was to serve as a principal investigator for a small device study. This helped me better understand the process of a study from start to finish, including how to accurately budget for all expenses related to the project. While working on the device study I also began in my current position as a clinical research manager. This position requires me to work with a team of people including investigators, statisticians, clinical research team members, and others to design and implement studies, train study coordinators, and work as a monitor. To be effective in this line of work, it is important to be a team player but also be able to work independently.

During my tenure, I have been fortunate to conduct many types of research, including periodontitis and pregnancy outcomes, novel interdental devices, powered brushes, experimental gingivitis and devices, surveys of dental knowledge, and a validation study to produce a questionnaire that will determine when a pregnant woman should be referred for a periodontal evaluation.

The rewarding part of research is to see the significant changes that occur because of the results and findings of studies. As a result of the work that has been done with periodontitis and pregnancy, physicians are now more aware of the need for better oral health care, and some valuable improvements have been made in respect to social policy. Some health insurance carriers now pay for scaling and root planing for pregnant women and this has a positive effect on the health of mothers and infants.

There are many mechanisms for dental hygienists to become involved in research. Some of these include working in an academic setting that actively conducts research, working in a clinical research organization, working for a start-up research company, working on community-based projects and working in private-practice research. As a dental hygienist, you have training and knowledge that allows you to work not only in dental related but in various areas research.

If you have an inquisitive mind or have unanswered questions then research may be something you would find fulfilling. Working in research has provided me the opportunity to use my health care knowledge to benefit society.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Bisphosphonates and Osteonecrosis of the Jaw (ONJ)

Karen B Williams, RDH, PhD

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The purpose of *Linking Research to Clinical Practice* is to present evidence-based information to clinical dental hygienists so that they can make informed decisions regarding patient treatment and recommendations. Each issue will feature a different topic area of importance to clinical dental hygienists with A BOTTOM LINE to translate the research findings into clinical application.

## Intravenous bisphosphonate therapy and inflammatory conditions or surgery of the jaw: a population-based analysis

**Wilkinson, Gregg S. Kuo, Yong-Fang. Freeman, Jean L. Goodwin, James S. Journal of the National Cancer Institute. 99(13):1016-24, 2007 Jul 4.**

Department of Preventive Medicine and Community Health, University of Texas Medical Branch, 301 University Blvd, Galveston, TX 77555-1153

***Abstract***

**Background.** Recent reports have identified an association between osteonecrosis of the jaw or facial bones and treatment with nitrogen-containing intravenous bisphosphonates. We investigated this association by use of data from the Surveillance, Epidemiology, and End Results (SEER) program linked to Medicare claims.

**Methods.** We identified 16,073 cancer patients who were diagnosed between January 1, 1986, and December 31, 2002, and were treated intravenously with the bisphosphonates pamidronate (Aredia®) and/or zoledronic acid (Zometa®) between January 1, 1995, and December 31, 2003. We matched 28,698 bisphosphonate nonusers, at a 2:1 ratio, to 14,349 bisphosphonate users on month and year of the first bisphosphonate administration received by users, cancer type, age, sex, risk factors for osteonecrosis (diabetes, alcoholism, cigarette smoking, obesity, hyperlipemia, pancreatitis, or chemotherapy with L-asparaginase), bone metastasis, and SEER program geographic region. Patients were followed until the study's end on December 31, 2003; loss of coverage from Medicare Parts A and B; or one of the following outcomes: a diagnosis of inflammatory conditions or osteomyelitis of the jaw, surgery on the facial bones, or death, whichever occurred first.

**Results.** Use of intravenous bisphosphonates was associated with an increased risk of jaw or facial bone surgery (hazard ratio [HR] = 3.15, 95% confidence interval [CI] = 1.86 to 5.32) and an increased risk of being diagnosed with inflammatory conditions or osteomyelitis of the jaw (HR = 11.48, 95% CI = 6.49 to 20.33), compared with nonuse. The absolute risk at 6 years for any jaw toxicity was 5.48 events per 100 patients using intravenous bisphosphonates and 0.30 events per 100 patients not using such drugs. The risk of each outcome increased as cumulative dose increased (e.g., for 4-8 infusions, HR for operations on the jaw and facial bones = 3.63, 95% CI = 0.77 to 17.08; for more than 21 infusions, HR = 9.18, 95% CI = 1.74 to 48.53).

**Conclusions.** Users of intravenous bisphosphonates had an increased risk of inflammatory conditions, osteomyelitis, and surgical procedures of the jaw and facial bones. The increased risk may reflect an increased risk for osteonecrosis of the jaw.

***Commentary***

This study comprises one of the most extensive investigations on the increased risk of intravenous ONJ associated with bisphosphonate therapy. For this study, the authors used tumor registry data from the Surveillance, Epidemiology and End Results (SEER) program linked to Medicare claims data to examine the potential toxicity of intravenous administered bisphosphonates. An inherent methodological problem in assessing risk of ONJ in this study was the fact that the International Classification of Diseases, version 9 (also called the ICD-9 codes) did not have a specific classification for ONJ. The ICD classification system, developed by the World Health Organization, is the standard by which disease entities, signs, and symptoms are categorized worldwide. Therefore, these researchers used 2 outcomes that are closely related to ONJ, inflammatory conditions/osteomyelitis of the jaw and jaw or facial surgery, as proxy measures for their analyses to assess the relationship between bisphosphonates and ONJ-related outcomes. Bisphosphonate users were matched to nonusers (at a 1:2 ratio) using very stringent criteria (eg, type of cancer diagnosis, timing of first bisphosphonate treatment, gender, region of the country and other risk factors for osteonecrosis such as smoking, diabetes, and other systemic conditions) and more liberal criteria (type of cancer, age, gender, and number of risk factors). Cumulative dose of bisphosphonate was determined as the number of injections received.

Results from this study showed that the incidence of either ONJ-type outcome for bisphosphonate users versus nonusers at 3, 4, and 6 years were 2.00% versus 0.28%, 2.89% versus 0.30%, and 5.48% versus 0.30%, respectively. In addition, the independent risk for jaw toxicity as a function of intravenous bisphosphonate therapy (after controlling for other risk factors) was 11.48 for inflammatory conditions/osteomyelitis and 3.15 for operations on the facial bones. One of the most interesting findings was the relationship of dose response effect. For each one-dose incremental increase of intravenous bisphosphonate injection, there was an 8% increase in risk for any ONJ-type outcome. These findings also showed that several factors, most notably gender, type of cancer, or other risk factors for oral diseases, were not related to inflammatory conditions/osteomyelitis or operations on facial bones.

The authors were clear to identify that there were specific limitations in their study design. Probably the greatest problem in this study was the potential for misclassification of outcomes since there is no specific ICD-9 code for ONJ. A second limitation is that since Medicare data were used, this would likely result in an underreporting of the conditions. However, the sophisticated statistical analyses allowed the researchers to control for other explanatory factors and thus extract the unique association of ONJ-type events with the independent effects of the drug. More critically, the dose response relationship observed provides very good evidence supporting a causal association. The authors were very pointed in their discussion of needing to balance the risk of ONJ-type outcomes with the overall benefit of bisphosphonate therapy in individuals with advanced cancer with bone metastases. There is clear and substantial evidence that bisphosphonate therapy is very effective in reducing adverse skeletal events (fracture, need for surgery, need for radiation, etc) in patients with multiple myeloma. Therefore, oral health promotion and elimination of significant oral disease prior to implementation of bisphosphonate therapy is crucial.

## Safety of Oral Bisphosphonates: Controlled Studies on Alveolar Bone

**Jeffcoat, Marjorie K. International Journal of Oral and Maxillofacial Implants 21(3): 349-353; 2006.**

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***Abtract***

**Background.** Osteoporosis and osteopenia are characterized by reductions in bone mass and may lead to skeletal fragility and fracture. The latest generation of oral bisphosphonate drugs, including alendronate and risendronate, has been approved for the prevention and treatment of osteoporosis. These medications are chemically absorbed into bone, decreasing osteoclast number and activity and thereby decreasing bone resorption. The purpose of this report is to present safety data from 2 controlled studies in patients receiving oral bisphosphonates.

**Methods.** Study 1 tested the effect of alendronate (Fosamax®), an inhibitor of bone resorption, on alveolar bone. A total of 335 patients (162 men and 173 women, aged 30 to 79 years) with moderate or severe periodontal disease were randomized to either placebo or 70 mg alendronate once weekly. Alveolar bone height and safety were assessed over a 2-year period. Study 2 was a longitudinal single-blind controlled design comparing implant success in 50 consecutive patients (210 implants), 25 patients who received bisphosphonate therapy and 25 age-matched control subjects. Implant success and safety, including incidence of osteonecrosis of the jaws (ONJ), was blindly assessed for at least 3 years.

**Results.** In study 1, no cases of ONJ were observed in either treatment group. Furthermore, a trend toward lower incidences of infection and tooth loss was observed in the alendronate group. In study 2, no cases of ONJ were observed in either group, and implant success was greater than 99% in both groups.

**Conclusions.** On the basis of 2 controlled clinical studies, oral bisphosphonate usage was not associated with occurrence of ONJ.

***Commentary***

This study compiles results from 2 clinical trials on the use of oral bisphosphonates for periodontal patients. The rationale for examining the safety of oral bisphosphonate medications was primarily based on the potential beneficial effect for altering osteoclastic activity in periodontal applications balanced by the potential for ONJ. Recent case studies on ONJ suggest that bisphosphonates as a class of drugs may cause ONJ, although only a very few cases have been associated with oral dosing. In the first study, subjects with moderate to severe periodontal disease were randomly assigned to receive either 70 mg of oral alendronate or placebo. All subjects also received nonsurgical periodontal treatment at the outset of the study period and periodontal maintenance at 3-month intervals across the entire 2-year study. Evaluations consisted of obtaining clinical and radiographic evidence of ONJ, oral infection, and alveolar bone loss at each 3-month observation period by an examiner who was unaware of subjects' treatment group assignment. Results showed that for subjects with low bone mineral density at the beginning of the study, there was significantly less bone loss over the 2 year period in the bisphosphonate-treated subjects compared to placebo. In normal bone mineral density subjects, the difference between bisphosphonate and nonbisphosphonate subjects was not significant. More critically, for these 335 subjects, there were no cases of ONJ observed during the study timeframe. In the second study, implant patients with osteoporosis who had been taking unspecified doses of oral bisphosphonate for 1 to 4 years, were age-matched to a similar group of osteoporotic patients not taking bisphosphonates. Following placement of implants, subjects were followed for a 3 year period. One-hundred percent of bisphosphonate-treated subjects and 99.2% of subjects not taking bisphosphonates were determined to be "treatment successes." In this study, treatment success was defined as having less than 2 mm of bone loss, no mobility, no infection, and no evidence of ONJ during the study period. No cases of ONJ were observed in either group by the end of the 3-year period.

The author concludes that oral bisphosphonate therapy may be beneficial for reducing alveolar bone loss, without greatly predisposing these patients to an increased risk for developing ONJ. However, the author did not adequately address whether cumulative dose of bisphosphonates over an extended period might feasibly increase risk for ONJ. Current evidence suggests that half-life of bisphosphonates in blood is very short (several hours) whereas the half-life in bone may be many years and possibly life long. If indeed these drugs concentrate over time in bone, studies of 2 or 3 years may be insufficient to adequately evaluate the risk of oral bisphosphonates in ONJ. Additionally, there was no mention of whether either of the studies discussed included an assessment of adherence to medication. There is a large body of medical evidence that

suggests that patients often are not adherent to their medication regimes. Without an explicit evaluation of medication adherence, one cannot determine if the lack of ONJ is attributable to taking or failing to take the drug.

## The Bottom Line

Currently there is substantial concern in the dental community about the risk of bisphosphonates in the development of osteonecrosis of the jaw. Several abbreviated terms are used when describing this clinical entity and include ONJ, BON, BRON, and BRONJ. Bisphosphonate-related ONJ is associated with decreased bone turnover, which can dramatically reduce healing potential following extraction or trauma. Bisphosphonate-related ONJ signs and symptoms include numbness, pain, tooth mobility, soft tissue swelling, sequestration of bone, and development of nonhealing lesions of exposed bone in the mandible or maxilla. In the past 5 years alone, more than 180 publications (articles, letters, guidelines to clinicians, and commentaries) dealing with bisphosphonates and ONJ have appeared in the medical and dental literature. While the vast majority of published study designs have been either case studies or retrospective, case-control investigations (many with a relatively small number of patients), the consistency of evidence on the risk of **intravenous** bisphosphonate therapy for developing ONJ is compelling. To date, the potential increased risk for ONJ related to **oral** bisphosphonates appears to be less but little evidence has been generated in this regard. However, the extended half-life of bisphosphonates in bone suggests that there is a need for longer follow-up periods to justify the safety of these oral medications as they relate to risk for ONJ.

Whether the link between bisphosphonates and ONJ is causal or not, the strength of evidence for this association cannot be ignored. Dental professionals, however, must comprehensively consider the evidence when providing care and education to patients receiving IV bisphosphonate therapy. Intravenous bisphosphonates are the current standard of care for patients with multiple myeloma and for patients with bone metastases associated with breast or prostate cancer. These medications, delivered intravenously, have significant therapeutic benefits for cancer patients as they reduce bone loss, fractures, need for radiation, and other skeletal events. As such, the focus of dental care should be on reducing oral conditions that may predispose these patients to ONJ. Removing severely diseased teeth prior to bisphosphonate treatment, if at all possible, is prudent. However, as not all cancer patients receive an oral assessment prior to treatment, the dental team must work to reduce the need for future extractions or other dental procedures that rely on bone healing once IV bisphosphonate therapy has been initiated. The role of the dental hygienist in managing the oral health of these patients is critical. Establishing a protocol for care that centers on promoting oral health and preventing future disease should be the primary emphasis for the dental hygienist. The dental hygienist should ensure that the maintenance schedule is appropriately conservative given the patients past level of oral disease activity and that patient education is given very high priority during the dental hygiene appointment.

Therefore the following recommendations can be made based on the findings in these 2 studies:

**IV** bisphosphonate therapy is a statistically significant independent risk factor for being diagnosed with an inflammatory condition, osteomyelitis of the jaw, or jaw surgery. This may reflect an increased risk for osteonecrosis of the jaw.

**Oral** bisphosphonate therapy was not associated with an increased risk for ONJ during a 2 to 3 year follow-up.

## Summary

Dental hygiene clinicians play a critical role in educating patients. With the recent flurry of information and misinformation about bisphosphonate-related ONJ, clinicians must be proactive in incorporating scientific evidence into their patient education for subjects at potential risk for this condition. Anecdotal evidence suggests that some dental offices are adopting a risk-aversive policy of refusing definitive dental treatment to subjects on either oral or IV bisphosphonate therapy. The current state of evidence suggests that the dental team should be proactive in providing patients on IV bisphosphonate therapy with appropriate care and education aimed at minimizing risk for ONJ. For individuals on oral bisphosphonates, while the risk is very less likely than that observed for IV therapy, education should be a priority. Eliminating frank disease and providing definitive care to reduce gingival and periodontal diseases (thus reducing the need for future dental extractions), as well as providing education and counseling for patients at risk, should be the standard of care for the entire

dental team. Until the dental research community provides definitive evidence of causality between ONJ and bisphosphonates, prevention and health promotion should be the standard for at-risk patients.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Debate: A Teaching-Learning Strategy for Developing Competence in Communication and Critical Thinking

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## Introduction

Complex issues of health policy, politics, and professionalization require teaching strategies that engage and motivate today's graduate and undergraduate students to be critical thinkers in preparation for roles as leaders, organizers, and advocates. One strategy, the debate, requires students to work as individuals and as a team to research critical issues, prepare and present a logical argument, actively listen to various perspectives, differentiate between subjective and objective information, ask cogent questions, integrate relevant information, develop empathy, project confidence, cultivate poise, and formulate their own opinions based on evidence.[1,2,3,4,5,6,7,8,9] Therefore, the debate strategy can be used as an effective pedagogical method to achieve these aforementioned competencies in baccalaureate and graduate dental hygiene programs.

## Review of the Literature

Debate can be defined as an old teaching-learning strategy that presupposes an established position, either pro or con, on an issue, assertion, proposition, or solution to a problem.[10] Protagoras of Abdera is thought to have developed the educational method of debate dating back to the 5th century.[1,11] Debate as a teaching strategy thrived throughout the 19th and early 20th century and then declined in popularity.[12,13] Renewed interest in debate as an educational teaching strategy occurred in the 1980s with the philosophy of promoting critical thinking, and continues to be a useful tool to develop skills in critical thinking, communication, and logic.[1] The debate process is worthy of consideration by dental hygiene educators as a valuable tool for experiential learning.

Tumposky suggested that debate nurtures students' critical thinking skills and awareness of thought, and facilitates clinical reasoning and ability to share viewpoints with others while learning specific content.[2] Debate also allows students to move beyond "rote learning of facts, theories, and technique," and provides an opportunity for applying knowledge through role-playing while demonstrating their ideas, values, and attitudes.[14] However, Tumposky also cautions that debate can ultimately compromise and distort the process of learning, eg, students can work to be effective in influencing the thinking of others at the expense of being accurate.[14] Another limitation in debate is that it can cause frustration and anxiety in some learners.[1]

In preparation for a debate, students must thoroughly examine and research the problem using reason, logic, and analysis to formulate opinions.[1] Students must then engage in constructive teamwork to unify their position and eliminate redundancy.

This mechanism allows for taking on a position, expression of opinions/arguments while maintaining composure during analytical rebuttals. Garrett, Schoener, and Hood believe that debates are effective in courses associated with controversial issues.[1] As such, debate as a method of teaching and learning promotes professional roles such as leader and change agent while minimizing faculty bias and encouraging independent thinking in presenting controversial topics.[2]

Debates should be used as a "learning experience" and not as a test of knowledge acquired.[1] In the health professions, therapists must make appropriate decisions concerning treatment options for their patients.[14] Debates offer the opportunity to practice analytical and communication skills along with logical thought processes important to health professionals in making decisions.

The literature notes negative aspects of debate as a teaching method. For example, important topics can sometimes be trivialized as being either black or white and right or wrong.[9,12] Some issues have multidimensional viewpoints that may be better addressed in an open discussion; however, a debate can always be followed by a class discussion.[1] For example, to counter these limitations, Garrett, Schoener, and Hood recommend that following a debate, the teacher can plan an open discussion to allow alternative viewpoints and questions to be addressed by all members of the class.[1] Some argue that debates are about winning and losing, creating frustration and anxiety onto the student. Limitations can be minimized by down playing grades and competition, and emphasizing the process of preparation for and participation in the debate.[1]

## Methods

At Old Dominion University, in the senior/graduate level course *DNTH 416/516 Administration Leadership and Professional Development*, the debate strategy is used to teach the following complex, controversial topics that by nature present with multiple, conflicting issues and opinions in terms of problems and resolutions:

- The US healthcare system in crisis
- The dental hygiene educational system
- Preceptorship training for dental hygienists
- Self-regulation versus dentist regulation of the dental hygiene profession
- Level of autonomy and supervision in dental hygiene practice

Scheduling the debates during the last 5 weeks of the semester allows students to build on prior learning and have adequate time to prepare their arguments and rebuttals. Debating these topics provides a situation that students may experience once they graduate and become actively involved in affecting legislative change via professional association activity.

### *Pre-debate*[1,2]

For each week's topic, 8-10 students assume a unique position on 1 of 2 opposing teams (pro and con) that will debate a complex issue in need of resolution from the perspective of either organized dental hygiene or organized dentistry (or those who might conflict or support the respective positions) (see Figure 1a, 1b, 1c for the scenario and guidelines provided to the students). For the sake of debate, students must prepare to adopt, present, and defend positions that they do not necessarily agree with. Team, as well as individual preparation, is mandatory for a successful debate.

**Figure 1. Debate Setting (Hypothetical Scenario)**

A series of four open hearings will be held by the Committee on Health, Welfare and Institutions of the Virginia State Legislature to discuss healthcare reform, the future of dental hygiene education, preceptorship, licensure and practice in the Commonwealth. The Committee will eventually make a recommendation to the Virginia General Assembly that will affect dental hygiene. Members of the Virginia Dental Hygienists' Association, the Virginia Dental Association and representative of various private interest groups and healthcare coalitions will participate to present oral testimony and debate various aspects of the issues. See Table 1 for a brief synopsis of the key issues involved and the basic positions taken by the dental hygiene and dental communities.

**Basic positions on the issues to be debated**

| Issues | PRO Position | CON Position |
|---|---|---|
| *Healthcare System and the Healthcare System in Crisis (individual versus employer-based versus government run approaches)* | Currently proposed healthcare reforms (managed care, personal medical accounts, national health insurance, consumer driven health plans) have benefits for the public and profession. | Current reforms place the public and practitioner at risk. Fee for service, direct reimbursement, and indemnity strategies are still the best. |
| *Education* | Expansion of the formal education preparation of dental hygienists. Dental hygienists should control the educational system for the preparation of dental hygienists. Appropriate level of education, e.g., Associates, Baccalaureate, Masters (including ADHP), and doctoral preparation. | Restriction of the formal educational preparation of dental hygienists. Dentists should control the educational system for the preparation of dental hygienists; dental assistants can be trained to do some dental hygiene services such as coronal scaling. The least amount of education for minimal competency is the best approach. |
| *Preceptorship* | Preceptorship should not be tolerated because it places clients at risk and undermines a quality system of education. | Preceptorship is a viable solution for preparing dental hygienists, who are in short supply in some dental practices and geographical areas. |
| *Dental Hygiene Regulation* | Dental hygienists should control the education and licensure system, including licensure requirements, testing procedures and disciplinary action.<br>There should be a state board of dental hygiene to regulate the profession. ADHA should control the accreditation system. | Board of dentistry should control the education and licensure system including licensure requirements, testing procedures and disciplinary action. State boards of dentistry adequately address dental hygiene regulatory issues. ADA should control the accreditation system. |
| *Practice* | Dental hygienists should be able to practice under general supervision, unsupervised, and/or independent practice.<br>Dental hygienists should be able to practice in settings to improve the public's access to care. General supervision and unsupervised practice expand public access to dental hygiene care. | Dental hygienists should be able to practice under direct supervision only.<br>Dental hygienists should be able to practice in a dental office or typical public health setting with dentist supervision.<br>General supervision and unsupervised practice present a risk to the public and to the practitioner. |

**Guidelines for Debaters on the Day of the Debate**

- Dress the part to make an impact.
- Introduce yourself by name, title, educational background, years of experience and affiliation.
- Thank the Committee for allowing you the opportunity to present your viewpoint.
- Take 5 minutes to present your position, with supporting evidence and statistical data, to persuade the state legislators and to achieve your goals.
- Bring in representation from special interest groups, written testimony for others, Petitions, etc.
- Debaters in favor of dentistry's position will present their oral testimony first; debaters favoring dental hygiene's position will go second. Have the very last debater (or some designee) on each side of the issue, close with a summary of the key points.
- After all testimony on the issue is presented, state legislators on the Committee will ask questions (this is the class as a whole).
- At the end of the open hearing, each member of the Committee (class as a whole) will vote on the issue. A short debriefing will occur to discuss most effective to least effective strategies used by the debaters to present their arguments and persuade the audience.

**Guidelines for Debaters in Preparation for the Debate**

- Meet with members of your group to prepare your strategy.
- Determine "Who" will present the oral testimony (e.g. officers of your professional organizations, director of a nursing home, private concerned citizen, etc.). You need to assume an analytical persona. Every member of the team must present an oral argument.
- Coordinate with members of your group to avoid duplication and redundancy.
- Use costumes and props to define your analytical persona, clarify points and be persuasive.
- Be prepared to counter/rebut the issues/arguments raised by the opposition with evidence-based data!!!!

Once students sign-up for a debate topic (see Figure 2a, 2b, 3c for student sign-up sheet), each respective debate-team member assumes the role of resident expert, studies the issue from a unique perspective, collaborates with his/her respective debate team to avoid redundancies and formulate debate strategy, and prepares a cogent, a 10-12 minute presentation/argument. To jump start the assignment, I distribute a resource file to each debate team, making it clear that I expect additional evidence-based research on the current issue under debate. Although students receive written and verbal guidelines for planning their roles in the debate and the evaluation rubric, the learning activity is student researched, directed, and carried out.

## Figure 2. Students Sign-up Sheet for Debate Topics

| **Healthcare Crisis/Delivery/Finance Options** | **Key Resources** |
|---|---|
| 1. | Any professional journals on health |
| 2. | policy, education, practice, or administration |
| 3. | Anything on the uninsured and underinsured |
| 4. | Healthcare reform proposals in the US Congress |
| 5. | Healthcare delivery/finance systems in other |
| 7. | developed countries |
| 8. | |
| 9. | World Health Organization |

(pro and con Medicaid, Medical savings accounts, Clinton plan, Bush plan, consumer-driven plans, managed care systems, National Health Insurance, National Health Service, Canadian Health System, systems from other countries)

---

| **Dental Hygiene Education** | |
|---|---|
| 1. | Anything current on the Future of Dental |
| 2. | or Dental Hygiene Education or on the |
| 3. | advanced dental hygiene practitioner. |
| 4. | |
| 5. | Look at educational trends in nursing, PT, OT |
| 6. | PEW Foundation Reports |
| 7. | Institute of Medicine reports |
| 8. | ADA reports |
| 9 | ADHA reports and position papers |

(pro or con on associate level education, BSDH education, MSDH education, doctoral education, Advanced Dental Hygiene Practitioner Program)

**Preceptorship**

1. Curriculum for the Alabama Preceptorship
2. Program
3.
4. American Dental Hygienists' Association ADA
5. action on preceptorship.
6. From: http://www.adha.org/profissues/preceptorship/adaactions.htm
7.
8. Interview a dental hygienist from Alabama
ADHA documents on preceptorship

(pro or con on preceptorship, Alabama dental hygiene program, using dental assistants to scale)

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**Licensure**

1. Written Statement of the American
2. Association of Dental Schools to the
3. Institute of Medicine Committee on the
4. Future of Dental Education. *JDE* 58(1)
5. 26-37, 1994
7.
8. American Board of Dental Examiners (ADEX)
9. PEW Foundation Reports
ADEA, ADA, ADHA
College of Dental Hygienists of British Columbia
http://www.cdhbc.com/html/homepage.html

**"Point/Counterpoint" on the role of portfolio** assessments for dental licensure in January 2006 issue of the *Journal of the American Dental Association*. You may view the article by going to: http://jada.ada.org/cgi/content/full/137/1/30

(pro or con on institutional licensure, self-regulation for dental hygienists, board certification, national licensure, regional licensure, sunset review outcomes, Canadian approach to self- regulation, New Mexico's approach to self regulation, Iowa's approach to self regulation)

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**Practice**

1. Written Statement of the American
2. Association of Dental Schools to the
3. Institute of Medicine Committee on the
4. Future of Dental Education. JDE 58(1)26-
5. 37, 1994
6. Federal Trade Commission Publications
7. around 1980
8. ADEA, ADA, ADHA
9. ADEA,'s Center for Public Policy and Advocacy

(pro or con on direct, indirect, personal, general supervision; independent practice, independent contracting, unsupervised practice, alternative practice, limited permit dental hygiene, prescription privileges)

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**Other sources for current information:**

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|---|---|
| • *Journal of the American Dental Association*<br>• *Prospectus of the ADHA*<br>• *Journal of Dental Hygiene Education Update* (biannual publication *ACCESS* of the ADHA)<br>• *Surgeon General's Report on Oral Health*<br>• *Healthy People 2010*<br>• *PEW Reports* on various health-related issues<br>• Association of Schools of Allied Health Professions (www.asahp.org)<br>• American Academy of Periodontology www.perio.org<br>• *International Journal of Dental Hygiene* | • ADA News (www.ada.org)<br>• Oral Health Report Card http://www.dentalgentlecare.com/oral_health_report_card.htm<br>• *Journal of Dental Education RDH Magazine*<br>• ADHA (www.adha.org)<br>• Center for Health Workforce Studies (Http://chws.albany.edu) at the University of Albany<br>• *Reports of Health Personnel in the US: Trends, Issues and projections of Supply and Demand for Selected Health Disciplines,* Bureau of Health Professions, US Department of Health and Human Services (also known as *The Tenth Report* to Congress) |
| • YOUR OWN RESEARCH | • YOUR OWN RESEARCH |



***The debate***[1, 2,15]

During each week's debate, the entire class learns about the issue via listening to the 8-10 different presentations/arguments, witnesses friendly debate among the 8-10 students on the panel, and has the opportunity to pose questions and voice their opinions regarding the issues. Structure of the debate includes:

*Constructive Argument Phase*- Each side orally presents their constructive argument without interruption using their adopted analytical persona.

*Rebuttal Phase* - Each side has the opportunity to challenge the constructive argument, and rebut statements based on logic and evidence.

*Class Interaction Phase* - Each member of the audience (the class) has the opportunity to get involved in the debate by asking questions, making observations, pointing out areas of potential compromise, or expressing alternative positions that were not brought out during the debate.

Each debater is also required to develop one good test question that measures acquisition of the major point that he/she was making during the constructive argument phase of the debate. Having to prepare a good test question helps debaters focus on their key message; if the question is good, I include it on the final exam. This part of the assignment encourages good test question writing and class attentiveness, knowing that the class may be tested on the information. It also requires students to apply their knowledge and skills from an educational methods course taken the previous semester.

### *Key Advantages* [1-9, 14,15]

Given that each debater is responsible for: a) bringing to the forefront unique, evidence-based information from the professional literature, and b) developing one test question that measures student knowledge of the main point of their 10-12 minute oral argument, a large body of complex, conflicting, rapidly changing information can be covered in a short period of time. Moreover, students gain proficiency in accessing information from electronic databases, interviewing professionals in the community, using resource people from various professional organizations, synthesizing and analyzing information, orally communicating their position effectively and succinctly, and defending their position all within the context of a healthy debate.

### *Key Disadvantages* [2, 9, 12, 14, 16]

Perhaps the greatest limitation of the debate is its emphasis on competition, ie, winning and losing without enough emphasis on compromise and the consensus building necessary for reaching the best solution. Some students may trivialize issues at the expense of winning while others are uncomfortable with a confrontational environment. This is a limitation given that most of our students are women and research shows that women in particular are much more comfortable with consensus building rather than with public argument. Also, some minority students, regardless of gender, may come from cultures that value group harmony over individual opinion and argument.

### *Post-debate*

Upon completion of each week's debate, students and the instructor leave the class enlightened, better able to express personal opinions, and hopefully more prepared to take action about issues that affect the dental hygiene profession.

### *Evaluation*[15]

Students receive an evaluation rubric at the beginning of the semester when the debate assignment is explained and when debate groups are formed (see Figure 3 for rubric used to evaluate student debate performance). Although group preparation is important for developing a coherent pro or con argument, and to avoid redundancy of arguments, each debater is evaluated on his/her own performance in areas such as: presentation of self, use of statistics/evidence-based research to support the argument, critical examination of the issue, and use of media and handouts to support the arguments. Mechanics of the delivery such as enthusiasm, eye contact, control when debating, and extemporaneous argument rather than reading from a prepared text is also evaluated.

**Figure 3. Debate Rubric for Evaluating Student Debate Performance**

| | Earned/Possible |
|---|---|
| **EFFECTIVE INTRODUCTION** | |
| 1. Acknowledge and thank the audience | /5 |
| 2. State credentials/affiliation to establish your credibility | |
| 3. Purpose of the presentation communicated to audience. | |
| 4. Significance of the issue is clearly explained:<br>-supportive statistics<br>-positions of various constituents | |
| 5. Perceives implications of the issues for dental hygiene/public policy | |
| **REVIEW OF CURRENT LITERATURE** | |
| 1. Issues comprehensively discussed/evidence-based. | /5 |
| 2. Important findings noted | |
| 3. Studies critically examined | |
| 4. Differentiates between fact and opinion | |
| 5. Amount of information presented is appropriate | |
| **CONCLUSIONS/SUMMARY** | |
| 1. Conclusions are evidence based and supported by data presented | /5 |
| 2. Recommendations are made | |
| 3. A closing statement is evident | |
| 4. Thank the audience | |
| 5. Submit in writing a multiple choice question that tests one key point made. | |
| **MECHANISMS OF THE PRESENTATION** | |
| 1. Uses quality media, powerpoint, pointers and/or handouts to enhance the effectiveness of the message. | /5 |
| 2. Establishes rapport with the audience, e.g., good eye contact, high energy level, enthusiasm (avoids "reading" to the audience) | |
| 3. Knowledgeable about the subject:<br>-commands respect as a resident expert<br>-answers questions in an authoritative manner | |
| 4. Presentation is logically organized and coherent | |
| 5. Maintains composure and control during heated debate (avoids emotionalism) | |
| | Total /20 = _____ |

After each debate, I ask the class to vote on which side was most convincing (rather than what side of the issue you most support), and then I ask them to identify the most-effective to least-effective strategies used by the debaters. Hopefully, they will remember the most effective debate strategies used and emulate these strategies in the future.

## Summary

The literature highlights key benefits from debate as a teaching-learning strategy for developing critical thinking and analytical skills while fostering teamwork and communication. Authors report that this method of teaching-learning has been implemented successfully in nursing and occupational therapy programs and would benefit other academic programs in the health sciences, particularly in courses that cover controversial issues. Although there are disadvantages to using the debate as a teaching-learning strategy, the benefits far outweigh the disadvantages.

In conclusion, debating is an effective pedagogical strategy because of the level of responsibility for learning and active involvement required by all student debaters. Moreover, it provides an experience by which students can develop competencies in researching current issues, preparing logical arguments, actively listening to various perspectives, differentiating between subjective and evidence-based information, asking cogent questions, integrating relevant information, and formulating their own opinions based on evidence. After the debate is over, students also report that the experience is FUN!

## Acknowledgements

## Notes

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## References

1. Garrett M, Schoener L, Hood L. Debate: A teaching strategy to improve verbal communication and critical-thinking skills . Nurse Education. 1996;21: 37-40.
2. Tumposky NR. The debate debate. The Clearing House. 2004 ;78: 42-55.
3. Archbold PG, Hoeff B. Reframing the issue: a debate on third party reimbursement. Nurs Outlook. 1981;15(17): 423-427.
4. Bradshaw M, Lowenstein A. Debate. . In: Fuszard B. , editor. Innovative Teaching Strategies in Nursing. (2nded). Gaithersberg, MD: Aspen; 1995.
5. Elliot LB. Using debates to teach the psychology of women. Teaching Psychol. 1993;20(1): 35-38.
6. Moeller TG. Using classroom debates in teaching developmental psychology. Teaching Psychol. 1985;12(4): 207-209.
7. Fuszard B. Innovative Teaching Strategies in Nursing. (2nded). Gaithersberg, MD: Aspen; 1995.
8. Gustafson MB, Corcoran SC. Teachers' Desk Reference. Oradel, NJ: Medical Economics; 1978.
9. DeYoung S. Teaching Strategies. Redwood City, CA: Addison-Wesley; 1990.
10. Fluharty GW, Ross H. Public Speaking and Other Forms of Speech Communication. (editionnded). New York, NY: Barnes & Nobles; 1996.
11. Protagoras The Internet Encyclopedia of Philosophy [homepage on the Internet]. [cited 2007 Aug 2]. Available from: http://www.iep.utm.edu/p/protagor.htm.
12. Combs HW, Borne G. The impact of marketing debates on oral communication skills. Bulletin. 1989;52(2): 21-25.
13. Freely AJ. Argumentation and Debate. (6thed). Belmont, CA: Wadsworth Co; 1986. 248- lastpage.
14. Griswold LS. Debate as a teaching Strategy. The American Journal of Occupational Therapy . 1999;54: 427-428.
15. Pernecky M. Debate for the economics class-and others. College Teaching. 1997;45: 136-8.
16. Tannen D. Language, gender, and teaching. Rethinking Schools. 1992;6(2): 4-7.
17. Belenky MF, Clenchy BM, Goldberger NR, Tarule JM. Women's Ways of Knowing. New York, NY: Bosie Books; 1986.
18. Gay G. Culturally Responsive teaching: Theory, research, and Practice. New York, NY: Teachers College Press; 2000.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Effect of Power Toothbrushing on Simulated Wear of Dental Cement Margins

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***Power toothbrushes (PTBs), in combination with abrasive dentifrices, may encourage wear of dental cements at crown margins.***

***Purpose.The objective of this in vitro simulation was to control the clinical variables associated with PTB use and measure the potential side effects of PTBs with mild and abrasive dentifrices.***

***Methods and Materials. Four PTBs ( Braun-Oral-B-Professional Care at 150 g brushing force, Sonicare-Elite at 90 g, Colgate-Actibrush at 200 g and Crest-Spinbrush-Pro at 250 g) and 2 dentifrices mixed 1:1 with tap water (Mild= Colgate-Total, Colgate-Palmolive; Abrasive= Close-up, Chesebrough-Ponds) versus tap water alone (control) were used to abrade 2 cements (Fleck's Mizzy Zinc Phosphate [ZP]; 3M-ESPE Unicem universal cement [UC]) using cement-filled slots (160 m wide) cut into wear-resistant ceramic blocks. A custom fixture controlled PTB/block alignment, PTB loads, and other testing variables. Wear was measured (3 profilometer traces/slot, 5 slots/block/group, baseline to 5-year differences) and analyzed (3-way ANOVA, $p \leq 0.05$, Bonferroni)***

***Results. Wear for ZP was much greater than UC ($p<0.05$) for all 4 PTBs and both dentifrices. Brushing with water showed no effects ($p<0.05$). Cement-PTB-dentifrice interactions did occur. Only minor differences occurred among PTBs. Pooled 5y-wear levels for ZP for both dentifrices (~21 µm /5y) were similar to values for current-day posterior composite materials.***

***Conclusions. Combinations of PTBs with mild and abrasive dentifrices produced significant wear with ZP but not UC; thus, resin-composite cements seem to represent a better choice for wear resistance.***

**Keywords:** power toothbrushes, dentifrices, wear, zinc phosphate, resin-composite cements, profilometer

## Clinical Relevance Statement

The objective of this study was to measure wear produced by 4 power toothbrushes using 2 dentifrices on 2 dental cements at simulated restoration margins.

## Introduction

Power toothbrushes (PTBs) are the latest technological device for oral hygiene care. PTB types and brands include: battery-operated oscillating, rechargeable oscillating, or rechargeable sonic action units (Table I and Figure 1a, 1b). Clinical studies have been published on both the effectiveness of plaque removal, stain removal, and biofilm removal, as well as some side effects such as tooth surface wear and production of dental hypersensitivity.[1,2,3,4] Both battery-operated PTBs and rechargeable PTBs are efficacious for plaque removal, but like manual toothbrushes (MTBs), may cause tooth surface or restoration wear when improperly used or combined with abrasive dentifrices. Tooth surface wear is greater for PTBs than MTB, depending on the amount of force and type of dentifrice used.[5-6]

**Figure 1A. Examples of PTBs (Left-to-Right: Crest Spinbrush, Colgate Actibrush, Oral-B Professional Care, and Sonicare Elite).**


**Figure 1B. Magnified view of PTB heads (Left-to-Right: Colgate Actibrush, Crest Spinbrush, Oral-B Professional Care, and Sonicare Elite)**

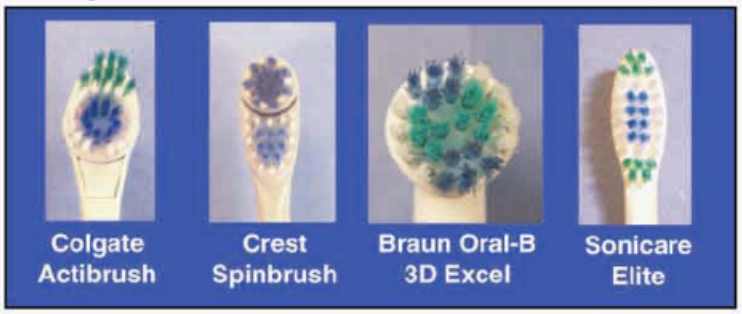


**Table I. Summary of rechargeable and disposable battery-operated PTB features.**

| *Category* | *Types* | *Action* | *Motions per min* | *Characteristics* |
|---|---|---|---|---|
| Recharge | Sonicare Elite | Side to Side | 31,000 | Quadpacer; 2m timer |
| | Interplak | Counter Rotational | 4,200 | Auto-Flush; Dispenses Mouthrinse |
| | Braun Oral B Professional Care | Rotation-Oscillation | 8,800 | Two-speed option; 2m timer |
| | Roda-Dent | Circular | 90,000 | Rounded Head |
| | Teledyne Aqua Tech | Circular | No Data | Rounded Head |
| | Ultrasonex | Ultrasonic | 90 | Sonic Vibration |
| Battery | Crest Spinbrush Pro | Dual-Action Oscillation | No Data | Rounded head |
| | Colgate Actibrush | Oscillation | 4,500 | Small rounded head |
| | Colgate Motion | Dual Head Oscillation | 4,500 | Rounded head |
| | Braun Oral-B | Oscillation | 3,800 | Rounded head |

There is limited research examining potential problems of using PTBs with cemented restorations. Potential side effects of PTBs on tooth surface wear and some restorative materials have been investigated.[7] There has been speculation within the literature that energy from sonic toothbrushes may affect the integrity of cements. Retentive strengths of crowns were evaluated by McDaniel et al[8] by comparing changes in resin, glass ionomer, or zinc phosphate cements; Hansen et al[9] evaluated effects of Sonicare, Interplak, and no exposure. Both studies simulated 2 years of sonic tooth brushing and found no effects. Gheewalla et al[10] examined Sonicare, Oral-B, and Rota-Dent effects on resin-bonded orthodontic brackets (n=1080) in a 6-month clinical trial and findings revealed no failures. Buchalla et al[11] assessed the wear of 11 different dental cements after exposures to neutral versus acidic pH solutions by using regular toothbrushes loaded onto 4 mm (4000 µm) wide slots of the cement. Results demonstrate that resin cement displayed the most abrasion resistance and acidic conditions had a greater effect on conventional cements than resin cements. A limitation to the Buchalla et al study was the wide slots for cement exposure did not realistically represent clinical cement margins. Shinkai et al[12] tried to test the effects of 4 different particle-size filled composite resins on the marginal wear and toothbrush abrasion of cemented Cerec inlays, revealing that wear decreased with smaller particle size. Yet, the authors did not maintain equal loading levels of the experimental cements, so it was impossible to separate particle size and loading level effects.

Studies have explored some possible degradation mechanisms, but none have carefully evaluated effects of PTBs on cement abrasion/erosion (wear). Cement margins may be at risk to more effective surface cleaning methods. The objective

of this *in vitro* simulation was to measure the effects of PTBs with mild and abrasive dentifrices on the wear of 2 dental cements at the margins of restorations.

## Method and Materials

Slots cut into ceramic blocks simulated cement margins of restorations (ProCad, Ivoclar, Vivadent Inc, Amherst, NY) and provided a stable reference system for measuring the effects of PTB and dentifrice combinations. After polishing the surfaces, wear was monitored over time by profiling the slots.

Four PTBs, including 2 categories (battery-powered and rechargeable) and several different bristle actions, were evaluated. The PTBs with 2-minute timers were modified to run "continuously" for the experiments. PTB effectiveness depends on charge or battery life, thus, only freshly recharged or new battery-powered PTBs were used. The Crest Spinbrush Pro and Colgate Actibrush were modified to allow an AC 3-volt (500 mA) adapter to be used as the power source. The Sonicare Elite was modified by attaching a timer box to the circuit in order to monitor the 2-minute cycles and allow the brush to continue after a 2-second delay, allowing the Sonicare Elite to run continuously. The Oral B Professional Care 7850 DLX has a 2-minute timer but ran continuously for an hour fully charged.

Two dentifrices (Colgate Total, RDA = 60-75, mild abrasivity) and (Close-Up Gel, RDA = 161, medium abrasivity) were used to measure the wear of each dental cement at the simulated margins (Baker, 1999). Dentifrices were compared to brushing with tap water alone. To mimic the action of dentifrice mixing with saliva and being diluted, dentifrice was mixed 1:1 by volume with tap water. The pH for each mixture was measured initially (Model AP61, Fisher Scientific, Pittsburgh, Pa) and was approximately neutral (tap water = 7.18, CT solution = 7.6, CU solution = 7.5).

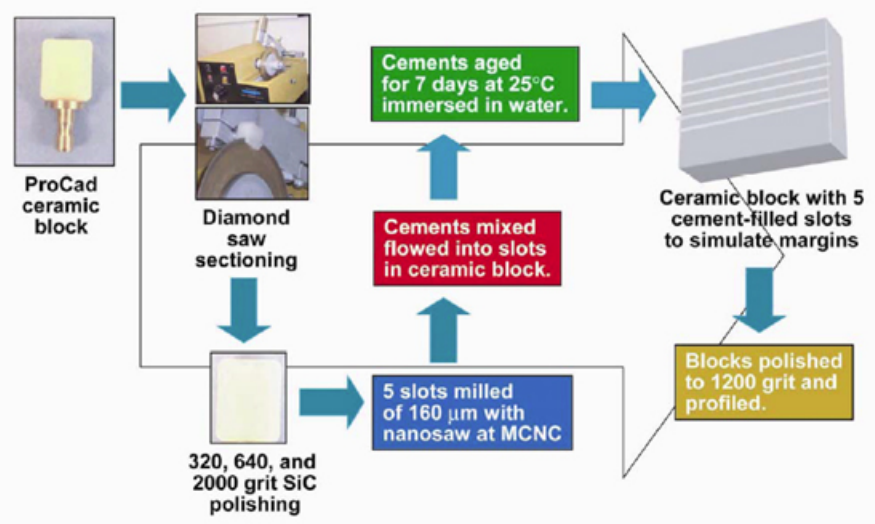
Fleck's Mizzy Zinc Phosphate (ZP) and 3M-ESPE Unicem resin-composite cement (UC) were evaluated. ZP represents the "gold standard" for all other cement comparisons, but is not currently in wide use. Resin-modified glass ionomer cement is commonly used for cementing materials with metal substructures (cast crowns, PFM, metal bridges). Normally, composite resin is used with all-ceramic or indirect composite restorations. Recently, universal cements have been promoted for cementing both metal substructures and all-ceramic restorations. Clinicians are interested in being able to use one cement for all applications. Information on the cements and their handling conditions are reported in Table II.

**Table II. Sources and handling conditions for dental cements.**

| Cement: (Abbrev) | Manufacturer and Address: | Lot Number: | Manipulation: |
|---|---|---|---|
| Flecks Mizzy (ZP) | Mizzy, Inc. Cherry Hill, NJ | P8682608 L648091808 | > Glass slab chilled with running water for 2 minutes and dried with paper towel.<br>> Powder (0.8g) proportioned into 1/16, 1/16, 1/8, ¼, ¼, ¼ increments.<br>> Liquid proportioned with glass micropipette (24 drops).<br>> Smallest-to-largest powder increments added to liquid mixture over 2 minutes.<br>> Cement added and flowed into slots by from one end to other. |
| UniCem (UC) | 3M-ESPE St. Paul, Minn | 162647 | > Capsule activated and amalgamated 15 seconds.<br>> Capsule beak bent open and cement dispensed onto wax-coated paper pad.<br>> Cement added and flowed into slots from one end to other. |

Cement margins were simulated as slots within all-ceramic blocks to mimic an all-ceramic restoration adjacent to tooth structure. ProCad ceramic blocks (2mm x 12mm x 10mm) designed originally for CAD-CAM milling, were cut on a diamond wafering saw (Buehler, Lake Bluff, Ill) and manually polished through a 320, 600, and 1200 grit series of SiC abrasives (Carbimet, Buehler, Lake Bluff, Ill) to produce smooth faces (Figure 2). Five slots were milled accurately into each face (160 µm wide about 350 µm deep) using a high-speed nano-saw (Model DAD 341, Disco Corporation, Japan).

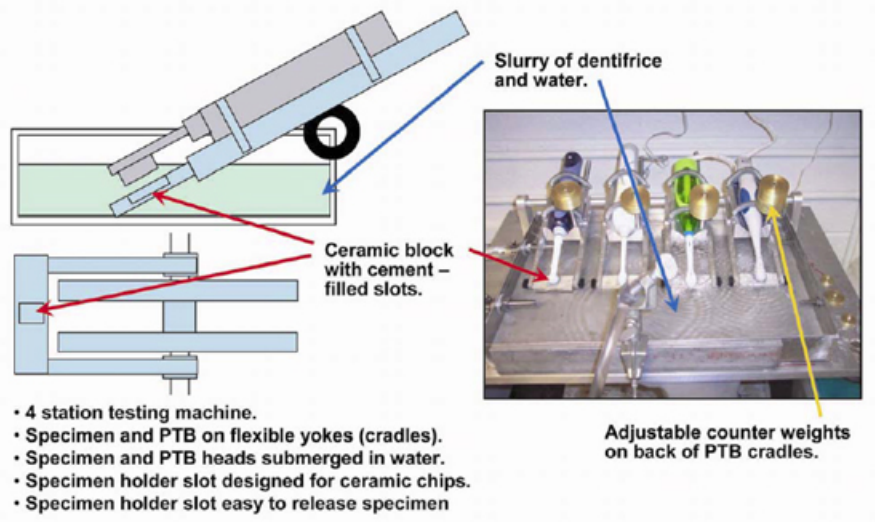
**Figure 2. Flow chart for the preparation and testing of specimens.**




Cements were mixed and manipulated according to manufacturer's directions (Table II) and flowed carefully from one end to the other of each slot. Blocks with cement-filled slots were conditioned in water for 7 days to insure that setting reactions were complete and that any potential water absorption (and any expansion) would have occurred. Ceramic block surfaces were polished with 1200 grit SiC to level the cements with the block surface and profiled to obtain baseline readings. Blocks with cements were then tested for a total of 3 hours and re-profiled. To minimize the time for longer-term absorption or swelling of cements in water that might cause slow but continued expansion, testing was accomplished in a few hours after 7 days of conditioning in water.

To control variables associated with PTBs use, custom equipment was designed to hold 4 PTBs (Figure 3) during the course of the experiments. Each PTB handle was secured with spring ties to a yoke permitting access to the on-off switches on the bottom surfaces of each handle. A second yoke held a 10x12mm ceramic block with its cement-filled slots, and was adjusted to align the specimen surfaces parallel to the PTB heads. Both yokes were articulated on a common rail. Each PTB yoke was equipped with weights to adjust loads on the PTB head against the block. Each load in grams was adjusted by using a calibrated spring scale (Science and Surplus, Milwaukee, Wis). Yokes were tipped forward to remain submerged in the solution of dentifrice/water, which was pumped continuously to the equipment reservoir from a constant temperature water bath (Figure 3). The relatively rapid circulation of the mixture provided sufficient agitation to keep the abrasive particles from settling out to any degree.

**Figure 3. PTB simulation equipment that holds 4 PTBs.**



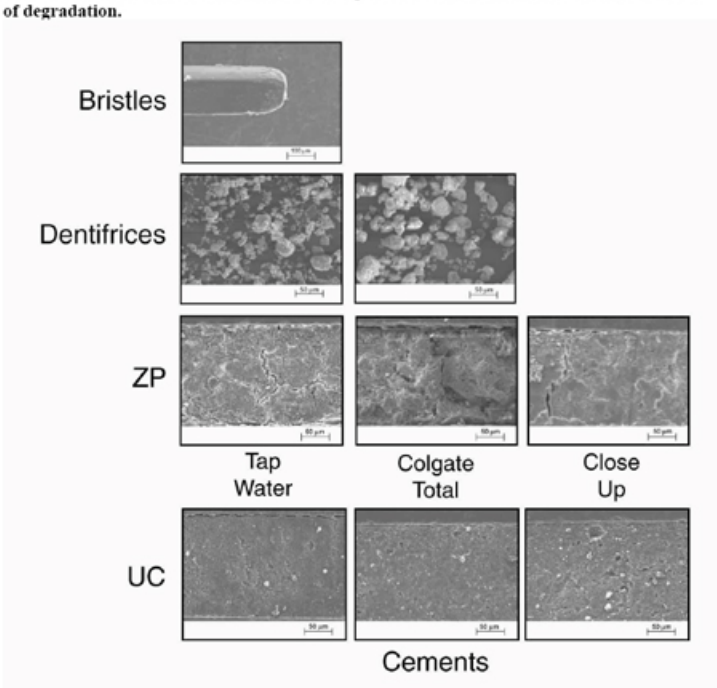

Most PTB recommendations call for a contact time of 30 seconds per quadrant (3 surfaces twice daily). Most PTBs contact approximately 2 teeth simultaneously. From these assumptions, it is possible to calculate the contact time per tooth surface. Contact time = (2x/d) x (30s/quadrant) x (2 teeth/brushhead) (3 surfaces/tooth) (7 teeth/quadrant) = 5.7 seconds/surface/day. This corresponds to 2085s/y (= 35m/y = or 0.58 h/y). To simulate ~5 years of PTB exposure for these experiments required (5y)( 0.58 h/y) = 2.9h  3hours.

Profilometry was used to monitor cement changes during the experiments and 3 small fiduciary lines were scribed on each block near the cement-filled slots to provide a simple, although approximate, referencing system (Surfanalyzer System 5000, Esterline-Federal Products, Providence, RI). The profilometer utilized a contact stylus with a precision of 0.2 µm and a travel of up to 10 cm. The sample was positioned so that the stylus could track across 5 slots at once.

Tracings were examined on a computer screen, enlarged to focus on one slot at a time, and analyzed by manual integration of the area of wear. A clear Mylar mask with a printed grid was placed over the computer screen to count areas from the original surface to the profiled surface. The grid area was divided by the width of the slot to calculate the average depth of wear for each location. Wear values from 3 locations for each of the 5 slots were averaged together (n=15) to calculate mean wear values of PTB, dentifrice, and cement type.

Following the conclusion of the wear experiments, SEM analysis (JEM 6300, Jeol USA, Peabody, Mass) was conducted on dentifrice abrasives, PTB bristles, and worn cements (Figure 5). Abrasive material from the dentifrices was separated by shaking with water, allowing the abrasive to settle, and decanting the superficial solution. This elution was repeated 5 times before collecting the abrasive. Dried abrasive particles were attached to double-stick tape on an SEM stub, sputter-coated with Au-Pd (Polaron E5200, Quorum Technologies, Houston, Tex), and examined for particle size and distribution. Bristles were collected from the inner portions of each PTB head to examine effects of exposure to tap water, Colgate-Total, and Close-Up in comparison to unused PTB bristles. Each bristle was attached to double-stick tape on an SEM stub, sputtered-coated with Au-Pd, and examined at 200X and 500X. Cements in slots were examined as well. To avoid artifacts from dehydration during sputter coating, blocks containing the ZP and UC cement specimens were processed by critical-point drying. After subsequent sputter coating, cements were examined at 15X and 500X.

**Figure 5. SEM analysis of bristles, dentifrices, and cements. A) Example of bristle size and geometry for Sonicare; B) Typical particle size of abrasive particles and evidence of some agglomeration for both CT and CU dentifrices; C) Examples of the microstructures of ZP and UC cements in the test slots after PTB experiments. ZP showed much more evidence of degradation.**

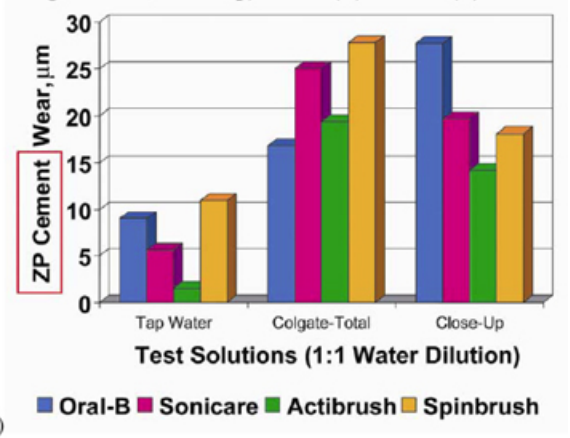



The experiments recorded cement wear as a function of 4 PTBs, 3 test solutions, and 2 cement types. SAS software (SAS, Cary, NC) was used to conduct nonlinear modeling analyses of all experimental effects to determine potential interactions and main effects. After determining the major effects from the models, Analyse-It (Analyse-It Software Ltd, PO Box 103, Leeds LS27 7WZ, England, UK) was employed for analysis of variance (ANOVA) to detect differences ($p \leq 0.05$) among all groups within smaller collections and pooled groups. ANOVAs for collections and pooled groups were performed using Bonferroni adjustments.

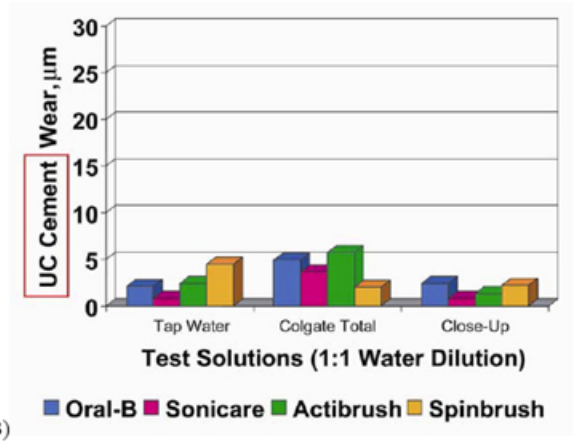
## Results

Differences in wear (μm) between the start and finish of the 5-year simulation of PTB brushing are presented in Table III and Figure 4 for different combinations of cement-PTB-dentifrices.

**Figure 4. Comparisons of the four individual PTBs in combination with different test solutions (water, Colgate-Total, Close-Up) for ZP (A) and UC (B) cements.**




(A)




(B)

**Table III. 5-year cement wear for different cements, PTBs, and test solutions.**

| *Summary of 5-Year Simulated PTB Wear of Cements (µm, mean ± sd)* | | | | |
|---|---|---|---|---|
| | | *Tap Water:* | *Colgate-Total:* | *Close-Up:* |
| ZP | PTB1 Pro | 9.0±7.5 µm [ab,A] | 16.8±8.7 µm [bc,B] | 27.7±8.4 µm [c,C] |
| | PTB2 Elite | 5.6±6.3 µm [a,A] | 25.0±17.0 µm [b,B] | 19.7±14.9 µm [b,C] |
| | PTB3 Actibrush | 1.5±3.2 µm [a,A] | 19.4±12.5 µm [b,B] | 14.2±6.3 µm [ab,C] |
| | PTB4 Spinbrush | 11.0±9.1 µm [a,A] | 27.8±9.1 µm [b,B] | 18.1±13.9 µm [ab,C] |
| UC | PTB1 Pro | 2.1±2.6 µm [a,AB] | 4.9±2.3 µm [a,AB] | 2.4±2.6 µm [a,A] |
| | PTB2 Sonicare | 0.8±0.7 µm [a,A] | 3.7±2.0 µm [b,AB] | 0.8±3.2 µm [ac,A] |
| | PTB3 Actibrush | 2.4±1.8 µm [a,AB] | 5.7±3.7 µm [a,A] | 1.3±1.4 µm [a,A] |
| | PTB4 Spinbrush | 4.5±3.5 µm [a,B] | 2.0±2.0 µm [a,B] | 2.2±1.6 µm [a,A] |

* Statistical analysis: For the 4PTBs for a single cement, small letters (=INTER-column) and capital letters (= INTRA column) show the differences for $p<0.05$.

There were significant differences among test solutions and between cements, but not among PTBs (Table IV). ZP experienced much greater wear ($p<0.05$) than UC for all test solutions, including small differences even within tap water. Both dentifrice test solutions produced significantly more cement wear than with tap water alone ($p<0.05$).

**Table IV. 5-year cement wear for different cements, pooled PTBs, and test solutions.**

| *Groups:* | | *Tap Water:* | *Colgate-Total:* | *Close-Up:* |
|---|---|---|---|---|
| ZP | All PTBs | 6.8 ± 4.2 µm [a,A] | 22.3 ± 5.0 µm [a,B] | 19.9 ± 5.7 µm [a,B] |
| UC | All PTBs | 2.5 ± 1.5 µm [a,A] | 4.1 ± 1.6 µm [b,B] | 1.7 ± 0.8 µm [b,A] |

Durability of the bristles was assessed by comparing bristle size and geometry before and after the simulated 5-year use. PTB bristles were approximately round in shape and almost exactly 150 µm in diameter, except the Sonicare bristles typically appeared about 25% larger in diameter. There were no apparent changes in bristle tip roundedness of diameter after 5-year simulated use. Bristle densities were calculated for each of the PTBs and were almost identical (Colgate Actibrush=6.1 bristles/mm2, Spinbrush=7.6, Oral-B=7.6, Sonicare=6.4).

Abrasive particles isolated from the dentifrices were primarily in the 1-40 µm range and often appeared to be agglomerates of smaller particles, although no formal particle size analysis was conducted. The mean particle size was approximately 1-5 µm range. Actual compositions of the abrasives and the amount of abrasive in each dentifrice was not determined. The SEM observations demonstrated that particles were sufficiently small and easily made contact with the cement, even after some wear might have taken place.

Microstructures of the 2 dental cements were different. ZP contains a reaction product matrix of tertiary zinc phosphate crystals wrapped around a large volume of residual ZnO powder.[14] The ZnO particle sizes varied from about 1-10 µm and the interparticle spacing was on the order of about 2-5 µm. UC cement is based on the free radial reaction of matrix monomers that surround reinforcing silicate filler particles. The silicate filler averaged about 1-5 µm in diameter. The interparticle spacing was much less than 2 µm.

Approximately one month after recording the planned wear measurements, and after continued storage of the specimen blocks in water, the cements were profiled again. The depths of wear had decreased (5-20 µm), indicating that water absorption continued to occur within the samples.

## Discussion

The PTBs producing equivalent results was not anticipated. This may be due to the experimental design, interpretation of the results, comparisons of results to published literature, clinical interpretation of the value of the results, and proposed future research areas.

Slurries of dentifrice were made using tap water (pH=7.2). In retrospect, it would have been more controlled to use water that was starting at a neutral pH. Buchalla et al11 earlier reported that for conventional cements, such as zinc phosphate, markedly acidic conditions (pH=3) produced more wear on exposure.

A presumption of this research was that the specimens were only affected by water absorption during the conditioning phase. However, differences in pH, ions from fluoride, or dentifrice additives may have caused minor osmotic differences between the inside and outside of cements that contributed to volumetric changes during the PTB testing phase. At the present time, no controls were analyzed to detect such changes. However, there is at least some evidence that these types of changes may be occurring. The cement specimens were remeasured after another week and there was at least some noticeable expansion continuing to occur. While these effects were avoided in this experiment by polishing, measuring, and testing all the specimens within 24 hours at the end of the 7-day conditioning phase, this is a potential problem for other measurement techniques that require any substantial delay. This would also indicate that SEM or similar microscopy techniques might not produce accurate reflections of volumetric changes.

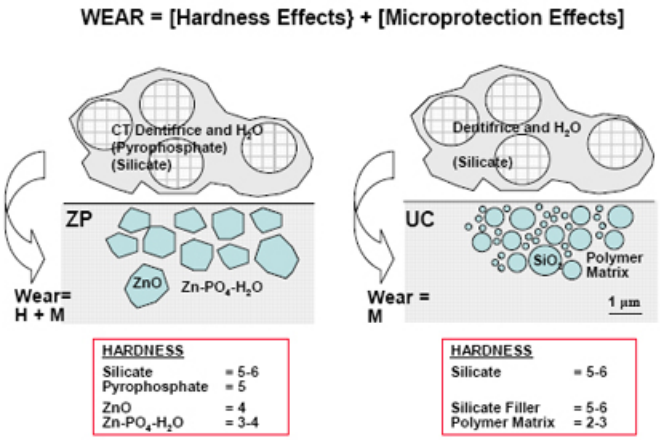
PTB simulation was designed so that PTB bristles were being used only in the wet state during the experiments. Patients would most likely store their PTB brush head in air and bristles would dry out between uses. Nylon tends to absorb water and become plasticized or softened. In a softened state, bristles may not produce as much 2-body wear of cement surfaces.

However, there did not seem to be a simple method to simulate the fact that bristles might behave harder during the initial phase of each PTB brushing.

Biofilm is omnipresent in the oral environment and would normally be present over dental cement margins. Most likely the biofilm would be an initial barrier to cement wear, although the effect could be minor. In any case, this effect would delay or decrease the extent of wear under clinical conditions.

It appeared that the dominating factor influencing observed cement wear was the resistance of the actual cements, and that abrasive particles in the dentifrices produced most of the observed wear. The results were not the effects of the differences in PTBs or other differences in dentifrice compositions. In both Colgate-Total and Close-Up, typical abrasive particles (1-5 µm range) seemed to easily contact the cement within the margin (160 µm wide), affect the weak ZP cement matrix, and produce wear. SEM views agreed with the wear measured by profilometry. These observations are consistent with the "protection theory" of wear for dental composites.[15] Macro-protection is the sheltering of restorative material by the cavosurface margins of tooth structure. Micro-protection is the sheltering of the weaker restorative material matrix by the harder filler phase particles, and this theory applies in this situation for cements (Figure 6). Materials with small-sized dispersed reinforcing filler phases, such as the residual powder particles in cements or composites, which create small interparticle separations, demonstrate good wear resistance.[15] Rankings of wear equated to rankings of interparticle separation and matrix resistance to wear. In this particular experiment, the smaller interparticle separation associated with smaller filler particles, and greater wear resistance of the UC matrix generated better overall wear resistance. Despite this apparent agreement with theory, more extensive investigation is warranted to confirm this explanation.

**Figure 6. Proposed mechanism of wear of dental cements based on varying contributions of hardness (HE) and microprotection (MP) factors. CT in contact with ZP is shown to the left, and CU in contact with UC is shown to the right, as examples of experimental test situations. Hardness values are expressed in terms of Mohs scale (and estimated from online mineral data).**




Greater wear was observed with ZP cement. Buchalla et al[11] noted that zinc phosphate was less wear-resistant than resin-based cements. One would logically expect that stronger materials would also provide more wear resistance and retentive strength as well, although the reasons may not be exactly the same.

Mean wear levels ranged from 14-28 µm. There was no information in the literature available for direct comparison, but some important suggestions that measured in vitro values are consistent with clinical wear. Wear-resistant, dental composite, Class 2 restorations typically display 5-15 µm of wear in 3-year simulation tests of food abrasion.[15] Four-year cement wear levels on occlusal surfaces for a clinical trial of bonded CAD-CAM inlay restorations were 55 µm16 for patients not using PTBs but which were subject to food abrasion.

PTBs may be recommended to patients with extensive cemented crown and bridge restorations, however, one should be cautious with ZP cement. It appeared that UC had excellent wear resistance. One also should be cautious in over-interpreting

these results since only 2 cements have been directly evaluated. One might expect that other commercial cements should fall in between the results for ZP and UC, but that is not yet known.

The PTB machine and model of testing materials in slots in ceramic blocks offer a good method to investigate a range of other experimental questions. For example, what is the effect of different PTB loading levels on cement wear? Is there an upper limit in wear that occurs due to macro-protection? Do other cements with small dispersed particle sizes demonstrate micro-protection? These will all help to further understand the wear mechanism and rates for dental cements.

## Conclusions

In summary, within the limitations of this 5-year simulation of dental cement wear by different PTBs and different test solutions, the following can be concluded:

1. ZP underwent much greater wear than UC ($p \leq 0.05$) for all 4 PTBs and both dentifrices.
2. There were relatively minor differences among individual PTBs ($p > 0.05$ for most comparisons).
3. Relatively minor differences occurred between mild and abrasive dentifrices ($p > 0.05$ for most comparisons).

## Abbreviations:

power toothbrushes (PTBs), manual toothbrushes (MTBs), Colgate-Total (CT), Close-Up (CU), zinc phosphate (ZP), resin-composite (UC).

## Trade Names:

Crest Spinbrush, Colgate Actibrush, Oral-B Professional Care, Sonicare Elite, Fleck's Mizzy Zinc Phosphate Cement, 3M-ESPE Unicem resin-composite cement, Colgate-Total, Close-Up, ProCad ceramic blocks.

## Notes

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## References

1. Conforti NJ, Chaves ES, Liebman J, Bowman JP, Warren PR, Cugini M. A comparative 3-month clinical investigation of the safety and efficacy of a battery-operated and a rechargeable oscillating-rotating power toothbrush. Am J Dent. 2001;14: 59-62.
2. Putt MS, Milleman JL, Davidson JR, Kleber CJ, Cugini M. A split-mouth comparison of a three-dimensional-action electric toothbrush and a high-frequency electric toothbrush for reducing plaque and gingivitis. J Int Acad Periodontol. 2001. Oct;3(4): 95-103.
3. Bader HI, Boyd RL. Comparative efficacy of a rotary and a sonic powered toothbrush on improving gingival health in treated adult periodontitis patients. Am J Dent. 1999;12: 143-147.
4. Hefti AF, Stone C. Power toothbrushes, gender, and dentin hypersensitivity. Clin Oral Invest. 2000;4: 91-97.
5. Sorensen J, Nguyen H. Evaluation of toothbrush-induced dentin substrate wear using an in vitro ridged-configuration model.. Am J Dent. 2002;15: 26B-32B.
6. Schemehorn BR, Zwart AC. The dentin abrasivity potential of a new electric toothbrush. Am J Dent. 1996;9: S19-S20.
7. Hansen PA, Woolsey G, Killoy WJ, Hanson C. Effect of brushing with sonic and couterrotational toothbrushes on the bond strength of full veneer crowns.. J Prosthet Dent. 1998;80: 429-433.
8. McDaniel TF, Browning WD, Dickinson G. Effects of sonic toothbrush use on permanent dental luting cements. Gen Dent. 2001;1: 90-93.

9. Hansen PA, Woolsey G, Killoy WJ, Hanson C. Effect of brushing with sonic and counterrotational toothbrushed on the strength of full veneer crowns. J Prosthet Dent. 2002;80: 429-433.
10. Gheewalla E, Perry R, Kugel G. Effects of three electric toothbrushes on orthodontic bracket retention. J Clin Orthod. 2002;36: 85-87.
11. Buchalla W, Attin T, Hellwig E. Brushing abrasion of luting cements under neutral and acid conditions. Oper Dent. 2000;25: 482-487.
12. Shinkai K, Suzuki S, Katoh Y. Effect of filler size on wear resistance of resin cement. Odontology. 2001;89: 41-44.
13. Baker K. Continuing Education Seminar; 1999.
14. Bayne SC. Continuing Education Seminar; 2003.
15. Bayne SC, Taylor DF, Heymann HO. Protection hypothesis for composite wear. Dent Mater. 1992;8: 305-309.
16. Heymann HO, Bayne SC, Sturdevant JR, Wilder AD, Roberson TM. The clinical performance of cad-cam-generated ceramic inlays. JADA. 1996;127: 1171-1181.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Sampling Water from Chemically Cleaned Dental Units with Detachable Power Scalers

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***Purpose. This study's purpose was to determine the effect chemical cleaning had on the microbial quality of water emitted from dental unit waterlines (DUWL), 3-way syringes, and power scalers.***

***Methods. Ten randomly selected dental units with attached self-contained independent water reservoirs filled with deionized water were used. An ultrasonic scaler was paired with each of the ten units. This combination was retained for the duration of the study. Water samples were collected at the beginning of the fall semester and again after two weeks. Analysis indicated unacceptable levels of microorganisms and the need for a shock treatment, which included cleanings on 3 consecutive days. Water samples were collected following the initial shock treatment and for the following 4 weeks. Weekly cleanings were performed as part of routine equipment maintenance. Water specimens from the 3-way syringes and scaler handpieces were spiral plated on R2A agar plates. Incubation was at room temperature for 7 days. Plates were examined and the number of colony-forming units per milliliter (CFU/mL) was determined for each specimen.***

***Results. The first sampling showed that none of the 3-way syringes and one of the power scalers produced potable water after sitting unused for 6 weeks and receiving only one chemical cleaning. Improvement was noted after the second cleaning with specimens from 8 units having bacterial levels <500 CFU/mL. Three power scalers emitted potable water. Improvements in the bacterial levels of the power scalers were noted following the shock treatment; all of the power scalers emitted potable water.***

***Conclusions. Practitioners should routinely treat dental units and power scalers with products that will maintain acceptable microbial water quality. Administration of a shock treatment may be necessary prior to beginning a weekly maintenance protocol. Shock treatments are beneficial if units or power scalers have not been used for an extended period of time.***

**Keywords:** biofilm, ultrasonic scalers, waterline cleaners, waterlines

## Introduction

Dentistry is unique because it is the only health care discipline that routinely uses tap water in the treatment of patients. In most cases, the water used comes from municipal utilities or from private wells. Water moves throughout the office with some going directly into the dental units and then onto and through high-speed handpieces, 3-way (air-water) syringes, and power scalers, employing a system of very thin plastic tubing. The water then enters patients' oral cavities and can become aerosolized or become part of spatter, which could place practitioners at risk for occupational exposure.[1-4]

The goal of infection control in dentistry is to reduce or eliminate exposure of patients and dental team members to microorganisms. Potential pathogens usually can come from patients and practitioners. Another source, however, could be from the environment, such as air or water.[1-3]

Dental unit water lines (DUWL) contain relatively small amounts of water, much of which is in continuous contact with the inner surfaces of the tubing. The water is not in constant motion with extended dormant periods. Movement of water varies with greatest flow being in the middle of the tubing. DUWL readily become colonized by a variety of microorganisms, including bacteria, viruses, and protozoa.[1-3]

Water entering dental units usually contains few microorganisms. However, water coming out of the unit is often highly contaminated. Proliferation of microorganisms occurs within biofilms that adhere to internal surfaces of DUWL. These microorganisms exist in 2 forms - sessile and planktonic. Sessile organisms adhere to surfaces, while planktonic microbes are present within water. Planktonic microbes are shed into the water from the adhering, sessile biofilm organisms.[1-3]

Biofilm organisms adhere because of cell surface polymers, many of which are highly hydrated exopolysaccharides commonly referred to as glycocalyx polymers. These polymers give biofilm its slimy nature. The glycocalyx provides protection and nutrition and affords a site for microbial multiplication.[1-3]

Although human oral microorganisms have been found in DUWL, the vast majority present are waterborne forms. Most waterborne organisms are of low pathogenicity or are opportunistic pathogens causing harmful infections only under special conditions or among immunocompromised individuals. Microorganisms of greatest concern are the species of *Pseudomonas*, *Legionella*, and *Mycobacterium*.[1-5]

Biofilms form quickly and serve as continuous sources of contamination for DUWL water. Flushing of lines will temporarily reduce microbial emissions, but does not remove biofilm. Use of sterile water will not reduce the level of microorganisms released. The only remedy is to effectively remove the biofilms through the application of certain chemicals. Routine use of additional chemicals will help retard biofilm development.[1-3,19]

There is no evidence that indicates any widespread public health problem from exposure to DUWL emissions.[1] However, sources of microbes causing low levels of infectious diseases are not always identified. The presence of microorganisms in DUWL water is of concern and is contrary to the goals of infection control. Because exposure to microorganisms can cause infections, it is the responsibility of dental health care practitioners to use water that has the lowest level of microbial contamination.[3]

## Review of the Literature

The first report of microbial contamination of dental unit waterlines (DUWL) occurred in 1963.[6] Numerous publications have since confirmed these findings.[7-11] Most DUWL are narrow- bore plastic tubing, which carry water to handpieces, power scalers, and 3-way (air-water) syringes. These lines readily become colonized with microorganisms, which can include bacteria, fungi, and protozoa.[1-5, 11-15]

There have been numerous reports of waterborne infection involving hospital settings as well as in the community.[1,5] The most common scenarios involved direct contact with water or exposure to residual waterborne contamination of inadequately

reprocessed medical instruments. Inhalation of contaminated aerosols has also caused infections. The majority of outbreaks have involved *Legionella* and *Pseudomonas*, but the fungus *Cladosporium* has also been implicated.

Research has not indicated a measurable risk concerning adverse health effects among dental personnel or patients and exposure to dental water. There has been only one case reported in the dental literature suggesting a link between exposure to DUWL water containing *Pseudomonas aeruginosa* and localized infection in 2 immunocompromised patients. Transient carriage was noted in 78 healthy patients similarly exposed, but without any reports of illness.[7]

Research has demonstrated microbial counts above 200 000 CFU/mL within 5 days after installation of new dental unit waterlines.[16] Counts in the millions can occur. Contact could be via direct exposure of tissues or through ingestion. Much of the water used in dentistry becomes a spray, which readily becomes aerosolized.[1,5]

Although there has not been evidence of a public health problem, the presence of a large number of microorganisms in DUWL emissions causes concern. Also, it is inconsistent with accepted infection control principles.[1] Standards for drinking water quality in the United States are established by the Environmental Protection Agency (EPA), the American Public Health Association, and the American Water Works Association.[17,18] These groups have set a limit for heterotrophic bacteria at ≤500 CFU/mL in drinking (potable) water. The Centers for Disease Control and Prevention (CDC) recommends this level of bacteria as a maximum in water used as a coolant or irrigant for nonsurgical dental procedures.[1]

Some have investigated the effects of drying dental unit waterlines as a means of reduction in bacterial loads found in the dental unit water. However, results have concluded that this technique did not reduce the counts of bacteria in the water samples any more than in the control groups.[19]

For many years, the CDC recommended flushing DUWL to reduce microbial emissions.[1] However, research has demonstrated that flushing does not remove biofilms, nor does it permanently improve the quality of water used clinically.[1-5]

Because flushing cannot achieve the recommended value of ≤500 CFU/mL over extended periods of time, other interventions must be used. One method is the use of in-line micropore fil-ters, which are often positioned near the handpiece or 3-way syringe connection. There is evi-dence that some filters can produce potable water. However, there are concerns because they have no effect on biofilms present in DUWL, often require chemical or UV treatment of filtered water, and can be expensive and may need to be replaced daily or weekly. Also, it is not easy to determine when a filter loses its capacity.[1-5]

Self-contained, independent water systems (attached bottles) isolate the dental unit from municipal water. The quality of the water used can be better controlled and chemicals can be introduced into the DUWL to remove biofilms or retard its formation. Using independent water systems (even if using sterile water) without chemical treatments cannot reliably improve water quality for extended times. Such delivery systems must be maintained properly in order to achieve maximum benefit.[1-5]

Chemicals can be passed through DUWL either through a self-contained reservoir or by a metering device. The dosage and frequency of chemical use varies greatly by product. Experimentation indicates that when used correctly, chemicals can remove/neutralize biofilm and/or prevent biofilm formation. Using chemicals is time consuming and often involves purging of DUWL after use. Regimens must be strictly followed. Chemicals must be compatible with the dental unit components and various dental materials being placed using treated water.[1-5]

Studies conducted using power scalers have confirmed the use of phosphate-buffered chlorine dioxide mouthrinses as possible choices of disinfectants for waterlines and in reducing the level of biofilms as compared to water rinsing and drying methods. While reduction has been shown within recommended CDC guidelines, complete elimination of biofilm has not been accomplished.[20]

This study's purpose was to determine the effect commercially prepared disinfectant cleaning of dental unit waterlines (DUWL) had on the microbial quality of water emitted from 3-way syringes and power scalers.

## Methods

### *Dental Units*

Ten dental units were randomly selected within the Dental Hygiene Clinic at Indiana University School of Dentistry for sampling. All units were identical (A-dec, Excellence Model, Newberg, Ore) with attached, self-contained water systems (independent water reservoirs). The units had been in service for 4 years. A single, central air compressor supplied all units. Bottles were changed daily. The deionized water used came from a single source.

Cleaning of DUWL occurred at the end of the work day on Thursdays. The DUWL cleaning agent used was Sterilex (Sterilex Corporation, Owing Mills, Md), which is an alkaline peroxide- based product with a phase transfer technology. The liquid chemical stayed in the DUWL until the beginning of the next working day when the lines were purged.

### *Power Scalers*

Two types of power scalers (Cavitron Select SPS and Model Y, Dentsply International, York, Pa) were used. The scalers are attached to any unit in the Clinic when needed. Otherwise they were held in storage. Prior to the start of this study, the scalers had never undergone cleaning with Sterilex.

### *DUWL Cleaning Schedule*

The Dental Hygiene Clinic closes each summer for 6 weeks during which time there is no chemical cleaning of the water lines. When students are present, the dental units are cleaned on a weekly basis. However, at that time cleaning did not include the power scalers. For purposes of this study, 5 Denstsply Cavitron Select SPS (Type I) and 5 Dentsply Model Y (Type II) power scalers (See figure 1) were attached and the unit and scaler pairs were cleaned together. The unit-scaler combinations were retained for the duration of the study. (See figure 2) Water sampling of 3-way syringes and power scaler handpiece lines were performed within 3 working days after the first 2 cleanings.

Figure 1: Cavitron Units

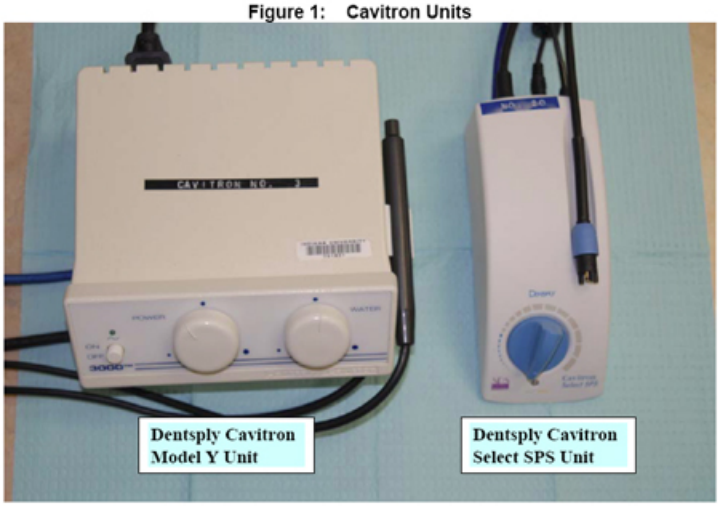

**Figure 2: Example of paired Cavitron unit and water bottle**

Results indicated unacceptably high levels of microorganisms and a need for a "shock treatment." This involved Sterilex applications for 3 consecutive nights to the units with the power scalers attached. Weekly Sterilex treatments were then resumed.

### *DUWL Sampling*

Neither sterile Cavitron ultrasonic inserts nor 3-way air water syringe tips were present when collecting water samples. First, 50 mL of water from the 3-way syringe and power scaler handpiece were collected and discarded. Then, 10 mL of water from the 3-way syringes and power scalers were added to sterile polypropylene conical tubes (Falcon 15 mL, Becton Dickinson, Franklin Lakes, NJ). Similar specimens were obtained from 3 unopened bottles containing deionized water to be used on the Clinic's units. Specimens were immediately transferred to a microbiology laboratory for processing.

### *DUWL Specimen Processing*

One tenth of a milliliter of filter-sterilized sodium thiosulfate (1.0% w/v) was added to each tube to neutralize any possible residual chlorine, thus reducing the possibility of a bacteriostatic (carry-over) effect.

Specimens were plated in duplicate using a Spiral Platter (Spiral Systems, Inc., Cincinnati, Ohio) onto R2A agar plates (Difco Laboratories, Detroit, Mich). R2A medium was developed to monitor heterotrophic bacterial populations in water treatment processes and in distribution water. Plates were incubated aerobically at 21°C for 7 days.

Following incubation, numbers of colonies on each plate were counted with the aid of an illuminated box (Spiral Systems, Inc.) and expressed as colony-forming units per mL (CFU/mL) of original specimen.

## Result

Table I reports bacterial levels in water specimens obtained the first 2 weeks after the beginning of the fall semester. Weekly cleanings of the units with power scalers attached were performed.

**Table I. Growth of Bacteria of R2A* Medium Prior to Shock Treatment**

** Agar Plate Medium*

| Testing Combinations | | | | Testing Combinations | | | |
|---|---|---|---|---|---|---|---|
| Sampling 1 | | | | Sampling 2 | | | |
| Dental Unit | CFU/mL[1] | Scaler type[2] & scaler unit no. | CFU/mL | Unit | CFU/mL | Scaler type[2] & scaler unit no. | CFU/mL |
| 2 | 6320 | Type II 9 | 16,200 | 2 | 540 | Type II 9 | 12,320 |
| 3 | 4320 | Type I 19 | 4480 | 3 | 2340 | Type I 19 | 15,980 |
| 9 | 7380 | Type II 7 | 120 | 9 | 360 | Type II 7 | 15,980 |
| 10 | 3580 | Type II 2 | 9420 | 10 | 6360 | Type II 2 | 18,220 |
| 11 | 6280 | Type II 15 | 15,669 | 11 | 360 | Type II 15 | 13,880 |
| 12 | 1820 | Type I 5 | 11,300 | 12 | 40 | Type I 5 | 220 |
| 13 | 1420 | Type II 12 | 14,260 | 13 | 120 | Type II 12 | 6840 |
| 16 | 6280 | Type I 2 | 3320 | 16 | 160 | Type I 2 | 60 |
| 17 | 12,240 | Type I 14 | 3820 | 17 | 0 | Type I 14 | 0 |
| 20 | 4380 | Type I 19 | 3220 | 20 | 380 | Type I 19 | 5980 |
| **AVE** | **5402** | | **6152** | **AVE** | **1065** | | **8948** |

1CFU/mL = colony forming units per milliliter

2 Scalers: Type I = Dentsply Cavitron Select SPS ; Type II = Dentsply Model Y

Average of Supply bottles Sampling 1 = 2812 CFU/mL

Average of Supply bottle Sampling 2 = 392 CFU/mL

Water recommended for use in dentistry should contain ≤ 500 CFU/mL. In the first sampling, none of units emitted acceptable water. Levels varied widely, from 1420 CFU/mL to 12 240 CFU/mL. Only one of the power scalers produced potable water. Again, bacterial levels were quite variable. Water specimens were obtained from 3 unopened water bottles. The average of the bacterial counts for these bottles was 2812 CFU/mL. This confirmed that levels of the bacteria emitted from the units with scalers attached were unacceptably high and greatly exceeded the CDC's recommended levels.

Improvement was noted for 8 of the 10 units after the second cleaning with specimens from 8 of the 10 units having bacterial levels ≤ 500 CFU/mL (Table II). Only 3 power scalers (all SPS) emitted potable water. The average for bacterial counts for the 3 supply bottles tested was 392 CFU/mL. Table II reports bacterial counts of the units with 2 types of scalers attached following the shock treatment and the weekly cleanings. However, not all of these results were within acceptable levels according to the CDC guidelines.

Table II. Growth of Bacteria on R2A* Medium After Shock Treatment **Agar Plate Medium*

**Testing Combinations**

| Sampling 1 | | | | Sampling 2 | | | | Sampling 3 | | | | Sampling 4 | | | | Sampling 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dental Unit | CFU/mL [1] | Scaler[2] type & unit no. | CFU/mL | Dental Unit | CFU/mL | Scaler type & unit no. | CFU/mL | Dental Unit | CFU/mL | Scaler type & unit no. | CFU/mL | Dental Unit | CFU/mL | Scaler type unit no. | CFU/mL | Dental Unit | CFU/mL | Scaler type & unit no. | CFU/mL |
| 2 | 0 | Type II 9 | 0 | 2 | 0 | Type II 9 | 0 | 2 | 0 | Type II 9 | 0 | 2 | 0 | Type II 9 | 0 | 2 | 0 | Type II 9 | 0 |
| 3 | 2600 | Type I 19 | 0 | 3 | 0 | Type I 19 | 0 | 3 | 0 | Type I 19 | 0 | 3 | 160 | Type I 19 | 0 | 3 | 880 | Type I 19 | 0 |
| 9 | 0 | Type II 7 | 0 | 9 | | Type II 7 | 0 | 9 | 0 | Type II 7 | 0 | 9 | 0 | Type II 7 | 0 | 9 | 0 | Type II 7 | 0 |
| 10 | 0 | Type II 2 | 0 | 10 | 3200 | Type II 2 | 0 | 10 | 40 | Type II 2 | 0 | 10 | 0 | Type II 2 | 0 | 10 | 2500 | Type II 2 | 0 |
| 11 | 0 | Type II 15 | 0 | 11 | 0 | Type II 15 | 0 | 11 | 0 | Type II 15 | 0 | 11 | 0 | Type II 15 | 0 | 11 | 2000 | Type II 15 | 0 |
| 12 | 0 | Type I 5 | 0 | 12 | 0 | Type I 5 | 0 | 12 | 0 | Type I 5 | 60 | 12 | 0 | Type I 5 | 0 | 12 | 0 | Type I 5 | 0 |
| 13 | 0 | Type II 12 | 0 | 13 | 2000 | Type II 12 | 0 | 13 | 0 | Type II 12 | 0 | 13 | 0 | Type II 12 | 0 | 13 | 2600 | Type II 12 | 0 |
| 16 | 0 | Type I 2 | 0 | 16 | 0 | Type I 2 | 0 | 16 | 0 | Type I 2 | 20 | 16 | 0 | Type I 2 | 20 | 16 | 1200 | Type I 2 | 0 |
| 17 | 0 | Type I 14 | 0 | 17 | 0 | Type I 14 | 0 | 17 | 0 | Type I 14 | 20 | 17 | 120 | Type I 14 | 0 | 17 | 0 | Type I 14 | 0 |
| 20 | 0 | Type I 19 | 0 | 20 | 0 | Type I 19 | 0 | 20 | 0 | Type I 19 | 0 | 20 | 0 | Type I 19 | 0 | 20 | 1400 | Type I 19 | 0 |
| AVE | 260 | | 0 | AVE | 500 | | 0 | AVE | 4 | | 10 | AVE | 28 | | 2 | AVE | 1058 | | 0 |

1CFU/mL = colony forming units per milliliter

2 Scalers: Type I = Dentsply Cavitron Select SPS ; Type II = Dentsply Model Y

## Discussion

This study set out to investigate the prevalence of microbial contaminations within ultrasonic scaling units and air-water syringe waterlines and methods by which control of these contaminations may be accomplished and maintained. Based on our results, we have demonstrated that levels of microorganisms from the ultrasonic units' waterlines remain high and at unacceptable levels for public safety, well above the CDC Guideline of 500 CFU/mL. After shock treatment and weekly cleaning, all water specimens from both types of scalers had acceptable bacterial levels according to the guidelines. No culturable bacteria were obtained from ninety-two percent of the power scalers during the timeframe of the study. Practitioners should consider routine flushing of the ultrasonic waterlines as well as the air-water syringe waterlines with disinfectants. What remains unclear is how often the water lines should be "shocked" and how often a maintenance level of disinfectant is to be used. Although the results showed that using protocols similar to those demonstrated in the study does reduce microorganisms, the results of the collected data were mixed.

Varied results in levels of contamination were discovered at both the initial collection phases and following administration of disinfectants. Human error in collection of data and in administration of the disinfection protocol could have impacted these results. Administration of any disinfecting mechanism for the maintenance of water lines for air-water syringes and ultrasonic scalers is technique sensitive. Close adherence to recommended guidelines and schedules is critical. Additional studies may consider more clearly defined protocols for administration of disinfectants to waterlines for biofilm control. In addition, the water supply used for the closed water systems on the dental units utilized water treated by deionization and filtration. This process does not equate to sterile water. It is possible that contaminants in this source contributed to the uneven results. Further study may consider the use of sterile water for systems as an alternative to a reverse osmosis system in order to reduce biofilm. Another possible reason for the varied results may be the water bottles themselves, although they are cleaned with soap and water after each use. It is possible that the bottles are a contributing source of contamination. The opening of the bottle is small, making routine disinfection difficult. Further study may clarify this issue and propose solutions for this dilemma.

## Conclusion

Results of the study suggest that when using Sterilex as a line cleaning agent treatment for ultra sonic scalers should include administration of an initial shock treatment followed by routine weekly maintenance should be included. This practice resulted in the emission of potable water for the 4-week duration of the study. Ultra sonic water line maintenance should be an integral part of every infection control program.

## Acknowledgements

***The authors would like to thank Tuwana Ivy, clinic clerk for IUSD's Department of Dental Hygiene for her assistance during this study. The authors would also like to thank IUSD second-year dental hygiene students Erin Hudson, Samantha Judge, Casey McClain, and Leah Taylor for their efforts in completing the clinical aspects of the study.***

## Notes

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## References

1. Centers for Disease Control and Prevention . Guidelines for infection control in dental health-care settings - 2003. MMWR. 2003. 52;(RR-17): 29-32.
2. Organization for Safety and Asepsis Procedures. From Policy to Practice: OSAP's Guide to the Guidelines. Annapolis, MD: OSAP; 2004. 75-82.
3. Miller CH, Palenik CJ. Infection Control and Hazardous Materials Management for the Dental Team. (3rded). St. Louis (MO): Elsevier Mosby; 2005. 260- 275.
4. Mills SE. Waterborne pathogens and dental waterlines. Dent Clin N Am. 2003;47: 545-557.
5. Mills SE. The dental unit waterline controversy: defusing the myths, defining the solutions. J Am Dent Assoc. 2000;131: 1427-1441.
6. Blake GC. The incidence and control of bacterial infection of dental unit water lines - a possible source of cross infection. Brit Dent J. 1963;115: 413-416.
7. Martin MV. The significance of bacterial contamination of dental unit water systems. Brit Dental J. 1987;163: 152-154.
8. McEntegart MG, Clark A. Colonization of dental units by water bacteria. Brit Dent J. 1973;134: 140-142.
9. Kellet M, Holbrook WP. Bacterial contamination of dental handpieces. J Dent. 1980;8: 249-253.
10. Abel LC, Miller RL, Micik RE, Ryge G. Studies on dental aerobiology. IV. Bacterial contamination of water delivered by dental units. J Dent Res. 1971;50: 1567-1569.
11. Walker JT, Bradshaw DJ, Bennett AM, Fulford MR, Martin MV, Marsh PD. Microbial biofilm formation and contamination of dental unit water systems in general dental practice. Appl Environ Micobiol. 2000;62: 363-367.
12. Szymanska J. Evaluation of mycological contamination of dental unit waterlines. Ann Agric Environ Med. 2005;12: 153-155.
13. Mills SE, Lauderdale PW, Mayhew RB. Reduction of microbial contamination in dental units with povidone-iodine 10%. J Am Dent Assoc. 1986;113: 280-284.
14. Barbeau J, Buhler T. Biofilms augment the number of free-living amoebae in dental unit waterlines. Res Microbiol. 2001;152: 753-760.
15. Challacombe SJ, Fernandes LL. Detecting Legionella pneumophilia in water system: a comparison of various dental units. J Am Dent Assoc. 1995;126: 603-608.
16. Barbeau J, Tanguay R, Faucher E, Avezard C, Trudel L, Cote L, Prevost AP. Multiparametric analysis of waterline contamination in dental units. Appl Envirol Microbiol. 1996;62: 3954-3959.
17. US Environmental Protection Agency. National primary drinking water regulations, 1999: list of contaminants. US Environmental Protection Agency [homepage on the Internet]. Washington, DC: EPA. [cited 2006 Oct 10]. Available from: www.epa.gov/safewater/mcl.html.
18. American Public Health Association, American Water Works Association and Water Environment Foundation. . In: Eaton AD, Clesceri LS, Greenberg AE. , editors. Standard Methods for the Examination of Water and Wastewater. Washington, DC: American Public Health Association; 1999.

19. Fiehn NE, Larsen T. The effect of drying unit waterline biofilms on the bacterial load of dental unit water. Int Dent J. 2002;52(4): 251-4.
20. Wirthlin MR, Marshall GW. Evaluation of ultrasonic scaling unit waterline contamination after use of chlorine dioxide mouthrinse lavage. J Periodontol. 2001;72(3): 401-410.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Obstetricians' Knowledge and Practice Behaviors Concerning Periodontal Health and Preterm Delivery and Low Birth Weight

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***Introduction. Investigators have reported that periodontal disease may be a risk factor for pregnancy complications including preterm delivery (PTD) and low birth weight (LBW). This study assessed obstetricians' knowledge and practice behaviors concerning periodontal disease and its role in adverse pregnancy outcomes.***

***Methods. One hundred ninety four practicing obstetricians in a 5 county area in central North Carolina were surveyed. Of the 138 eligible physicians, 55 responded yielding a 40% response rate.***

***Results. Most answered correctly when asked about the description of gingivitis (95%). A lower number of respondents were correct when asked about the description of periodontitis (67%). When asked about what causes periodontal disease or what is associated with periodontal disease, most answered correctly with bacteria (94%), although many answered tooth decay (73%), aging (69%), and excess dietary sugar (51%). Most were correct in responding that periodontitis was more serious than gingivitis (80%). Twenty-two percent looked into patients' mouths at initial prenatal examination, 9% periodically, and 48% only when a problem was mentioned by the patient. Forty-nine percent rarely or never recommended a dental examination. Most (84%) considered periodontal disease to be as important a risk factor to adverse pregnancy events as those currently known in obstetrics practice.***

***Conclusions. Data from this study demonstrate that there is knowledge of periodontal disease and its potential role as a pregnancy risk factor but suggest limited incorporation of dental care into clinical medical practice.***

**Keywords:** Dental Hygiene, Physician's Knowledge, Oral Health, Low Birth Weight, Preterm Labor, Physician's Practice Behaviors, Pregnancy; Periodontitis

## Introduction

Preterm birth, low birth weight infants, and infant mortality are major health concerns in the United States and are considered leading perinatal problems in the developed world.[1] A preterm delivery (PTD) is an infant born less than 37 completed weeks gestation.[2] A low birth weight (LBW)infant is an infant born weighing less than 2500 g.[3] In 2004, of all live births,

12.5% were born premature, and 8.1% were born weighing less than 2500 g.[4] Infant mortality has decreased 18% between 1992-2002; however, it still remains high with 7 out of every 1000 infants dying before their first birthday.[4] The economic impact for these infants is estimated at $5.5 billion, annually.[5] Children born premature or LBW have an increased risk for neurodevelopmental problems, learning disabilities, and other health disparities.[6]

Potential conditions and risk factors regarding periodontal disease and PTD and LBW are being studied. Recent research suggests that periodontal disease may be an important risk factor in determining poor pregnancy outcomes.[1-3, 7-17] The purpose of this study was to assess a group of North Carolina obstetricians' knowledge of periodontal disease, their beliefs regarding periodontal disease as a potential risk factor for PTD and LBW, and whether practice behaviors reflected these beliefs. This study provides information about these obstetricians' knowledge of periodontal health and how it may relate to preterm delivery or low birth weight infants. These findings may contribute to the literature pertaining to knowledge of physicians regarding oral health and particularly periodontal health for pregnant patients.

## Review of the Literature

### *Periodontal Disease and the Immune Response*

Periodontal disease is a group of infections and conditions that cause inflammation of the gingiva and the surrounding structures, which leads to destruction of the supporting tooth structures. Periodontitis is an anaerobic infection with gram-negative bacteria that leads to the destruction of the periodontal tissue and adjacent bone. Many of the predominate organisms associated with periodontal disease are *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans*, *Treponema denticola*, *Bacteriodes forsythus*, *Fusobacterium nucleatum*, *Prevotella intermedia*, *Campylobacter rectus*, *Peptostreptococcus micros*, and *Eikenella corrodens*. The vesicles of gram-negative bacteria shed lipopolysaccharide (or endotoxin), activate the host immune response, and penetrate into gingival tissues, causing the host to secrete cytokines (Il-1 , TNF-α, Il-6), prostaglandins ($PGE_2$), and matrix metalloproteinases (MMPs). This infiltration and inflammatory response can also lead to the damage of soft tissue and bone that is seen in periodontal disease. During periodontal inflammation, bacteremias and endotoxemias occur and initiate a strong systemic antibody response due to the large surface area of the infected gingival area.[16] Host immune factors inhibit bacterial invasion and proliferation as well as cause damage to the host via prostaglandins, complement factors, cytokines, and antigen-antibody complexes.[18] In the attempt to rid the tissues of the bacterial invasion of the periodontal tissues, the host defenses contribute to the destruction of tissues locally. It has been established that in response to infection/LPS/endotoxin, endogenous host products are produced and are responsible for many effects of the infection to the body, and potentially to systemic health.

### *Initiation of Labor*

The initiation of normal labor at term involves the triggering of prostaglandin production.[19-22] The prostaglandins ripen the cervix, change membrane structure, and cause myometrial contraction.[21] Throughout the course of normal pregnancy, intraamniotic levels of $PGE_2$ and TNF-α rise steadily until a critical threshold is reached to induce labor, cervical dilation, and delivery.[22] The amniotic fluid of patients in labor contain TNF-α and IL-1 .[23] Evidence that prostaglandins participate in the mechanisms of labor in humans stems from the fact that (1) abortion and labor result from administration of prostaglandins, (2) inhibitors of prostaglandins delay the onset of labor and can arrest preterm labor, (3) elevated prostaglandins are found in amniotic fluid and maternal plasma at term deliveries, (4) prostaglandin precursors, arachidonic acid, are increased in the amnionic fluid during labor, and (5) labor results from intraamnionic administration of arachidonic acid.[19] Increased production of cytokines is associated with term as well as preterm labor.[24] Preterm labor may be a result of maternal infection before normal labor is initiated.

### *Maternal Infection and Pregnancy*

Maternal infection during pregnancy is a risk factor for infant brain damage, cerebral palsy periventricular leukoplakia, major pulmonary or bronchopulmonary dysplasia, and ultimately death.[3] Evidence of subclinical infection as a cause of PTD and LBW is demonstrated by abnormal amniotic fluid findings, and elevated maternal serum C-reactive protein (CRP) levels.[19] Maternal infections can lead to preterm premature rupture of the membranes (pPROM) and preterm labor (PTL).[25] Bacterial vaginosis (BV) is a condition where the normal balance of bacteria in the vagina is disrupted and replaced by an overgrowth of anaerobic bacterial species. BV is associated with increased risks for PTL and pPROM. Women whose genital tracts harbor gram-negative anaerobic bacteria similar to the type of gram-negative infection that causes periodontal infections are at high risk for preterm birth.[25]

Three mechanisms linking oral infections to secondary systemic effects have been proposed. They include metastatic spread of infection from the oral cavity as a result of transient bacteria, metastatic inflammation caused by immunological injury induced by oral organisms, and metastatic injury from the effects of circulating oral microbial toxins.[26-28]

*Fusobacterium nucleatum*, a common oral species, is the most frequently cultured oral species from amnionic fluid in women with preterm labor.[25] Bacterial and host secretory products activate the production of prostaglandins, leading to the onset of labor by inducing uterine contractions and cervical ripening.[29] Elevated levels of IL-6 and IL-8 have been observed in patients with preterm labor.[29-30] Maintenance of uterine activity may depend on an ongoing infection or the presence of cytokines. TNF-α production before onset of labor suggests that cytokines may play a role in the induction and persistence of labor. Inflammatory stimuli induce hyperirritability of uterine smooth muscle, enhancing contractions, cervical thinning, and cervical dilation, causing preterm labor.[8]

### *Association Between Periodontal Disease and PTL and LBW*

The hypothesis for the association between periodontal disease and PTL and LBW is that in the presence of periodontal disease, lipopolysaccharide (LPS) exposure, inflammatory mediators, and maternal cytokine production in the maternal serum places the patient at risk for poor pregnancy outcomes. Serving as a chronic reservoir of LPS, periodontal infection could target the placental membranes via the bloodstream.[7,11] Produced locally in the periodontal tissues, inflammatory mediators such as TNF-α and PGE2 can act as a potential systemic source of fetotoxic cytokines due to the high vascularity of the periodontium.7 Preterm delivery is believed to be initiated by the release of cytokines such as $PGE_2$ and TNF-α.[31] The production of maternal cytokines, TNF-α , and prostaglandins in response to the gram-negative periodontal infection effect the onset of labor by signaling to the body that it is time for delivery, regardless of the age of the fetus.32 Bacterial seeding from the oral cavity through a hematogenous route is a potential pathway of infection.

### *Periodontal Disease and PTL and LBW Research*

Much research has been conducted in the last decade and a half on the relationship between periodontal disease and adverse pregnancy events. Collins et al demonstrated that pregnant hamsters infected with *Porphyromonas gingivalis* (*P gingivalis*) could lead to adverse pregnancy outcomes.[32-34] These included decreased fetal weight, an increase in embryolethal events, and fetal malformations. Significant associations were found between increasing levels of $PGE_2$ and TNF-α , fetal growth restriction, and embryo lethality. This study demonstrated that periodontal pathogens can elicit poor pregnancy outcomes and that the levels of $PGE_2$ and TNF-α produced were associated with severity of effect on the fetus.

One study reported intravenous challenges with *Escherichia coli* and *P gingivalis* to the pregnant hamster.[34] These challenges produced embryo lethal effects on the fetus. Multiple exposures to *P gingivalis* resulted in decreased fetal weight and increased fetal mortality. Study outcomes suggested a relationship between periodontal pathogens and poor pregnancy

outcomes. These studies using the pregnant hamster model also suggested that inoculation and intravenous challenges of *P gingivalis* resulted in decreased fetal weight, fetal malformations, fetal growth restriction, and increased fetal mortality.[32,34]

In another study, Collins et al fed hamsters a plaque promoting diet and evaluated the microbial challenge from the plaque to pregnancy outcomes. This study established that periodontal infection could provide a microbial challenge sufficient to produce poor pregnancy outcomes, including growth restricition.[33]

In a landmark study, Offenbacher et al assessed the potential role of maternal periodontal infections as a risk factor for abnormal pregnancy outcomes. After controlling for other risk factors and covariates, this study demonstrated that periodontal disease was a statistically significant risk factor for preterm birth (PTB) and LBW infants and that maternal periodontal disease could lead to a 7-fold increased risk of delivering a preterm or low birth weight infant.[7]

Damare et al conducted a pilot investigation that studied the associations among the levels of $PGE_2$ in gingival crevicular fluid (GCF), serum, and amnionic fluid of women who had an amniocentesis.[9] Examiners collected periodontal health status, GCF, serum, and amnionic fluid. It was found that $PGE_2$ levels in the GCF are positively associated with amniotic fluid levels of PGE2, and therefore may be an indicator of cytokine present in the amniotic fluid.

In 1998, Dasanayake et al conducted a case control study with a hypothesis that poor oral health could be a risk factor for PTB and LBW.[35] While controlling for obstetric risk factors, they evaluated the effects of periodontal status and dental caries of the woman at the time of delivery on the birth weight of the infant. It was reported that mothers of LBW infants were more likely to be shorter and less educated, have gained less weight during their pregnancy, and had more areas of gingival bleeding and calculus accumulation. They also reported that the risk of LBW was higher in mothers who had no or late prenatal care.

Offenbacher et al studied potential pathogenic mechanisms of periodontitis- associated pregnancy complications in 1998.[11] The study was undertaken to determine if periodontal infections could provide sufficient challenge to the mother to trigger premature labor. Forty eight case-controlled subjects were measured for GCF levels, levels of $PGE_2$ and IL-1B to determine whether maternal mediator levels were related to pregnancy outcomes. The levels of 4 periodontal pathogens were measured by using DNA probes. Results demonstrated the levels of GCF-$PGE_2$ were significantly higher in PTL and LBW mothers as compared to the controls. In mothers who were pregnant for the first time and had a PTL and LBW infant, there was a significant inverse association between birth weight, gestational age, and GCF-$PGE_2$ levels. Data indicated a dose-response relationship for increasing GCF-$PGE_2$ as an indicator of current periodontal disease activity and decreasing birth weight. Results demonstrated that 4 organisms were associated with periodontitis. *Actinobacillus actinomycetemcomitans*, *Tannerella forsythia* (*Bacteriodes forsythus*), *Porphyromonas gingivalis*, and *Treponema denticola* were detected at higher levels in PTL and LBW mothers than in the controls. The results indicated that infection is a risk factor for PTL and LBW and that periodontal disease is a sufficient infectious challenge to cause PTL and LBW.

Mitchell-Lewis et al reported early data from an ongoing study examining PTL and LBW and periodontal disease in a group of young, minority, pregnant, and post-partum women that included an intervention.[36] Oral examinations were performed for decay and periodontal disease. Subgingival plaque was obtained and DNA tests performed for periodontal pathogens. Two groups were randomized to a control (did not receive treatment) and experimental group (received periodontal treatment ). After baseline data was collected, a full mouth debridement and oral hygiene instructions were provided to the patients in the experimental group. It was found that PTL and LBW mothers had greater numbers of *Tannerella forsythia* (*Bacteria forsythus*) and Campylobacter rectus and consistently higher counts of all other organisms than mothers who delivered at term. In addition, they reported that periodontal therapy during pregnancy substantially reduced PTL and LBW, although the reduction was not statistically significant due to the small sample size. Of the women who were not treated with periodontal therapy, 18.9% gave birth premature or delivered a LBW infant as compared to 13.5% who did receive treatment. Although not significant, the difference represented a reduction of 28.6%. The findings agreed with the hypothesis that a subgingival periodontal infection by gram-negative, LPS-producing species may be a factor in the pathogenesis of PTL and LBW.

Jeffcoat et al performed a large prospective study (n = 1313) that showed a significant association between PTL and LBW and periodontal disease in the second trimester of pregnancy.[37] Medical, periodontal, and behavioral assessments were made between 21 and 24 weeks gestation. Medical records were consulted after birth to determine the infants'gestational ages. While adjusting for other risk factors such as smoking, race, and maternal age, it was determined that the risk for prematurity in patients with periodontal disease was 4.5 to 7 times higher than in periodontally healthy patients. Jeffcoat et al followed this study with an intervention study of 366 women with periodontitis between 21-25 weeks gestation and found that performing scaling and root planning in pregnant women with periodontitis may reduce PTB in this population.[38]

An intervention study by Lopez et al was undertaken to examine the association between periodontal disease and PTL and LBW.[39] Two groups of women were studied during pregnancy. One group had gingivitis or mild periodontal disease and received periodontal treatment before 28 weeks' gestation, while another group with periodontal disease had no treatment. The incidence of PTL and LBW was 8.6% in women with periodontal disease as opposed to 2.5% in women with no periodontal disease. The incidence of preterm birth was 1.5% in periodontally healthy women and 5.2% in women with periodontal disease. The incidence of LBW was 1.0% in periodontally healthy women versus 3.4% in women with periodontal disease. Periodontal disease was deemed a significant risk factor for prematurity and LBW and was associated with both, independent of other risk factors.

The Oral Conditions and Pregnancy (OCAP) study was a 5-year prospective cohort investigation by Offenbacher et al that demonstrated that periodontal disease is an independent risk factor for PTL and LBW.[8] Full mouth periodontal examinations were performed at enrollment (prior to 26 weeks gestational age) and again within 48 hours postpartum in order to assess changes in periodontal status during pregnancy. The prevalence of prematurity was greater in mothers with periodontal disease when compared to mothers with healthy periodontium, P=0.017. The findings demonstrated that periodontal disease or disease progression had significant effects on gestational age and birth weight. The study also demonstrated that mothers with the most severe periodontal disease had the smallest infants and that maternal infection may impair fetal growth and promote prematurity. Finally, the authors suggested that periodontal disease is a significant risk factor for poor pregnancy outcomes and may be as important as other known risk factors such as smoking, alcohol, or genitourinary tract infections.

Madianos et al evaluated the maternal and fetal antibody response to periodontal organisms.[12] Maternal serum samples were assayed for IgG antibody levels against 15 periodontal organisms using the checkerboard immunoblotting technique. Positive reactions were detected by Western Blot. Fetal exposure of the fetus to periodontal organisms was indicated by the high amount of antibody seropositivity to oral organisms. There was a 2.9-fold increase of IgM seropositivity among PTL and LBW infants as compared to infants delivered at term. The study found that a hematogenous spread of infection leading to fetal exposure was a major pathogenic mechanism of periodontitis-associated prematurity. As evidenced by the presence of IgM antibody against periodontal pathogens in cord blood, it was concluded that oral organisms can present an antigenic challenge to the fetus and that this IgM seropositivity was much greater in preterm births. The data from this study provides initial evidence that specific oral pathogens may be important in maternal periodontal infections leading to PTL and LBW.

### *Physicians' Knowledge and Practice Behaviors Regarding Oral Health*

Although many studies have been conducted to investigate the link between periodontal disease and PTB/LBW, little is known about the practice implications of this potential relationship to patient care. How do physicians view this area of research and are they using it to counsel their pregnant patients?

Several studies have been performed to determine physicians' knowledge and practice behaviors regarding oral health care. In a study by Lewis et al, half of the physicians reported that they had no training in medical school or residency regarding oral health.[40] In addition, only 9% had current knowledge regarding oral or periodontal health, as evaluated by a questionnaire.[40-42]

Physicians have reported that they are not sufficiently trained to perform a dental examination on their patients. In a national survey by Lewis et al, 90% of the pediatricians felt that they had an important role in identifying dental problems and teaching prevention to families. Interestingly, half of them reported that they had no training in medical school or residency

regarding dental issues.[40] McCundiff et al reported that only 7% of primary care physicians performed an examination for oropharyngeal cancer on their patients, and that their knowledge in this area needed to be more current.[41] Yellowitz et al found that 82% of physicians never completed a routine oral cancer examination on most of their patients.[42] Pediatricians have reported that they are not educated about dental health, even though they are the first health professional to consult with expectant parents and examine infants.[43] In a study that assessed the knowledge, attitudes, and beliefs of pediatricians and family practice physicians toward pediatric preventive care, Sanchez et al demonstrated that both groups recognized that they receive inadequate training about pediatric dental care during medical school and residency.[44] Of these physicians, only a few provided their patients with oral health education during the prenatal period. According to a 1992 publication by Wender et al, pediatricians' education about oral health has not changed in 20 years.[45]

Only one study to date has been performed that surveyed obstetricians regarding oral evaluations performed during prenatal examinations and referrals of their patients to dentists.[46] The purpose of the study was to investigate if obstetricians perform oral examinations; if they consult with patients' dentists regarding oral health; and, whether there was interest in attending dental continuing education to learn more about oral health. Almost half of the obstetricians (46.8%) indicated that they never had the time to perform an oral examination. When an examination was made, the posterior pharynx was examined each time by 46% of the obstetricians , the gums were examined by 24%, and the teeth by 30%. Forty-five percent of the obstetricians reported that 1 to 5 referrals to dentists were made in a year. Seventy-eight percent were interested in continuing education regarding periodontal infection and PTL and LBW. It was concluded that there was need and interest in this group of obstetricians in obtaining new information regarding periodontal disease and PTL and LBW.

Since so little is known about obstetricians and their performance of dental examinations and referrals of patients to dentists during pregnancy, the current study was deemed essential to add to the body of knowledge regarding obstetricians' practice behaviors and knowledge of periodontal disease and pregnancy outcomes.

## Methods

This study was an observational study, utilizing a descriptive study design. A survey was drafted and pilot tested at the University of North Carolina School of Dentistry for validity and reliability. Revisions were made and the survey was pilot tested twice at the Department of Maternal and Fetal Medicine at the University of North Carolina School of Medicine. Additional revisions were made to the survey. The project was approved by the Investigational Review Board at the University of North Carolina School of Dentistry. Surveys were sent to 194 practicing obstetricians in North Carolina, from Alamance (N=5), Durham (N=27), Guilford (N= 39), Orange (N=34), and Wake (N=89) counties. The targeted area in central North Carolina included 3 teaching hospitals. The study sample included all obstetricians in private practice, teaching, and community hospitals and clinics in the geographic area. Obstetricians were selected from directory and phone listings from the designated areas.

Survey questions were designed to include demographic variables, knowledge variables, attitudinal variables, and practice behavior variables. The survey design consisted of 20 multiple-choice questions. Some questions could be answered with more than one response, and therefore were not mutually exclusive. Likert scales were used to assess views on risk factors and practice behavior.

Three mailings were conducted over the course of 3 months between 2002-2003. Data were entered into an Excel database. Descriptive statistics, Chi Square and Fisher's Exact tests were calculated using SAS software (Cary, North Carolina, USA).

## Results

Of the 194 surveys sent, 55 obstetricians were ineligible due to retirement, no longer practicing obstetrics, or no longer in the study area. Of the remaining 139 eligible obstetricians, 55 responded with complete data yielding a 40% response rate.

Sixty-six percent were male, the mean age was 46 years, most worked in private practice, and 44% had been practicing for more than 15 years. One third instructed medical students, residents, nursing students, and physicians' assistant students (Table 1). About 42% treated more than 80 prenatal patients per week.

**Table 1. Demographic and Professional Characteristics of Survey Respondents (N=55)**

| | N(%) |
|---|---|
| Gender | |
| Male | 36 (66%) |
| Female | 19 (34%) |
| Age | |
| Mean | 46 years |
| Range | 31-69 years |
| SD | |
| Practice Setting | |
| Group private practice | 44 (78%) |
| University based practice | 13 (23%) |
| Solo Private practice | 2 ( 3%) |
| Obstetric Clinic | 2 ( 3%) |
| *More than one response given by some respondents | |
| Instruct Students | |
| Residents | 22 (39%) |
| Medical Students | 18 (32%) |
| Nursing Students | 9 (16%) |
| PA Students | 12 (21%) |
| Number of Years in Practice | |
| < One Year | 0 |
| 1-5 Years | 8 (15%) |
| 6-10 Years | 9 (16%) |
| 11-15 Years | 14 (24%) |
| > 15 Years | 24 (44%) |

Table 2 reports the respondents' personal experience with dentistry and their knowledge about gingivitis and periodontitis. Most (69%) were current with regular dental checkups (69%) and only 20% had been told that they had periodontal disease. Regarding knowledge about gingivitis, the majority answered that it was a reversible infection (66%) with reversible redness and swelling (83%). When asked about periodontitis, 76% answered that it was a reversible infection and 32% thought it involved tooth decay. Eighty percent knew that periodontitis was more serious than gingivitis. When asked what causes periodontal disease, 94% indicated bacteria, 73% tooth decay, 69% aging, and 51% answered that excess sugar were possible indicators for the condition.

**Table 2. Respondents' Personal Experience and Views of Oral Health (N=55)**

| | N (%) |
|---|---|
| Last seen by dentist | |
| within last 6 months | 38 (69%) |
| 6 months - 1 year | 8 (15%) |
| 1-2 years | 6 (11%) |
| >2 years | 3 (5%) |
| Last dental exam to assess gingival health | |
| within last 6 months | 38 (69%) |
| 6 months – 1 year | 8 (15%) |
| 1-2 years | 6 (11%) |
| > 2 years | 3 (5%) |
| Have you ever been told that you have Periodontal Disease | |
| Yes | 11 (20%) |
| No | 44 (80%) |
| *Which of the Following cause/are related to periodontal disease? | |
| Excess sugar | 29 (51%) |
| Bacteria | 52 (94%) |
| Tooth decay | 41 (73%) |
| Aging | 39 (69%) |
| *Which of the following describes gingivitis? | |
| Tooth decay | 3 (5%) |
| Potentially reversible infection of the gums | 37 (66%) |
| Reversible redness and/or swelling of the gums | 47 (83%) |
| Lesions on the tongue | 0 ( 0%) |
| *Which of the following describes periodontitis? | |
| Tooth decay | 18 (32%) |
| Potentially reversible infection of the gums | 43 (76%) |
| Lesions on the tongue | 1 (1%) |
| Which condition is more serious? | |
| Gingivitis | 11 (20%) |
| Periodontitis | 44 (80%) |

*Respondents were allowed to check more than one

Table 3 reports the respondents' knowledge of the relationship between pregnancy and oral health. Forty-seven percent felt that excess decay definitely or may worsen during pregnancy. Ninety-one percent answered that swelling of the gums definitely or may worsen during pregnancy and 98% answered that bleeding gums occurs or worsens during pregnancy. Regarding tooth loss during pregnancy, 53% answered that it probably doesn't or definitely doesn't occur during pregnancy and 28% answered that it may or definitely occurs. Regarding pregnancy risk factors and PTD and LBW, most (98%) regarded maternal smoking as the highest risk factor followed by preeclampsia (94%), periodontal disease (84%), and bacterial vaginosis (79%) (Figure 1). When asked about issues related to periodontal disease such as decay, swollen gums, bleeding gums, and tooth loss, younger female obstetricians that worked in a University-based practice answered with more accuracy (Table 4).

**Figure 1.**

**RESPONDENTS' ANSWERS TO VIEWS REGARDING RISK FACTORS FOR PTL and LBW**

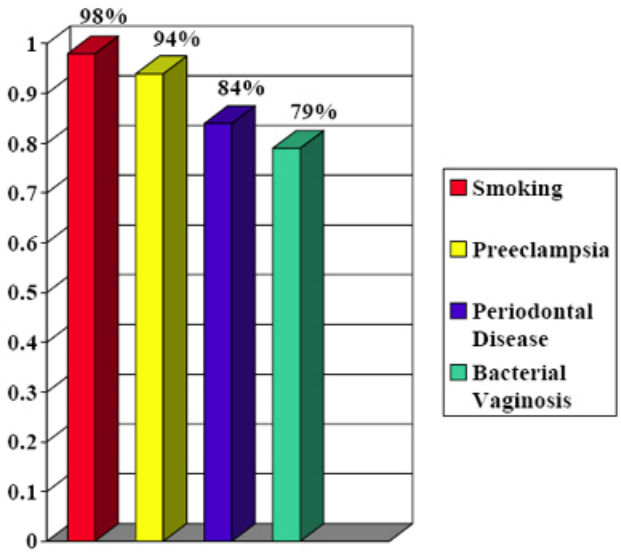



**Table 3. Respondents' Knowledge of the Relationship Between Pregnancy and Oral Health**

| | Definitely Occurs | May Occur | Uncertain | Probably Does Not Occur | Definitely Does Not Occur |
|---|---|---|---|---|---|
| | N (%) | N (%) | N (%) | N(%) | N (%) |
| How certain are you that excess decay occurs or worsens during pregnancy? | 3 (5%) | 23 (42%) | 9 (16%) | 17 (31%) | 3 (5%) |
| How certain are you that swollen gums occurs or worsens during pregnancy? | 22 (40%) | 28 (51%) | 3 ( 5%) | 2 ( 4%) | 0 ( 0%) |
| How certain are you that bleeding gums occurs or worsens during pregnancy? | 28 (52%) | 25 (46%) | 1 (2%) | 0 ( 0%) | 0 ( 0%) |
| How certain are you that tooth loss occurs or worsens during pregnancy? | 2 ( 3%) | 13 (25%) | 10 (19%) | 20 (38%) | 8 (15%) |

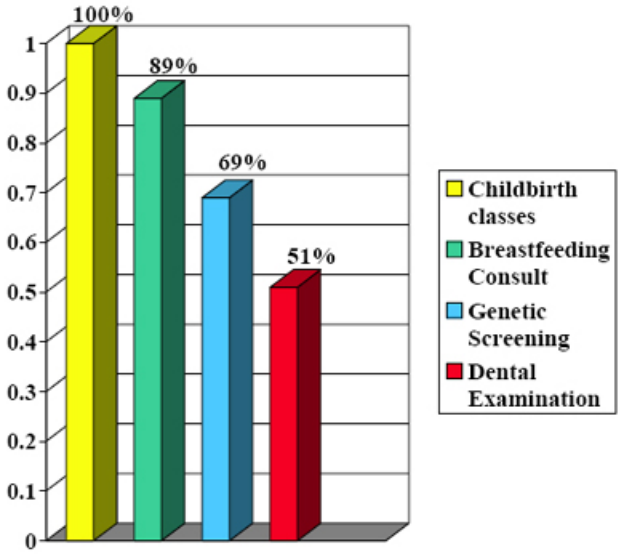
**Table 4. Knowledge of Cause of Issues Related to Periodontal Disease By Practice Setting, Gender and Length of Time in Practice**

| | N | Correct (%) N (%) | Incorrect N (%) |
|---|---|---|---|
| Gender: | | | |
| Male | 37 | 2 ( 5%) | 35 (95%) |
| Female | 18 | 1 ( 6%) | 17 (94%) |
| *Setting: | | | |
| Private Practice | 45 | 2 ( 5%) | 43 (95%) |
| University | 13 | 2 (15%) | 11 (85%) |
| Length of time in Practice: | | | |
| ≤ 10 years | 17 | 2 (12%) | 15 (88%) |
| > 10 years | 38 | 1 ( 3%) | 37 (97%) |

The obstetricians in the study recommended childbirth classes (100%), breastfeeding consultations (89%), and genetic screening (69%), while only 51% recommended dental exams during pregnancy (Figure 2). Regarding recommendations for dental examinations, those in private practice were similar to those in University settings.

**Figure 2.**

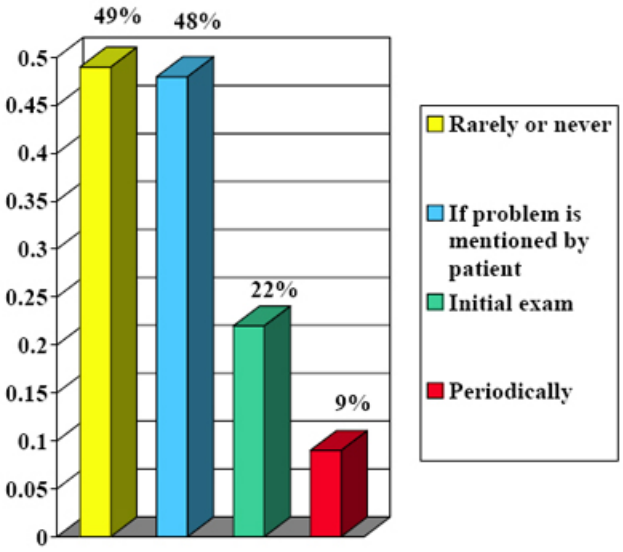
**RESPONDENTS' ANSWERS TO QUESTIONS REGARDING RECOMMENDATIONS TO PATIENTS**




When the obstetricians looked into patients' mouths, 22% did so at the initial prenatal examination, and 49% rarely or never looked (Figure 3). For those in private practice and in a University setting, both groups looked into patients' mouths (55% and 39%, respectively) only when a problem was mentioned by the patient. More obstetricians who had been practicing for more than 10 years (33%) looked into patients' mouths at the initial visit, and more obstetricians who had been practicing for less than 10 years (59%) looked into patients' mouths only when a problem was mentioned by the patient.

**Figure 3**

**VISUAL DENTAL EXAMS PERFORMED BY RESPONDENTS**




## Discussion

Since little is currently known in the literature about provider knowledge of periodontal disease and PTL and LBW, it was most appropriate to utilize the survey approach for this investigation. There were no previous measures of knowledge of this topic in this population. Although family practice physicians, nurse practitioners, physicians' assistants, and midwives also provide prenatal care to North Carolina women, a decision was made to include obstetricians for 2 reasons. Obstetricians provide the majority of prenatal care in North Carolina. They are trained differently and practice in settings that differ from other prenatal care providers, thereby preventing confounded study results. The 5 counties included in the study are diverse in their demographic makeup and proximity to major medical centers and therefore provide a good study population.

There was an adequate number of obstetricians identified in the geographical area allowing for an appropriate sample size. A high response rate is desirable in order to decrease nonresponse bias. A response rate higher than 40% was anticipated from this group. Historically, physicians' response rates to questionnaires have varied substantially.[47-48] Van Guest Cartwright investigated physician response rates in over 19 professional study samples and found response rates for professionals to range from 56% to 99%.47 There was only a 21.8% response to a similar study in West Virginia that surveyed obstetricians regarding oral evaluations performed and referrals of their patients to dentists.[46]

It is important to note that a sample such as this group may not be representative of obstetric providers everywhere, thus limiting the external validity. Nonresponse bias is a consideration in research. In this study, an analysis utilizing Chi Square and Fisher's Exact tests showed that differences and patterns of response between the respondents and nonrespondents were not extreme enough to be statistically different. The gender and county of the respondents and nonrespondents were very similar. There were no differences in respondents vs. nonrespondents with respect to urban areas vs rural areas. According to the US Census Bureau's definition of an Metropolitain Statistical Area (MSA) by county population, all 5 counties were defined as cosmopolitan areas.[49]

A high number correctly associated periodontal disease with bacteria, yet erroneously believed that tooth decay, aging, and excess sugar were also associated. This indicated that there is awareness of the cause of periodontal disease but the information that they have may not be totally accurate. The respondents had knowledge of gingivitis, yet 76% thought

that periodontitis is reversible. Those answering most questions correctly regarding gingivitis were those in private practice, female, and had been in practice for more than 10 years. Those answering most questions correctly regarding periodontitis were those in private practice, female, and had been in practice for less than 10 years. It is interesting to note that those in private practice were more accurate in their responses than those in academia. As shown by the responses, periodontal disease was considered a potential risk factor in obstetrics.

Regarding practice behaviors and recommending consultations, all recommend childbirth classes, most recommend lactation consultations, nutrition consultations, and genetic screening, yet only 51% recommend a dental examination. Less than 22% look into patients' mouths at the initial prenatal visit, 10% periodically, and 54% only when a problem is mentioned by the patient. Previous investigators have suggested that physicians may not look into patients' mouths due to lack of training.[40,43-45,50] One study reported that one half of the physicians surveyed had no training on oral examinations during medical school or residency.[40] Physicians may feel insecure in their knowledge about oral conditions. With time constraints on physicians, this may result in oral health being a minor aspect of care.[41] In one study of obstetricians, it was indicated that they never had time to perform a dental examination.[46]

Regarding risk factors related to PTL and LBW, smoking, preeclampsia, and bacterial vaginosis and periodontal disease were all cited as risk factors for PTL and LBW by over 75% of the participants. Smoking, preeclampsia, and bacterial vaginosis are commonly known obstetrics risk factors. In this study, periodontal disease was regarded as a greater risk factor than bacterial vaginosis. This could be due to the fact that the use of antibiotics in patients with bacterial vaginosis has decreased the risk of preterm low weight births.[51]

The concept of "periodontal medicine" has recently emerged to address dental health and its connection with systemic diseases. It refers to a new field of investigation that may have a dramatic effect on dentistry.[52] It is based on the emerging data that suggests that periodontal disease contributes to the morbidity and mortality of individuals with systemic diseases such as premature delivery, diabetes, atherosclerosis, stroke, and myocardial infarction.[52] According to the Surgeon General's Report, changes in education need to take place to incorporate this concept.[53-54] Many medical professionals do not have knowledge of periodontal disease and the potential infection that may exist in the oral cavity. Dental and medical school curricula should include a greater emphasis on systemic medicine and how to integrate this research information into clinical applications.[55] Patients need education in the prevention of disease and the relationship between oral disease and systemic health just as they need education in the control of diabetes, smoking cessation, weight reduction, and lowering of cholesterol. Continuing education for health professionals about the oral health-systemic health relationship is essential, and optimizing communication and collaboration between dental and medical professionals will be beneficial for patients.

Since this study was conducted, a paper has been published describing an oral health curriculum for medical students at the University of Washington.[55] Prior to the development of the curriculum, a pilot study of 229 medical students a the University of Washington revealed a generally positive attitude about the importance of oral health training but low student knowledge of caries, oral-systemic interactions, and oral health disparities across all training years. Their estimation was that medical students received about 2 hours of oral health related education across the 4 years of medical school. Their curriculum will incorporate 5 key oral health themes including oral-systemic health interactions and periodontal disease.

The research on PTL and LBW is nonconclusive. Since this study was conducted, studies have been published that have found an association between periodontal disease and PTL and LBW. [56-57] Others have looked at the impact of interventions in decreasing the incidence of PTL and LBW.[58-60] Two studies have found no association between periodontitis and adverse pregnancy outcomes.[61-62] Future studies may conclude whether there is a direct relationship. Regardless, this area of investigation has raised the consciousness about the importance of oral health. For example, insurers such as Cigna and Aetna have expanded dental coverage offerings for enrollees who might benefit from additional treatment. These insurers include pregnant women and people with cardiac disease. The increased coverage will include such services as an additional third scaling per year (including scaling and root planing).[63]

In the future, policies can be developed that improve the communication of good oral health care practices between physicians and dental hygienists, dentists, patients, and other health care providers. Formal education strategies will be

needed in medical and dental school curriculums regarding the association between oral health and systemic health for practitioners to be able to fully understand the health consequences of an untreated oral infection. In addition, a higher level of education in this area will be needed for dental hygienists, advance nurse practitioners, registered nurses, and others who come into frequent contact with patients. Improved communication between practitioners will become vital as increased knowledge is gained in this important area of health care.

Further investigation in this area is planned by the authors. Questions have arisen from this study that pertain to other health care providers and their knowledge of periodontal disease and oral-systemic conditions. In addition, no papers appear in the literature regarding curricula of dental and dental hygiene students in oral-systemic conditions and their relationship to periodontal diseases. Many questions need to be answered as we not only discover the physical mechanism of action between periodontal disease and oral-systemic conditions but also as we incorporate this knowledge into the medical and dental healthcare system.

## Conclusion

Current research efforts demonstrate a possible association between periodontal disease and a number of systemic illnesses. The link between periodontal disease and adverse pregnancy outcomes needs further research. As more knowledge is gained regarding periodontal diseases and systemic health and specifically maternal and infant health, there will be an increased opportunity for improved patient care. New standards could emerge from medical and dental/dental hygiene education as well as improved standards of communicating good oral health practices.

This study demonstrates that while there is some knowledge of periodontal disease as a potential risk factor for PTL and LBW among obstetricians, there is limited incorporation of this knowledge into clinical practice. Incorporation of dental information into medical curricula would increase knowledge of periodontal disease and its effects on the body as a whole. In addition, investigations are needed in effective ways to incorporate important science into clinical practice to benefit the health of all patients.

## Acknowledgements

***This paper was supported by a grant from the ADHA Institute for Oral Health.***

## Notes

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## References

1. Gibbs RS. The relationship between infections and adverse pregnancy outcomes: an overview . Ann Periodontol. 2001;6(1): 153-163.
2. Goldenberg RL, Rouse DJ. Prevention of premature births. N Engl J Med. 1998;339(5): 313-320.
3. McGaw T. Periodontal disease and preterm delivery of low-birth-weight infants. J Can Dent Assoc. 2002;68: 165-169.
4. National Center for Health Statistics. Final mortality data, 1990-1994; and period linked birth/infant death data, 1995-2002. [cited 2007 Jan 25]. Available from: http://www.marchofdimes.com/peristats.
5. McCormick MC. The contribution of low birth weight to infant mortality and childhood morbidity. N Engl J Med. 1985;312(2): 82-90.
6. Yu VYH. Developmental Outcome of Extremely Preterm Infants. Am J Perinatol. 200;17: 57-61.
7. Offenbacher S, Katz V, Fertik G, Collins J, Boyd D, Maynor G, McKaig R, Beck J. Periodontal infection as a possible risk factor for preterm low birth weight . J Periodontol. 1996;10(Supplement): 1103-1113.

8. Offenbacher S, Lieff S, Boggess KA, Murtha AP, Madianos PN, Champagne CME, McKaig RG, Jared HL, Mauriello SM, Auten RL, Herbert WN, Beck JD. Maternal periodontitis and prematurity. Part I:Obstetric outcome of prematurity and growth restriction . Ann Periodontol. 2001;6(1): 164-174.
9. Damare SM, Wells S, Offenbacher S. Eicosanoids in periodontal diseases: potential for systemic involvement . Adv in Exp Med & Biol. 1997;433: 23-35.
10. Davenport ES, Williams CWCS, Sterne AC, Sivapathasundram V, Fearne J, Curtis MA. The East London study of maternal chronic periodontal disease and preterm low birth weight infants:study design and prevalence data. Ann Periodontol. 1998;3(1): 213-221.
11. Offenbacher S, Jared HL, O'Reilly PG, Wells SR, Salvi GE, Lawrence HP, Socransky SS, Beck JD. Potential pathogenic mechanisms of periodontitis-associated pregnancy complications. Ann Periodontol. 1998;3(1): 233-250.
12. Madianos PN, Lieff S, Murtha AP, Boggess KA, Auten RL, Beck JD, Offenbacher S. Maternal periodontitis and prematurity. Part II: maternal infection and fetal exposure. Ann Periodontol. 2001;6(1): 175-181.
13. Jeffcoat MK, Hauth JC, Geurs NC, et al.. Periodontal disease and preterm birth: results of a pilot intervention study. J Periodontal. 2003. Aug;74(8): 1214-18.
14. Boggess KA, Lieff S, Murtha AP, et al.. Maternal periodontal disease is associated with an increased risk for preeclampsia. Obstet Gynecol. 2003. Feb;101: 227-231.
15. Boggess KA, Moss K, Madianos P, et al.. Fetal immune response to oral pathogens and risk of preterm birth. Am J Obstet Gynecol. 2005. Sep;193: 1121-1126.
16. Offenbacher S, Beck JD, Leiff S, Slade G. Role of periodontitis in systemic health: Spontaneous preterm birth. J Dent Educ. 1998;62(10): 853-858.
17. Jeffcoat MK, Geurs NC, Reddy MS, Goldenberg RL, Hauth JC. Current evidence regarding periodontal disease as a risk factor in preterm birth . Ann Periodontol. 2001;6(1): 183-188.
18. Williams R. Host modulation for the treatment of periodontal diseases. Inside Dentistry. 2007;3(spec issue 1): 1-5.
19. Gibbs RS, Romero R, Hillier SL, Eschenbach DA, Sweet RL. 1. A review of premature birth and subclinical infection . Am J Obstet Gynecol. 1992;166(5): 1515-1528.
20. Hillier SL, Witkin SS, Krohn MA, Watts DH, Kiviat NB. The relationship of amniotic fluid cytokines and preterm delivery, amniotic fluid infection, histologic chorioamnionitis and choramnion infection. Obstet Gynecol. 1993;81(6): 941-948.
21. Curbelo V, Bejar R, Benirschke K, Gluck L. Premature Labor. I. Prostaglandin precursors in human placental membranes . Obstet Gynecol. 1981;57(4): 473-478.
22. Gibb W. The role of prostaglandins in human partutiion. The Finnish Medical Society Duodecim, Annals of Medicine. 1998;30: 235-241.
23. Pollard JK, Thai D, Mitchell MD. Evidence for a common mechanism of action of Interleukin-1 , tumor necrosis Factor-α, and epidermal growth factor on prostaglandin production in human chorion cells. Am J Reprod Immunol. 1993;30: 146-150.
24. Keelan JA, Marvin KW, Sato TA, Coleman M, McCowan LME, Murray MD. Cytokine abundance in placental tissues:evidence of inflammatory activation in gestational membranes and preterm partuition . Am J Obstet Gynecol. 1999;81(6): 1530-1535.
25. Hill G. Preterm birth: associations with genital and possibly oral microflora. Ann Periodont. 1998;3(1): 222-232.
26. Gurenlian J. Inflammation: The role between oral health and systemic health. Access. 2006;20(4 Sup): 2-8.
27. Scannapieco FA. Periodontal inflammation:from gingivitis to systemic disease?. Compend Cont Educ Dent. 2004;25(7 (Suppl 1)): 16-25.
28. Epstein SE. The multiple mechanisms by which infection may contribute to atherosclerosis development and course. Circ Res. 2002;90: 2-4.
29. Von Minckwitz G, Grischke E, Schwab S, Hettinger S, Loibl S, Aulman M, Kaufmann M. Predictive value of serum interleulin-6 and -8 levels in preterm labor or rupture of the membranes. Acta Obstet Gynecol Scand. 2000;79: 667-672.
30. oldenberg RL, Hauth JC, Andrews WW. Intrauterine infection and preterm delivery. N Eng J Med. 2000;342(20): 1500-1506.
31. Jeffcoat MK, Geurs N. Oral bone loss, osteoporosis, and preterm birth: what do we tell our patients now? . Compendium . 2000;22(1): 22-27.
32. Collins JG, Windley HW, Arnold RR, Offenbacher S. Effects of a Porphyromonas Gingivalis infection on inflammatory mediator response and pregnancy outcome in hamsters. Infect Immun. 1994;62: 4356-4361.
33. Collins JG, Kirtland BC, Arnold RR, Offenbacher S. Experimental periodontitis retards fetal growth. J Dent Res. 1995;74: 158.
34. Collins JG, Smith MA, Arnold RR, Offenbacher S. Effects of Escheria Coli and Porphyromonas gingivalis lipopolysaccharide on pregnancy outcome in the Golden Hamster . Infect Immun. 1994;62: 4652-4655.
35. Dasanayake AP. Poor periodontal health of the pregnant woman as a risk factor for low birth weight . Ann Periodontol. 1998;3(2): 206-212.
36. Mitchell-Lewis D, Engbretson SP, Chen J, Lamster IB, Papapanou PN. periodontal infections and pre-term birth: Early findings from a cohort of young minority women in New York. Eur J Oral Sci. 2001;109: 34-39.
37. Jeffcoat MK, Geurs NC, Reddy MS, et al.. Periodontal infection and preterm birth: results of a prospective study. J Am Dent Assoc. 2001. Jul;132: 875-880.

38. Jeffcoat MK, Hauth JC, Geurs NC. Periodontal disease and preterm birth: results of a pilot intervention study. J Periodontol. 2003. Aug;74(8): 1214-8.
39. Lopez NJ, Smith PC, Gutierrez J. Higher risk of preterm birth and low birth weight in women with periodontal disease. J Dent Res. 2002;81(1): 58-63.
40. Lewis CW, Grossman DC, Domoto PK, Deyo RA. The role of the pediatrician in the oral health of children: a national survey . Pediatrics. 2000;106: E84.
41. McCundiff MD, Barker GJ, Williams K. Health professionals' baseline knowledge of oral/pharyngeal cancers . J Cancer Educ. 2000;15: 79-81.
42. Yellowitz JA, Goodman HS. Assessing physicians' and dentists' oral cancer knowledge, opinions and practices . J Am Dent Assoc. 1995;126: 53-60.
43. Tsamtsouris A, Garvis V. Survey of pediatricians' attitudes towards pediatric dental health . J Pedodontics. 1990;14(issue): 152-7.
44. Sanchez OM, Childers NK, Fox L, Bradley E. Physicians' views on pediatric preventive care . Pediatr Dent. 1997;19: 377-383.
45. Wender EH, Bijur PE, Boyce WT. Pediatric residency training: ten years after the task force report . journaltitle. Pediatrics;1992: 876-880.
46. Cunningham G, DeBiase D, Wearden S, Crout R. Evaluation of a patient's oral status by OB/GYN physicians: needs assessment . J Dent Res. 2000;79(Abstr): 2770.
47. VanGeest JB, Wynia MK, Cummins DS, Wilson IB. Effects of different monetary incentives on the return of a national mail survey of physicians. Medical Care. 2001;39(2): 197-201.
48. Cartwright A. Professionals as responders: variations in and effects of response rates to questionnaires . Br Med J. 1978;11(18): 1419-1421.
49. About Metropolitan and Micropolitan Statistical Areas [homepage on the Internet]. Washington, DC: U.S. Census Bureau, Population Division, Population Distribution Branch ; c2005. [cited 2007 Feb 9]. Available from: www.census.gov/population/www/estimates/aboutmetro.html.
50. Roberts MW, Keels MA, Sharp MC, Lewis JL. Fluoride supplement prescribing and Dental referral patterns among academic pediatricians. Pediatrics. 1998;101: E6.
51. Lamont R. Antibiotics for the prevention of preterm birth. N Engl J Med. 2000;342(8): 581-582.
52. Paquette DW, Madianos P, Offenbacher S, Beck JD, Williams RC. The concept of "risk" and the emerging discipline of periodontal medicine. J Contemp Dent Pract. 1999. Nov;15(1): 1-8.
53. U.S. Department of Health and Human Services. Oral health in America: A report of the surgeon general. Rockville, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Dental and Craniofacial Research; 2000. NIH publication 00-4713.
54. Chen I. The surgeon general's report on oral health: implications for research and education. NY State Dent J. 2000;11: 38-42.
55. Mouradian W, Reeves A, Kim S, et al.. An oral health curriculum for medical students at the University of Washington. Acad Med. 2005;80(5): 1-16.
56. Boggess KA, Beck JD, Murtha AP, et al.. Maternal periodontal disease in early pregnancy and risk for a small-for-gestational-age infant. Am J Obstet Gynecol. 2006;194(5): 1316-22.
57. Russell S, Dasanayake AP. Maternal periodontal disease is related to preterm low birth weight delivery in a group of Brazilian women. J Clin Periodontol. 2005;32(8): 886-90.
58. Offenbacher S, Lin D, Strauss R, et al.. Effects of periodontal therapy during pregnancy on periodontal status, biological parameters, and pregnancy outcomes: a pilot study. J Periodontol. 2006. Dec;77(12): 2011-24.
59. Lopez NJ, Da Silva I, Ipinza J, Gutierrez J. Periodontal therapy reduces the rate of preterm low birth weight in women with pregnancy-associated gingivitis. J Periodontol. 2005. Nov;76: 2144-2153.
60. Sadatmansouri S, Sedighpoor N, Aghaloo M. Effects of periodontal treatment phase I on birth term and birth weight. J Indian Soc Pedo Prev Dent. 2006. Mar;24(1): 23-6.
61. Michalowicz BS, Hodges JS, DiAngelis AJ, et al.. Treatment of periodontal disease and the risk of preterm birth. N Engl J Med. 2006. Nov;355(18): 1885-94.
62. Moore S, Ide M, Coward PY. A prospective study to investigate the relationship between periodontal disease and adverse pregnancy outcome. Br Dent J. 2004. Sep;11(5): 251-8.
63. Insurers Cover Extra Dental Cleanings to Reduce Costs [homepage on the Internet]. Menlo Park, CA: kaisernetwork.org ; c2007. [cited 2007 May 18]. Available from: http://www.kaisernetwork.org/daily_reports/rep_index.cfm.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Dental Hygienists' Opinions About Loupes In Education

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***Purpose. The present study was conducted in order to explore dental Hygienists' perceptions of the advantages and disadvantages of loupes, and the extent to which dental hygienists believe loupes should be utilized in the educational setting.***

***Methods. Dental hygienists were contacted through a popular dental hygiene website and were asked to participate in a survey regarding the use of loupes. Eight hundred sixty-eight valid surveys were completed. Participants were asked to indicate the extent to which they use loupes, the environments in which they have used loupes, when they think loupes should be introduced to students in dental hygiene school, and the advantages and disadvantages of using loupes.***

***Results. Results indicated approximately 60.5% of practicing dental hygienists surveyed for the study always or sometimes use loupes, however only 21% had actually used loupes as a student. A number of differences were found between those respondents who use loupes and those who do not use loupes in regards to how they believe loupes should be used in education. Alleged advantages of using loupes received much greater support than alleged disadvantages. Members of the American Dental Hygienists' Association (ADHA) were much more likely to always use loupes than non-ADHA respondents.***

***Conclusion. Dental hygienists participating in the survey believe that loupes should be introduced to dental hygiene students, although many believe using loupes should be an option while in school. Wide agreement exists among dental hygienists in regards to the advantages of using loupes. The authors contend that loupes are a vital tool that students should learn how to use, but the use of loupes should be optional once a student has learned how to use them properly.***

**Keywords:** loupes, dental hygiene, student, education, magnification, ergonomics

## Introduction

Controversy exists in the dental hygiene field as to if and when loupes should be introduced to dental hygienists. This is likely due to the fact that using loupes in the practice of dental hygiene is still a fairly new concept, and as with any new concept it is expected that it will be met with some resistance. More evidence is mounting regarding the advantages of using loupes in both patient care and for the dental hygienists themselves. Even though science may say the use of loupes is advantageous, it is extremely important to determine if dental hygienists recognize and understand the advantages loupes provide.

The present study explored dental Hygienists' opinions regarding the use of loupes in practice and education. Dental hygienists were asked to indicate if they agreed that an item was an advantage or a disadvantage in clinical practice.

Advantages and disadvantages explored included radiographic evaluations, tactile sensitivity for calculus detection, caries detection, restoration detection, soft tissue evaluations, and accuracy of periodontal probe readings by clinicians wearing loupes. The current study also explored clinician related factors such as ergonomics, confidence, and quality of care. Respondents were also asked to indicate whether or not they think loupes would have been beneficial to them while they were in school, when students should be introduced to loupes, and if using loupes should be a requirement or an option for students. Overall, the opinions gathered in this study provide strong support for the advantages of using loupes and their use in the educational setting.

## Literature Review

Clinicians are always looking for new instruments that allow them to perform their jobs at a higher level and ease the physical stresses of daily work. Loupes are one possible way to improve performance as well as help ease daily physical challenges associated with the practice of medicine and dentistry. Magnification has been an important part of medicine and dentistry for many years. The use of loupes is widespread in medicine, especially in fields like cardiothoracic and pediatric surgery where magnification is essential to performing the job correctly.1 Also, the use of loupes and magnification in dentistry has increased over the past 25 years.2

One reason for the increased use of loupes in dentistry is that loupes have the potential to reduce the number of clinical errors by 50%.3 Not only do loupes help reduce clinical errors, they have also been shown to aid in detection of early carious lesions, crown margin defects, and in the assessment of possible microleakage around restorations.3 Loupes may also help the user to actually gain visual access into the sulcus of a tooth with great detail.2 In turn, loupes allow for direct visualization into root canals, root fractures, and help in general dental diagnosis. Loupes may also help clinicians distinguish natural tooth surfaces from tooth-colored restorations.4,5

Besides the benefits to clinical diagnosis and treatment, research also suggests that loupes can help alleviate some of the physical stress to the body of a practitioner while he or she is treating a patient. Data suggests that dental professionals are at the risk for occupational musculoskeletal injury.4,6-12 Research also indicates that there is a correlation between seeing clearly and maintaining good posture.6 Without the ability to see fine detail, the clinician might contort his or her body into positions that can become detrimental over time. Loupes reduce natural head tilt, which allows the user to have less strain on the neck and upper back muscles.6,7

Despite the many advantages, a number of disadvantages of using loupes have also been identified. Loupes may feel cumbersome to wear at first, requiring an adjustment period on the part of the clinician.2 Another problem with loupes occurs if prescription eyewear is being worn. If the convergence of the 2 eyepieces is not equal, fatigue, headaches, eyestrain, and double vision can occur. Other problems associated with initial use of loupes can be increased weight on the bridge of the nose and decreased field of view.2 Also, loupes may be ineffective when extremely fine detail is needed as in detecting root canal orifices.13,14 A final minor drawback of loupes is that infection control can be difficult since some loupes do not tolerate disinfectants.15

With all of the research demonstrating the benefits of using loupes in clinical practice, one would think that clinicians of any type who might need magnification would be exposed to loupes while in school. This is not necessarily the case, especially in dental hygiene schools. Formal training with loupes for undergraduates may be the next step for most dental and dental hygiene schools.2 It has been suggested that incorporating loupes while in dental hygiene school encourages proper ergonomics, instrumentation, improved patient care, and enhanced sharpening skills that will benefit a dental hygienist throughout his or her lifetime.16 One study demonstrated that students approached their clinical boards with more confidence while wearing loupes and had more confidence when entering the workplace.15 Another study showed that students felt they performed their clinical work better, and 95% reported they had better visual acuity when using loupes.7

Most of the previously mentioned studies of magnification focused primarily on surgeons and dentists. Surprisingly, little research has been conducted to assess the extent of loupe usage by dental hygienists and dental Hygienists' opinions about the use of loupes in education. Studies have shown that some distinct advantages exist for using loupes in fields where magnification is needed, but whether or not dental hygienists know about and agree with the advantages and disadvantages

of using loupes has received little attention. Likewise, dental Hygienists' opinions about using loupes in education and when students should be introduced to loupes have received little attention.

The current study was conducted to explore dental Hygienists' opinions about possible advantages and disadvantages of using loupes in clinical practice and opinions about the use of loupes in education. While many hygienists may use loupes in private practice, the number that actually used them in school is likely very small. The current study was conducted in order to determine if dental hygienists would recommend the use of loupes in school and when they would incorporate loupes into the education of dental hygienists. With these factors in mind, the following hypotheses were developed and explored:

Hypothesis 1. A large percentage of dental hygienists will support the alleged advantages of loupes. Alleged disadvantages of loupes usage will receive minimal support from all dental hygienists.

Hypothesis 2. Dental hygienists who currently use loupes will be more supportive of the use of loupes in the educational setting and will agree that loupes would be beneficial in the educational setting more so than those who do not use loupes.

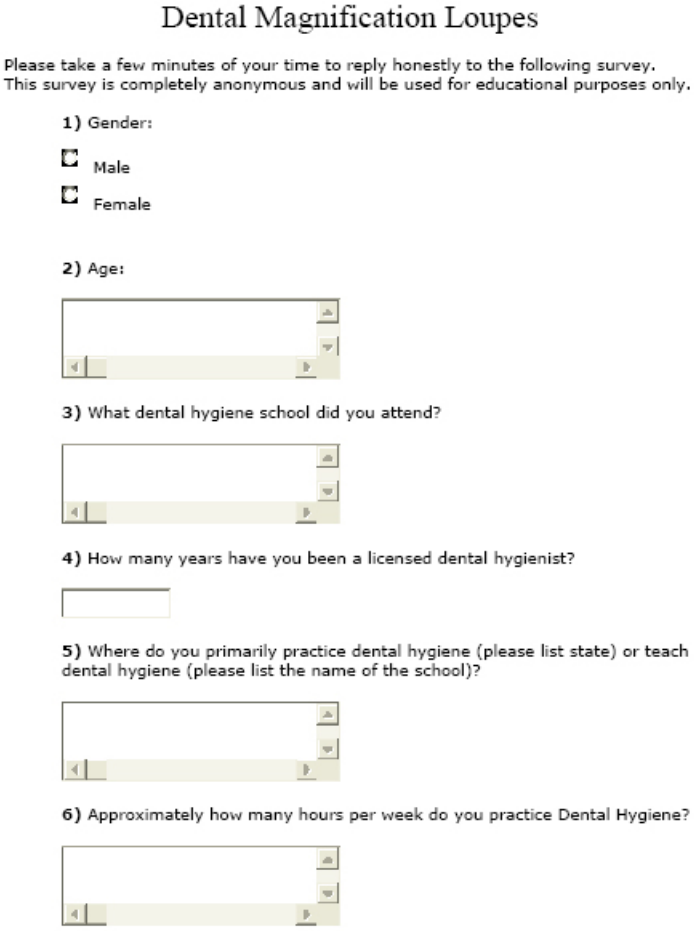
## Methods and Materials

A new survey instrument was developed to obtain dental Hygienists' opinions about loupes in education. The survey instrument was developed and administered under a blanket Institutional Review Board (IRB) approval from the University of Bridgeport for educational research conducted in a university research course. First, the survey was administered on paper to students in a dental hygiene research course at the University of Bridgeport. Based on feedback from the students, the survey was revised to eliminate any confusion in order that the desired information would be captured. The revised instrument was then converted into an internet survey form. The survey was then submitted to a dental hygiene website, with a link to the survey, for further pilot testing with registered dental hygienists. Sixty-six surveys were completed with feedback provided via email by the respondents. The data from this pilot study were analyzed to determine if the desired information was being captured and to ensure that responses to all of the items followed reasonable distributions. Results demonstrated that respondents were using the instrument as intended, and distributions of responses were within acceptable limits. Ultimately, the data from the pilot study were included in the final analysis.

The survey was then distributed to another website for the primary data collection. Dental hygienists were asked to participate in a survey regarding the use of loupes in the dental setting. Participants were assured that all information collected was completely anonymous. A total of 822 surveys were completed, with 802 considered valid. Twenty surveys were discarded due to the fact that the respondents were current dental hygiene students. The 66 responses from the pilot study were then included in the final data set for a total of 868 valid surveys completed.

Participants completed a survey that consisted of 15 items. Demographic information such as age, gender, years in practice, location, and ADHA membership was collected. The remaining items were a combination of multiple choice and "choose all that apply." Respondents indicated their current loupe usage and the environments in which they have used loupes (school, private practice, etc). Respondents were asked to identify all of the items they thought were advantages or disadvantages of using loupes in the practice of dental hygiene. They were also asked if they felt loupes would have beneficial to them when they were in school, how loupes should be introduced to students (as a requirement, an option, or not at all) and when dental hygienists should be introduced to loupes (first year of school, second year, when starting private practice, after a few years of practice, or never). See Figure 1a, 1b, 1c, 1d, for the complete survey.

**Figure 1A: Internet Survey Form**



Dental Magnification Loupes

Please take a few minutes of your time to reply honestly to the following survey.
This survey is completely anonymous and will be used for educational purposes only.

**1)** Gender:

☐ Male

☐ Female

**2)** Age:

**3)** What dental hygiene school did you attend?

**4)** How many years have you been a licensed dental hygienist?

**5)** Where do you primarily practice dental hygiene (please list state) or teach dental hygiene (please list the name of the school)?

**6)** Approximately how many hours per week do you practice Dental Hygiene?

**7)** Have you ever worked in an educational setting?

- ☐ Yes
- ☐ No

**8)** Do you currently use loupes when you are practicing dental hygiene?

- ☐ Yes, always
- ☐ Yes, sometimes
- ☐ No, but I plan to in the future
- ☐ No, never

**9)** In what environment have you used loupes?
(Please check all that apply)

- ☐ As a student
- ☐ As an educator
- ☐ In private practice
- ☐ None

Other (Please Specify): _____

**10)** How would you recommend the use of loupes in the educational setting?

- ☐ As a requirement
- ☐ As an option
- ☐ Not at all

**11)** When should a hygienist be first introduced to loupes?

- ☐ First year of dental hygiene school
- ☐ Second year of dental hygiene school
- ☐ When starting in private practice
- ☐ After a few years of private practice
- ☐ Never

**12)** What do you feel are the advantages of loupes?
(Please check all that apply)

- ☐ Ergonomics/posture
- ☐ Caries detection
- ☐ Periodontal probe readings
- ☐ Restoration detection
- ☐ Quality of care
- ☐ None
- ☐ Radiograph evaluations
- ☐ Calculus removal
- ☐ Confidence
- ☐ Soft tissue evaluation
- ☐ Increased sharpening accuracy
- Other (Please Specify): ☐

**13)** What do you feel are the disadvantages of loupes?
(Please check all that apply)

- ☐ Vision dependency
- ☐ Limited depth of vision
- ☐ Headache
- ☐ False sense of security
- ☐ Uncomfortable
- ☐ None
- ☐ Adjustment period
- ☐ Fatigue
- ☐ Infection control
- ☐ Cost-to-benefit ratio
- ☐ Decreased tactile sensitivity
- Other (Please Specify): ☐

**14)** Do you feel loupes were or would have been beneficial for you in the educational setting (introduced in your curriculum while in school)?

- ☐ Yes
- ☐ No

**15)** Are you currently a member of the American Dental Hygienists' Association (ADHA)?

- ☐ Yes
- ☐ No

Frequencies of responses were examined for all demographic and survey items. Demographics were explored through the use of percentages and means. Chi-square analysis was the primary statistical procedure used to examine potential differences in frequencies of responses based on group membership, which was derived from a variety of variables such as current loupe usage and ADHA membership. A non-response to an item was not included in the analysis of that particular item. Thus the N for the various analyses may be different depending on how many participants did not answer an item.

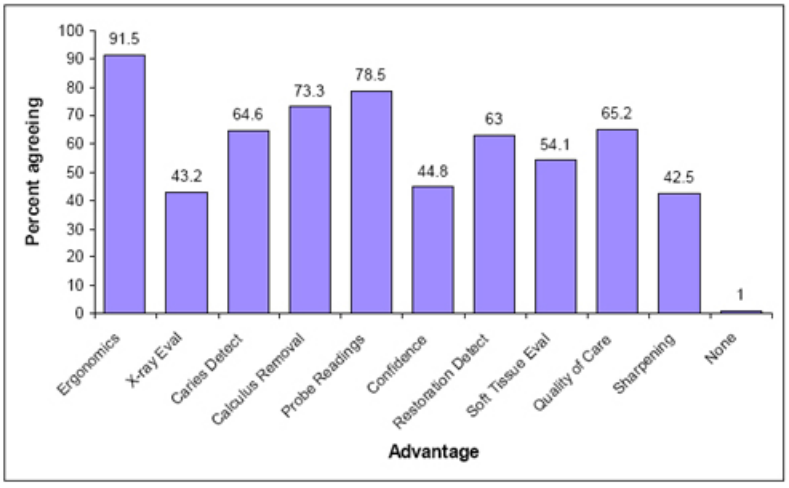
## Results

Examining the demographics of the survey responses indicated that 97.9% of the participants were female, 72% were ADHA members, 26.4% have worked in an educational setting, mean age was 40.56 years, mean years licensed was 13.46 years, and mean hours worked per week was 28.61.

When asked to indicate how often they used loupes, 44.3% responded always, 16.2% sometimes, 20.8% plan to, and 18.7% never use loupes. Only 21.4% indicated that they used loupes as a student, 9.4% as an educator, 59.7% in private practice, and 30.2% had never used loupes. Approximately 85.2% of respondents agreed that loupes were or would have been beneficial to them while in school. When asked how loupes should be implemented in the educational setting, 38.2% said as a requirement, 59.7% as an option, and 2.1% not at all. Participants were then asked to indicate when loupes should be introduced to a dental hygienist; 56.9% said in the first year of dental hygiene school, 37.4% in the second year of dental hygiene school, 0.9% when starting private practice, 4.2% after a few years in private practice, and 0.6% never.

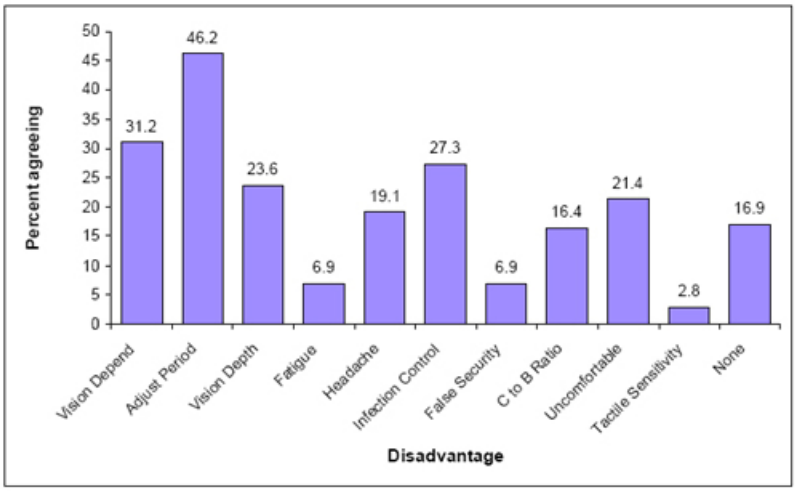
Participants were then asked to check all of the responses that they felt were advantages of loupe usage. The following values indicate the percentage of respondents that agreed that an item was an advantage of using loupes: ergonomics 91.5%, radiographic evaluations 43.2%, caries detection 64.6%, calculus removal 73.3%, probe readings 78.5%, confidence 44.8%, restoration detection 63.0%, soft tissue evaluations 54.1%, quality of care 65.2%, sharpening accuracy 42.5%, and no advantage 1.0%. See Figure 2 for graphical representation of results.

**Figure 2. Percentages agreeing that an item is an advantage of using loupes**




Participants were then asked to check all of the responses that they felt were disadvantages of loupe usage. The following values indicate the percentage of respondents that agreed that an item was a disadvantage of using loupes: vision dependency 31.2%, adjustment period 46.2%, limited depth of vision 23.6%, fatigue 6.9%, headache 19.1%, infection control 27.3%, false sense of security 6.9%, cost-to-benefit ratio 16.4%, uncomfortable 21.4%, decreased tactile sensitivity 2.8%, and no disadvantages 16.9%. See Figure 3 for graphical representation of results.

**Figure 3. Percentages agreeing that an item is a disadvantage of using loupes**




Relationships between current loupe usage (yes, always; yes, sometimes; no, but plan to; no, never) and frequency of responses to other items were examined through the use of the chi-square statistic. Chi-square values and their level of significance are reported followed by a brief description of the most noteworthy findings of the individual analysis

A significant relationship (chi-square (6) = 155.04, $p < 0.001$) was found for how respondents would recommend the use of loupes in the educational setting and loupe usage. Of those people who always use loupes, 58.8% said that loupes should be a requirement, while only 10.1% of those people who never use loupes said that loupes should be required while in school. However, 82.9% of those people who never use loupes thought that students should have the option of using loupes in dental hygiene school (Table I).

**Table I. Loupes recommendation in education by current loupe usage**

| | | | Loupes recommendation | | | |
|---|---|---|---|---|---|---|
| | | | Requirement | Option | Not at all | Total |
| Loupe usage | Yes, always | Count | 224 | 156 | 1 | 381 |
| | | Row % | 58.8% | 40.9% | .3% | 100.0% |
| | Yes, sometimes | Count | 41 | 98 | 1 | 140 |
| | | Row % | 29.3% | 70.0% | .7% | 100.0% |
| | No, but plan to | Count | 44 | 126 | 5 | 175 |
| | | Row % | 25.1% | 72.0% | 2.9% | 100.0% |
| | No, never | Count | 16 | 131 | 11 | 158 |
| | | Row % | 10.1% | 82.9% | 7.0% | 100.0% |
| | Total | Count | 325 | 511 | 18 | 854 |
| | | Row % | 38.1% | 59.8% | 2.1% | 100.0% |

Pearson Chi-Square Tests

| | | Loupes recommendation |
|---|---|---|
| Loupe usage | Chi-square | 155.037 |
| | df | 6 |
| | Sig. | .000(*) |

*p<0.001

A significant relationship was found for opinions in regards to when loupes should be introduced to a dental hygienist and loupe usage (chi-square (12) = 71.86, $p < 0.001$). The largest difference in responses was found between those respondents who always use loupes and those who never use loupes. Of those people who always use loupes, 66.8% thought that loupes

should be introduced in the first year, while only 45.6% of those who never use loupes thought that loupes should be introduced in the first year. (Table II).

**Table II. When to introduce students to loupes by current loupe usage**

| | | | When to introduce students to loupes | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | First year | Second Year | Starting private practice | After few years in private practice | Never | Total |
| Loupe usage | Yes, always | Count | 254 | 116 | 5 | 5 | 0 | 380 |
| | | Row % | 66.8% | 30.5% | 1.3% | 1.3% | .0% | 100.0% |
| | Yes, sometimes | Count | 65 | 69 | 0 | 5 | 0 | 139 |
| | | Row % | 46.8% | 49.6% | .0% | 3.6% | .0% | 100.0% |
| | No, but plan to | Count | 96 | 71 | 3 | 10 | 0 | 180 |
| | | Row % | 53.3% | 39.4% | 1.7% | 5.6% | .0% | 100.0% |
| | No, never | Count | 73 | 66 | 0 | 16 | 5 | 160 |
| | | Row % | 45.6% | 41.3% | .0% | 10.0% | 3.1% | 100.0% |
| | Total | Count | 488 | 322 | 8 | 36 | 5 | 859 |
| | | Row % | 56.8% | 37.5% | .9% | 4.2% | .6% | 100.0% |

Pearson Chi-Square Tests

| | | When intro to loupes |
|---|---|---|
| Loupe usage | Chi-square | 71.857 |
| | df | 12 |
| | Sig. | .000(*) |

*p<0.001

For the item asking if loupes would have been beneficial while in school, 95.0% of those people who always use loupes agreed that loupes would have been beneficial while in school, while only 61.8% of those who never used loupes agreed that loupes would have been beneficial to them while in school (chi-square (3) = 96.77, $p < 0.001$) (Table III).

**Table III. Thought loupes were/would have been beneficial to them while in school by current loupe usage**

| | | | Beneficial while in school | | |
|---|---|---|---|---|---|
| | | | Yes | No | Total |
| Loupe usage | Yes, always | Count | 360 | 19 | 379 |
| | | Row % | 95.0% | 5.0% | 100.0% |
| | Yes, sometimes | Count | 118 | 22 | 140 |
| | | Row % | 84.3% | 15.7% | 100.0% |
| | No, but plan to | Count | 152 | 26 | 178 |
| | | Row % | 85.4% | 14.6% | 100.0% |
| | No, never | Count | 97 | 60 | 157 |
| | | Row % | 61.8% | 38.2% | 100.0% |
| | Total | Count | 727 | 127 | 854 |
| | | Row % | 85.1% | 14.9% | 100.0% |

Pearson Chi-Square Tests

| | | Beneficial while in school |
|---|---|---|
| Loupe usage | Chi-square | 96.771 |
| | df | 3 |
| | Sig. | .000(*) |

*p<0.001

A significant relationship was found between ADHA membership and loupe usage chi-square (3) = 74.65, $p < 0.001$). ADHA members were more likely to always use loupes (51.4%) compared to people who were not ADHA members (25.7%) (Table IV).

**Table IV. Member of ADHA by current loupe usage**

| | | | Loupe usage | | | | |
|---|---|---|---|---|---|---|---|
| | | | Yes, always | Yes, sometimes | No, but plan to | No, never | Total |
| Member of ADHA | Yes | Count | 320 | 110 | 110 | 83 | 623 |
| | | Row % | 51.4% | 17.7% | 17.7% | 13.3% | 100.0% |
| | No | Count | 62 | 30 | 70 | 79 | 241 |
| | | Row % | 25.7% | 12.4% | 29.0% | 32.8% | 100.0% |
| | Total | Count | 382 | 140 | 180 | 162 | 864 |
| | | Row % | 44.2% | 16.2% | 20.8% | 18.8% | 100.0% |

Pearson Chi-Square Tests

| | | Loupe usage |
|---|---|---|
| Member of ADHA | Chi-square | 74.653 |
| | df | 3 |
| | Sig. | .000(*) |

*p<0.001

## Discussion

In support of the hypothesis regarding current loupe usage and opinions about the implementation of the use of loupes in the educational setting, approximately 85.0% of dental hygienists surveyed (95% of those who always use loupes) thought that loupes would have been beneficial to them if used while in school. Although such a large percentage thought that loupes are beneficial in education, only 38.2% thought they should be required, while 59.7% thought they should be an option. Results show that respondents who always use loupes are more likely to support loupes being introduced earlier

and as a requirement for students. However, even those respondents who always use loupes did not overwhelmingly agree that loupes should be a requirement. This suggests that while dental hygienists believe loupes are beneficial, they also believe students should be allowed to choose when and if they want to utilize loupes.

This study, combined with previous research, suggests that if a dental hygienist chooses to use loupes, both the dental hygienist and patients are likely to benefit in a number of ways. In support of the hypothesis regarding advantages and disadvantages of loupes, a large percentage of respondents agreed with the alleged advantages, while much smaller percentages agreed with the alleged disadvantages. The most widely supported advantages were ergonomics, calculus removal, caries detection, probe readings, and overall quality of care. These results demonstrate that even those respondents who do not use loupes recognize the benefits to themselves and their level of clinical care. The question remains, if people realize all of these benefits, why does such a large percentage (39.5%) continue to not use loupes?

We explored this question by asking dental hygienists to identify the disadvantages of using loupes. Vision dependency, adjustment period, infection control, and limited depth of vision were among the most agreed upon disadvantages. However, the percentages of respondents identifying these as disadvantages of using loupes were generally very low. The largest perceived disadvantage was adjustment period, with 46.2% respondents saying that they thought an adjustment period was necessary. This finding is very consistent with the previous literature. However, this finding could support the argument that loupes should be introduced to dental hygienists as soon as possible in the educational process so they can become accustomed to utilizing them properly. On the other hand, introducing loupes early to students could lead to even greater vision dependency on loupes during clinical practice. This could affect not only the learning process, but also the general vision of the user further down the road. The long-term effects of loupes on vision dependency and general vision of the user are topics that need to be addressed by future research.

Interestingly, respondents who were ADHA members were twice as likely to always use loupes compared to nonmembers. This is probably due to the fact that ADHA members are more aware of state-of-the-art techniques related to dental hygiene because they are generally more involved in the field. However, only about half of ADHA members surveyed always use loupes. Further research is needed in order to determine why ADHA members do or do not use loupes. Perhaps the current study, and others that will follow, can demonstrate to the remaining nonusers the advantages of using loupes in practice and in the educational setting.

Overall, the results of this study could impact the practice of dental hygiene in many ways, especially in the educational arena. Any dental hygiene school that does not currently allow students at least the option to use loupes should reconsider its position since such a large percentage of dental hygienists surveyed indicated that they felt loupes would have been beneficial to them in dental hygiene school. Also, the large percentage of respondents that identified advantages of using loupes demonstrates how using loupes can be beneficial to both the dental hygienist and the patient. The implication is that if students are taught to properly use loupes, they are likely to see benefits in ergonomics for themselves and in clinical practice in areas such as calculus removal. Ultimately, it is not only the dental hygienist that will benefit from being introduced to loupes in the educational setting, but also the patient.

## Limitations

The present study was an opinion survey and no causal relationships can be determined. Another potential limitation of the present study is that the results may not represent the opinions of all dental hygienists. The present study was limited to dental hygienists who use the internet and voluntarily participated. There could be fundamental differences in the opinions of those people who do not use the internet or who were unwilling to participate in this survey. However, results of the present study are credible because of the large sample size, variation of loupe usage, and variation in responses to the survey items.

### *Summary and Conclusions*

The present study demonstrates that even though all dental hygienists who responded are not currently using loupes, a large percentage believe that loupes would have been beneficial in their education. Also, this study shows that there is wide agreement among the respondents as to the advantages of using loupes (ie, ergonomics, calculus removal, probe

readings, etc). The present study was a starting point for research into the benefits of loupes in the educational setting. Further research is needed to determine if those people who use loupes in school actually experience the advantages identified in the present study. If future research continues to demonstrate results similar to those observed here, it would be hard to argue against loupes as a necessary tool of the dental hygienist who wishes to provide the highest quality of care.

## Acknowledgements

***The authors thank University of Bridgeport professor Marcia Lorentzen, RDH, MA, for her inputs into the development of the current study.***

***A special thanks to www.AmyRDH.com and www.DentalJobs.net for their help in recruiting participants for the Internet survey.***

## Notes

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## References

1. Jarrett PM. Intraoperative magnification: Who uses it?. Microsurgery. 2004;24(6): 420-2.
2. Forgie A. Magnification: What is Available, and will It Aid your Clinical Practice?. Dent Update. 2001: 125-130.
3. van As G. Magnification and the Alternatives for Microdentistry. Compend Contin Educ Dent. 2001;22(11A): 1008-1016.
4. Syme SE, Fried JL, Strassler HE. Enhanced Visualization Using Magnification Systems. J Dent Hyg. 1997;71(5): 202-206.
5. Coburn DG. Vision, posture, and productivity. Oral Health. 1984;74: 13-15.
6. Friedman M. Magnification in a Restorative Dental Practice: From Loupes to Microscopes. Compend Contin Educ Dent. 2004;25(1): 48-55.
7. Branson BG, Bray KK, Gadbury-Amyot C, Holt LA, Keselyak NT, Mitchell TV, Williams KB. Effect of Magnification Lenses on Student Operator Posture. J Dent Educ. 2004;68(3): 384-389.
8. Finsen L, Christensen H, Bakke M. Musculoskeletal disorders among dentists and variation in dental work. App Erg. 1998;29: 119-125.
9. Marshall ED, Duncombe LM, Robinson RQ, Kilbreath SK. Musculoskeletal symptoms in New South Wales dentists. Aust Dent J. 1997;42: 240-246.
10. Moen BE, Bjorvatn K. Musculoskeletal symptoms among dentists in a dental school. Occup Med. 1996;46: 65-68.
11. Oberg T, Oberg U. Musculoskeletal complaints in dental hygiene: a survey from a Swedish country. J Dent Hyg. 1993;67: 257-261.
12. Liskiewicz ST, Kerschbaum WE. Cumulative trauma disorders: an ergonomic approach for prevention. J Dent Hyg. 1997;71: 162-167.
13. Yoshioka T, Kobayashi C, Suda H. Detection rate of root canal orifices with a microscope. J Endod. 2002;28(6): 452-3.
14. Schwarze T, Baethge C, Stecher T, Geurtsen W. Identification of second canals in the mesiobuccal root of maxillary first and second molars using magnifying loupes or an operating microscope. Aust Endo J. 2002. Aug;28(2): 57-60.
15. Christensen G. Magnification in Dentistry. Useful tool or another gimmick?. J Am Dent Assoc. 2003;134: 1647-1650.
16. Richardson C. Demystifying Magnification. Contemporary Oral Hygiene. 2005;5(8): 17-21.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# North Carolina Dental Hygienists' View on Oral Cancer Control

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***Many oral and pharyngeal cancers (OPC) are preventable. Early detection improves survival rates. Hygienists have opportunities to help reduce the oral cancer burden among their patients.***

***Purpose. The purpose of this project was to qualitatively assess North Carolina dental Hygienists' views regarding OPC prevention and early detection.***

***Methods. Sixteen practicing dental hygienists participated in 2, 8-person focus groups. Focus groups were taped, transcribed, and analyzed qualitatively for content.***

***Results. Four major themes arose: 1) The charge of the dental hygienist was not necessarily to diagnose cancer, but to recognize abnormalities and initiate referral when necessary; 2) The dental hygienist is only helpful in the tobacco cessation process if the patient has a desire to quit; 3) The dental hygienist is most effective if the patient believes the provider is genuine and truly cares about the patient's well-being; 4) There is always a need for continued education in oral cancer screenings and tobacco cessation, specifically for hands-on courses. Barriers to performing OPC exams included: financial, time, and insufficient dentist support. Barriers for dental hygienists in providing tobacco cessation counseling included: lack of patient interest, lack of patient education materials and resources, smoking parents of adolescents, personality issues, and provider-patient diversity in age, gender, ethnicity, and culture.***

***Conclusions. Dental hygienists felt their most important contribution to oral cancer control was patient education and oral cancer awareness. Professional continuing education is important and barriers need to be addressed to improve oral cancer control efforts.***

**Keywords:** oral cancer screenings, dental hygienists, oral assessment, tobacco cessation

## Introduction

According to cancer statistics, more than 34 000 people are diagnosed with oral and pharyngeal cancer (OPC) in the United States each year. The five-year survival rate among OPC patients, approximately 50-60%,[1,4] is among the lowest of all cancers with an estimated 1 out of every 4 of these 34 000 cases resulting in death.[1,2]

The state of North Carolina has a continuing high OPC rate with 10.3 per 100 000 population.[3] The age-adjusted OPC 5-year mortality rate ranks 13th among all states.2 As with most cancers, the burden of OPC is unequal across the population and is partially determined by life circumstances, such as social position, economic status, culture, and environment.[4] As one of the leading tobacco producers in the nation, North Carolina's percentage of adult smokers in 2004 (22.5%) rated higher than the national percentage (20.5%),[5] making it a state of particular concern when it comes to risk factors for oral cancer.

In 2001, Patton and colleagues began to examine the epidemiology of oral cancer in North Carolina in order to assess the level of need for education as well as the target audience for oral cancer prevention and early detection information.[3,4] Their studies assessing knowledge related to risk factors and screenings for OPC included surveys of NC adults, dentists, dental hygienists, family physicians, and nurse practitioners.[6-10] These surveys revealed gaps not only in the knowledge level among NC adults,[9] but they also exposed deficiencies in NC medical and dental providers' (both dentists' and dental Hygienists') knowledge and practice levels regarding the control of OPC.[6-8,10] Dental hygienists are known for their role in the prevention of oral diseases. They are in a unique position not only to detect oral precancerous and cancerous lesions, but also to counsel and educate patients to avoid known risk factors that could cause oral cancer.

The purpose of this qualitative study was to gather data that might complement the quantitative data gathered in previous surveys[6-7] regarding NC dental Hygienists' knowledge, opinions, and practices regarding oral cancer prevention and early detection. In addition, this study explored patient-related factors, specifically tobacco use, that can influence prevention and early detection of oral cancer. The information gained from this study is intended to contribute to the development of a state model for promoting oral cancer awareness, prevention, and early detection that is consistent with the recommendations of the recent "National Strategic Planning Conference for the Prevention and Control of Oral and Pharyngeal Cancer."[4]

## Review of the Literature

### *Oral Cancer*

OPC traditionally includes malignant tumors of the lips, tongue, floor of the mouth, palate, gingiva, alveolar mucosa, buccal mucosa, and oropharynx. Almost all oral cancers begin in the flat epithelial cells or squamous cells that cover the surfaces of the mouth, tongue, and lips.[11] The most common site of occurrence is the tongue followed by the lip and the floor of the mouth, with the most common type being squamous cell carcinoma.[12] This disease affects more males than females with a male to female ratio of over 2:1. However, the difference between men and women is becoming less pronounced, possibly explained by more women exposing themselves to known risk factors such as alcohol and tobacco.[13] OPC is more common among middle age to elderly people with the median age of diagnosis being 64 years.[1]

When oral cancer metastasizes, it usually travels through the lymphatic system often appearing first in the lymph nodes of the neck. OPC cells can then spread to additional parts of the neck, the lungs, and other regions of the body.[11] Consequently, a common reason for poor survival rates is that oral cancers are usually diagnosed at an advanced stage after they have metastasized.[4]

### *Risk Factors and Prevention*

OPC is preventable when certain key risk factors are controlled. Several risk factors have been shown to be associated with OPC. Some of these include: over-exposure to the sun,[14] a diet low in fruits and vegetables,[15-17] and even some viral infections such as Human Papilloma Virus and Epstein-Barr Virus have been suggested to increase a person's risk.[17-19,20,21] However, the 2 most important risk factors, and perhaps the most controllable, are tobacco and alcohol use.[12, 22-29]

The role of tobacco and alcohol in the etiology of oral cancer has been well established. Specifically, in 1986 and 1988, expert working groups of the International Agency for Research on Cancer (IARC) reviewed animal and human studies of the carcinogenic risk of tobacco smoking and alcohol drinking, concludeding that these 2 exposures are causally related to cancers of the oral cavity and pharynx.[23,24]

Approximately 80% of oral cancer patients smoke, and treated OPC patients who continue to smoke have a 2-6 times greater chance of developing a second malignancy.[12,25] In addition to smoking cigarettes, cigars, and pipes, chewing tobacco, dipping snuff, the use of chewing substitutes such as betel nut quid and pan masala (common in Middle and Far Eastern countries), place an individual at high risk to develop OPC.[11,26] Heavy smokers and those who use tobacco over a long period of time are at especially high risk, but even their risk can increase with the consumption of alcohol.[11] In studies controlled for smoking, moderate to heavy drinkers can have a 3-9% greater chance of developing a malignancy.[27-29] However, of particular concern is the synergistic effect between alcohol and tobacco use, which in some studies gives the individual over a 100 times higher likelihood of developing OPC compared to abstainers.[22,30]

Results from several studies exhibit a general lack of knowledge regarding OPC risk factors among adults.[9,31-33] Greater efforts are needed in primary prevention of OPC, which includes the avoidance of tobacco and alcohol abuse. Patients need to be informed of the risks and educated on lifestyle changes that will help prevent and control morbidity rates related to OPC.

Dental professionals are in a unique role to provide risk factor counseling regarding the prevention of OPC, specifically, counseling related to tobacco and alcohol use. Patients visiting the dental office for problem-oriented appointments are often streamlined into a regular preventive recall schedule where they are seen for preventive services on a regular basis. OPC risk factor counseling can be added to these preventive services, and can potentially be a life saving element of care.[34,35]

Randomized controlled trials show that with tobacco, brief interventions can be successful in reducing tobacco use and dental clinical teams can be effective in this process.[36,37-41] A recent meta-analysis of 37 randomized clinical trials and quasi-experiments found that smoking cessation advice from any type of health care provider results in increases in quit rates,[38] and another study showed that 40% of smokers try to quit in response to a health care provider's advice.[42] Tobacco-use interventions by oral health professionals have reported achieving cessation rates of up to 18%.[36,43]

A survey of dentists in a managed care setting revealed that dentists' perceptions regarding success in helping patients quit using tobacco were highly correlated with the percentage of tobacco-using patients who were asked about tobacco use, the frequency with which they were given advice, and the average time spent counseling with a patient.[44] However, the authors were quick to caution that these results should not be generalized to outside populations because the particular group of dentists that participated in this study was not representative of other populations. In addition, the relatively low response rate may indicate a resistance to the incorporation of tobacco cessation into dental health professionals' daily practice regimes.[44] Though dental professionals are aware of the risks associated with tobacco and alcohol use, they often feel ill-prepared or uncomfortable presenting patients with a clear cessation message.[34,35,45]

### *Early Detection*

In addition to controlling risk factors, one of the greatest opportunities to improve mortality rates for OPC is early detection. More than 80% of lesions detected in stages I and II can be cured with appropriate treatment. Unfortunately, almost two-thirds of OPC lesions are diagnosed in stages III and IV, requiring more aggressive treatment and still resulting in poor survival rates.[46,47]

OPC can present itself in precancerous stages, such as erythroplakia (red patch), leukoplakia (white patch), and/or erythroleukoplakia (mixed red and white patches), all of which can become malignant and can be detected upon visual examination.[26] These premalignant lesions of the oral mucosa are amenable to larger scale screening opportunities prior

to their transformation to malignant lesions. Other warning signs and symptoms suggesting the possibility of oral cancer may include:[11]

- A sore on the lip or in the mouth that won't heal
- Bleeding in the mouth
- Loose teeth
- Difficulty or pain when swallowing
- Difficulty wearing dentures
- A lump in the neck
- An earache

Most often these symptoms do not mean oral cancer is present. However, all should be observed by a dentist or physician so that in the case of oral cancer, chances of survival can be improved by early detection and treatment.[11]

Early detection depends on a thorough and a perceptive clinician or even a patient who might identify an abnormality in the mouth, neck, and/or surrounding areas. A study done by Holmes et al interviewed 51 patients with newly diagnosed OPC to determine detection patterns and whether recognition of these cancers by various health care providers was associated with a lower stage at diagnosis.[48] In this study, all lesions detected by physicians occurred during a symptom-driven examination. Dentists, dental hygienists, oral and maxillofacial surgeons, and in one case, a denturist were more likely to detect OPC during nonsymptom-driven examinations, and the lesions detected during nonsymptom-driven exams were of a statistically significant lower average clinical and pathologic stage (1.7 and 1.6, respectively) than lesions detected during a symptom-directed examination (2.6 and 2.5, respectively). Additionally, patients who sought care from a regional specialist (dentist, oral and maxillofacial surgeon, or otolaryngologist) with symptoms related to their lesion were more likely to have appropriate treatment initiated than those who initially sought care from their primary care physician. Finally, the study found that the dental office was the most likely source of detection of a lesion during a screening exam. Patients referred from a dental office were of significantly lower stage than those referred from a medical office.[48]

A review completed by the Cochrane Collaboration entitled, *Screening programmes for the early detection and prevention of oral cancer*,[49] evaluated a study by Sankaranarayanan et al which discussed the efficacy of OPC visual screenings on oral cancer control.[49,50] The purpose of this 9-year randomized controlled trial was to determine if visual screening had an effect on OPC mortality rates.[50] Thirteen clusters involving 191 872 individuals were chosen for the study, 7 were randomized to 3 rounds of oral visual inspection by trained health care workers at 3-year intervals and 6 to a control group during 1996-2004, in Kerala, India.[50] Healthy participants aged 35 years and older were eligible for the study. Patients testing positive during screening procedures were referred for clinical examination by doctors, biopsy, and treatment. Outcome measures were survival, case fatality, and oral cancer mortality.

Over the 9-year period, there were 164 oral cancer deaths. The 21% reduction in oral cancer mortality in all individuals in the intervention-screened group (77 out of 205 subjects with oral cancer) compared with controls (87 out of 158 subjects with oral cancer) was not significant. However, a significant 34% reduction in mortality was recorded in the high-risk group (tobacco or alcohol users) in the screening arm compared with controls. Additional statistical analyses performed by the Cochrane Collaboration review authors examined survival rates from Sankaranarayanan et al's published data. The proportions of patients still alive 5 years after diagnosis were compared among the control and intervention groups. A significantly higher 5-year survival rate (50%) was reported in the intervention group than in the control group (34%).[49]

The authors concluded that oral visual screenings can reduce mortality in high-risk individuals and have the potential to prevent at least 37 000 cancer deaths worldwide.[50] In the Cochrane review, while Kujan et al also concluded that this study showed a significant difference in mortality rates between the intervention and control groups for high-risk patients, they also stated that there is insufficient evidence to support or refute the use of a visual examination as a method of screening

for oral cancer in the general population.[49] More studies are needed in order to confirm the data from Sankaranarayanan et al's study. In the meantime, since screening by visual examination might be effective in the early detection of OPC, the suggestion of the Cochrane Collaboration review authors was that "systematic examination of the oral cavity by dental healthcare professionals should remain an integral part of their routine daily work."[49]

### *Dental Hygienists Opinions and Practices Regarding OPC Control*

Surveys of dental health care professionals reveal gaps in their practices of oral cancer screening as well as alcohol and tobacco use cessation counseling.[6-8,51-58] A study conducted by Horowitz et al used focus groups of dental hygienists and revealed a wide variety of practices regarding OPC screenings and patient education activities.[53] Dental hygienists in this study were candid about their belief that dentists and dental hygienists need to be more attentive in providing oral cancer examinations on a routine basis. Unfortunately, the results of this study as well as a previous survey of Maryland dental hygienists[55,56] revealed rationales for why they are not providing screenings and assessments. Many dental hygienists did not feel they had time to provide such exams. In addition, some did not provide them because it was not expected of them by their employer. Perhaps even more compelling was that several of the study participants felt uncomfortable or unsure about exactly how to provide a comprehensive examination.[53,55,56] Regarding assessment of risk factors, many of the focus group participants said they do conduct fairly comprehensive health assessments, which includes evaluating the patient's tobacco use, but they thought more needed to be done to educate patients regarding oral cancer control.[53]

A similar study conducted by Ashe et al sought to determine the opinions and practices of North Carolina dental hygienists regarding OPC control.[6-7] Over 90% were assessing their patients' tobacco use, however, only 58% were addressing their patients' alcohol use. While the majority of the respondents agreed or strongly agreed that dental hygienists should be trained to provide cessation counseling, few felt adequately trained to do so. Regarding OPC screenings, the dental hygienists from this study answered contrary to the Maryland survey[55-56] in that NC dental hygienists felt comfortable in providing OPC screening exams, and even felt confident in their abilities to detect abnormalities that may be precancerous. However, they agreed with Maryland dental hygienists regarding the need for more CE courses and/or formal training regarding oral cancer control education. Finally, this survey found that only 10% reported attending CE courses on the topic, while 96% expressed interest in attending such courses.7 The response rate for both the Maryland [55-56] and NC surveys[6-7] was approximately 60%. One could consider that dental hygienists responding to these surveys may have a higher knowledge and confidence level in the subject. In contrast, the nonresponders may have little knowledge and/or interest regarding oral cancer and inadequate training in OPC control, which may have influenced their decision to not respond. Therefore, these surveys may over-represent dental Hygienists' knowledge and training regarding the early detection and prevention of OPC.[6]

In 2005, Cruz et al conducted the first survey to assess alcohol abuse cessation practices among a population-based sample of oral health care workers in New York.[45] Their findings were similar to those in Maryland and NC with regards to OPC screenings and tobacco cessation counseling. In terms of alcohol abuse counseling, they reported 17% of dental hygienists were asking patients about alcohol use; 12% advised heavy alcohol users to reduce use; 7% assessed their patients' willingness to reduce use; and only 2% and 1% of the dental hygienists assisted their patients who were heavy alcohol users in developing an alcohol-use reduction plan and arranging for a follow-up contact, respectively. Finally, in terms of readiness to assist heavy alcohol users in developing an alcohol-use reduction plan, only 4% of dental hygienists were assisting more than 80% of their alcohol-abusing patients to reduce use for more than 6 months.[45]

### *The Role of the Dental Hygienist*

Dental hygienists play a key role in the prevention of oral diseases. They are in a unique position not only to detect oral precancerous and cancerous lesions, but also to counsel and educate patients to avoid known risk factors that could cause oral cancer. Holmes et al assessed detection practices of OPC and concluded that appropriate treatment and lower stage at diagnosis were most often associated with a nonsymptom-driven examination, which was most likely to occur in a

dental office.[48] Dental hygienists may not think of themselves as "life-savers", but in detecting a precancerous lesion or even a malignant lesion in the early stages and educating their patients of the signs and risk factors associated with oral cancer, they can influence mortality rates and help reduce the number of lives lost to OPC.

The purpose of this qualitative study was to assess NC dental Hygienists' views regarding OPC prevention and early detection.

## Methods

Two focus groups of 8 dental hygienists each were held during a 2006 annual dental hygiene continuing education (CE) course at the University of North Carolina (UNC) School of Dentistry. This project received approval by the UNC Institutional Review Board. Dental hygienists were recruited by email and telephone prior to the CE course by obtaining a list of registrants containing names, email addresses, mailing addresses, and phone numbers from the UNC CE office. Due to a limited response through email and telephone, onsite recruitment through announcements was used to obtain a sample of 8 hygienists for each focus group.

The focus group sessions took place in a classroom setting at the UNC School of Dentistry. However, as opposed to a traditional classroom seating arrangement, participants were seated in a round table fashion with the facilitator and note-taker sitting within the circle. Sessions were recorded using cassette tapes and 2 recorders with one being attached to a microphone. Recorders were placed in the center of the table to allow for maximum capture of all participants' voices which were later transcribed.

The first session was held on an evening following lectures entitled: "The Dental Hygienist's Role in Tobacco Cessation" and "Recognizing Pathological Lesions Masquerading as Periodontal Disease." The focus group lasted approximately 64 minutes. Dinner was provided for the participants and they were reimbursed $50 for their participation.

The second focus group was held during lunch following a lecture entitled: "Providing Culturally Competent Dental Hygiene Care." Participants only had one hour between courses for lunch, and therefore the session lasted only 48 minutes. Lunch was included with the course, and the dental hygienists were again provided $50 for their participation.

At the beginning of each focus group, background information on the project was provided and consent forms were reviewed, signed, and collected. Participants were then asked to go around the table and state their first name, the area of NC in which they lived, and why they decided to take part in the focus group. Eight prompt questions were then used along with some additional probing questions that addressed the dental Hygienists' perceptions, practices, and comfort levels associated with oral cancer risk factors, OPC screenings, and tobacco cessation.

Following the discussion questions, participants were asked to complete an exit questionnaire. The purpose of the questionnaire was to provide demographic information on the study population such as: number of years in practice, hours worked per week, graduation institution (2 year versus 4 year), county in North Carolina in which the participant practiced, and the approximate percentage of the patients in their practice using tobacco. Only one out of the 16 dental hygienists did not complete the questionnaire (Table I).

**Table 1**
Demographic Information of Participating Dental Hygienists

| Dental Hygienists | Mean | Range |
|---|---|---|
| Years in practice | 14.5 | 1 – 35 |
| Hours worked (week) | 31.8 | 16 – 40 |
| Approximate % of patients using tobacco | 42% | 3% – 96% |

Qualitative content analysis was used to generate major themes and barriers (**Figures 2** and 3) that emerged from the discussion.[59] The moderator for the sessions transcribed both session tapes, and then categorized quotes according to corresponding questions. A summary for each question was then written. Another research team member, acting as the note taker during the focus group sessions, also reviewed the transcripts along with the summaries. Subsequently, both the moderator and the note taker examined patterns that had emerged from the data to report major themes and barriers related to the participants' opinions, knowledge, and practices regarding OPC screenings and tobacco cessation counseling.

**Figure 2**
Barriers to OPC Screening Exams

| Barriers | Quote |
|---|---|
| 1. Money/Insurance | "He [dentist] wants an FMX and a panorex; insurance won't cover all of that; and that helps to detect [oral cancer]…" |
| 2. Time | "I'm sorry, time was an issue, and I did not do it there [private practice] as regularly as I do it now [hospital setting],…" |
| 3. Insufficient Support From Dentist | "Unless the dentist is behind you, he/she [patient] is just going to think, 'oh, it's just a white spot, and I'm not going to worry about it." |

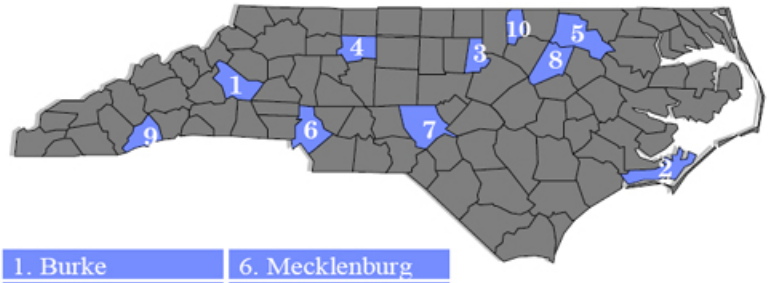
**Figure 3**
Barriers to Tobacco Cessation Counseling

| Barriers | Quote |
|---|---|
| 1. Lack of Patient Interest | "In my experience, zyban doesn't even work if they don't want to quit." |
| 2. Lack of Patient Education Materials | "I want my patient to help themselves… my commitment is to educate them…" |
| 3. Smoking Parents of Adolescents | "…when the person that gave them cigarettes is sitting out in the waiting room and is going to light up with them when they leave…" |
| 4. Provider – Patient diversity In age, ethnicity and culture | "I'm trying to preach to a 45 year old patient … They look at me like, 'what do you know?'" |

## Results

The study population represented counties spread across North Carolina as illustrated in Figure 1. The dental hygienists participating in this study estimated that approximately 42% of their patients were using some form of tobacco. The participants ranged in years of practice from 2 to 35 years and the mean number of hours worked per week was 31.8 (Table I). Ten of the dental hygienists graduated with an associate degree in dental hygiene, and 5 graduated with a bachelor's degree.

**Figure 1**
North Carolina Counties Represented by Focus Group Participants




| | |
|---|---|
| 1. Burke | 6. Mecklenburg |
| 2. Carteret | 7. Moore |
| 3. Durham | 8. Nash |
| 4. Forsyth | 9. Transylvania |
| 5. Halifax | 10. Vance |

The majority of the dental hygienists in both groups reported performing OPC exams on every patient, and these exams were being performed by both the dentist and the dental hygienist. In some situations, the dental hygienists reported that while the dentists were performing the screenings, it was mostly for new patients and selectively for those they felt were high risk as opposed to universally for every patient. In addition, they thought most dentists performed only an examination of the intra-oral mucosa, and it was unusual to find a dentist that performed an entire head and neck examination. A few

of them even felt the dental hygienist was more likely to find something because, "they are going from corner to corner...whereas the dentist is probably going to only one area to work."

Four major themes emerged from the discussions. They included

The charge of the dental hygienist was not necessarily to diagnose cancer, but to recognize abnormalities and initiate referral when necessary.

The dental hygienist is only helpful in the tobacco cessation process if the patient has a desire to quit.

The dental hygienist is most effective if the patient believes the provider is genuine and truly cares about the patient's well-being.

There is a need for continuing education courses in oral cancer screenings and tobacco cessation, specifically hands-on courses.

***Theme 1: The charge of the dental hygienist was not necessarily to diagnose cancer, but to recognize abnormalities.***

While the majority reported that they were uncomfortable in their level of training in making a differential diagnosis for oral malignancy, several of the dental hygienists relayed that their charge was merely to recognize normal from abnormal, and initiate a referral for differential diagnosis. Most of them felt confident that they could and were recognizing abnormalities in and around the mouth. A couple of the participants even noted that their comfort level was improved knowing that the dentist was also performing an oral cancer screening because, "2 sets of eyes are better than one."

When asked about the use of diagnostic tests such as Vizilite® (Zila Pharmaceuticals, Inc., Phoenix, Ariz) and Oral CDx® brush biopsy (CDx Laboratories, Inc., Suffern, NY), many of them recognized that even if they were using these tests, this was a preliminary screening to help them determine whether or not the patient needed to be referred to a specialist to make a definitive diagnosis. Some of their related comments included:

"Most of the time we can tell when something doesn't look right, and I think that is what our charge is."

"They're taking that biopsy, and sending it to a lab and it's the abnormal cell count that's actually determining whether or not this is oral cancer. Because it could be a mole or a freckle in someone's mouth and it's nothing. Or it could be the total opposite. Nobody really knows without that structured lab test."

"I know normal from abnormal. With as many oral pathology classes as I've taken over the years, I wish I could identify something as being precancerous as opposed to just being a red flag."

"But you're the front source, you're the front line. If you don't send them to the oral surgeon they're never going to have that biopsy."

***Theme 2: The dental hygienist is only helpful in the tobacco cessation process if the patient has a desire to quit.***

Almost all of the participants agreed that only if the patient showed a desire to quit, would they provide counseling. Most of them believed that a patient will only quit when and if he or she "wants" to. One dental hygienist went a little further, and said she felt it was her responsibility to inform every patient of the risks of tobacco use, but again, if the patient showed no desire or willingness to try, she did not go any further. Only a couple of the participants stated specific situations where they would always counsel a patient to quit smoking. These included periodontal patients, patients undergoing implant treatment, and pregnant women. Comments about determining whether or not to provide counseling included:

"It is an addiction...It's really one of those things, if they don't want to, there's really nothing you can do for them."

"In my experience, Zyban® doesn't even work if they don't want to quit."

"If they come in and immediately confess, 'I know I shouldn't smoke' you've got somebody that's probably willing to listen."

"I used to be a smoker. I know what people used to say to me, and I smoked through school, and it was just one of those things until you are ready to quit...you will not."

***Theme 3: The dental hygienist is most effective if the patient believes the provider is genuine and truly cares about the patient's well-being.***

All of the dental hygienists felt one of the most important things they could do for their patient was show them that they were genuine and that they cared about their health. They felt this helped in communication with the patient. One dental hygienist discussed the importance of documentation of personal data as well as clinical data. Clinical data provides a basis for comparison at each appointment, and personal data provides reminders of who the patient is and helps the dental hygienist form a relationship with the individual. The participants reiterated that if there is a genuine relationship between patient and provider, the patient has more reason to listen to what the provider knows because, "they don't care how much you know, until they know how much you care." In expressing opinions regarding this theme, some of their statements were:

"They're not really going to have any trust in you, or your ability to do anything for them if they don't even think that you know them."

"I think we're one more health care provider that can iterate to the patients the problems that smoking will incur if they're young...and that I care about you...I care about you as a person, as my patient, and I want you to come back for the next 20 years..."

"When I was growing up my dental hygienist was my provider for about 8 years. I loved going there. It was just nice to know that she knew me...it makes it more comfortable."

"You have to make them understand that you are not just concerned about their mouth. You know, communicate with the patient and let them know that yes we are concerned about your whole health and not just your teeth."

***Theme 4: There is a need for continuing education courses in oral cancer screening and tobacco cessation, specifically hands-on courses.***

Almost all of the dental hygienists said there was always a need to refresh their knowledge level, and gave suggestions for the best methods of continuing education. Many of them felt just having the opportunity to talk with other dental hygienists and share ideas was helpful in improving their skills. Two dental hygienists from separate focus group sessions reported attending courses with local oral surgeons, and reported these courses to have been the most insightful and helpful courses related to the topic of early detection of oral cancer. The oral surgeons showed them "hands-on" techniques for what and how to palpate when performing an intra- and extra-oral screening exam. In addition, the oral surgeons had shown pictures of patients they had seen. Many of the participating dental hygienists suggested that the use of pictures to help them recognize lesions was helpful. Dental hygienists from the first focus group had attended an all day CE course on tobacco use, tobacco cessation, and recognizing pathological lesions. A couple of these dental hygienists referred to the course and said the pictures were the most helpful aspect in improving their knowledge regarding pathological lesions.

In regards to tobacco cessation, most of the dental hygienists stated that their training had come largely from working experience as opposed to their formal education. The useful tool of discussions with other professionals was reiterated. They felt this provided examples of dialogue they could use and how to approach specific patients when discussing tobacco cessation. They also liked the idea of courses where they were given sample dialogues and an opportunity to practice them.

In offering suggestions, the dental Hygienists' responses included:

- "...you have to continue to learn. There's always going to be new methods of doing things...."
- "A workshop where you actually do it, not just sit down and listen to a lecture..."
- "...courses like the one we sat through today are perfect, the pictures are vital, you can see them..."
- "I learn more by talking to other people...how would she say it, versus the way I say it...getting together as hygienists and sharing how we all do it is really helpful."

***Barriers to OPC screening exams***

The dental hygienists from both groups identified several barriers to performing OPC exams (Figure 2). First, a financial barrier was suggested. Many of the dental hygienists came from rural, low-income areas where patients had little, if any, money to spend on dental and or medical expenses that are not covered by insurance. Several of the dental hygienists suggested the panoramic radiograph as a helpful tool when detecting advanced cancerous lesions of the jaw. However, most insurance companies will only cover this procedure once every 5 years. The same barrier was mentioned in the use of ViziLite® and Oral CDx®. Insurance often will not cover these tests, and the participants found many patients did not have money to cover extra diagnostic tests. In addition, it was suggested that these tests only give reason to refer the patient for a biopsy, and again, in some situations, the patient will end up paying more money to have a surgical biopsy to determine the pathological diagnosis.

Another barrier mentioned by several of the dental hygienists was a lack of support from the dentist. In some situations, the dental hygienist is the only one encouraging the patient to have a biopsy, and the patient doesn't always perceive the urgency without the support or encouragement from the dentist as well.

One dental hygienist felt that having more time just for the health history assessment would be useful in the early detection of oral cancer. When asked if they were performing a comprehensive health assessment including assessment of alcohol and tobacco use for every patient, all of the participants agreed they were doing it. In addition, most of them reported that it was rare for a dentist to do a thorough review of the health history. Most of the dentists, if assessing the health history, were reported to do so only for new patients. At subsequent visits, it was usually only the dental hygienist performing such an assessment.

Other barriers mentioned were in regards to the native language, ethnicity, and personality of the patient. The dental hygienists explained that some patients are just harder to approach and talk with than others.

***Barriers to Tobacco Cessation***

As with oral cancer screenings, the participants identified several barriers when providing tobacco cessation counseling (Figure 3). Some felt it was easier to talk to or counsel patients who were using spit tobacco as opposed to smoking, because smoking is more widely accepted. As with the previous question, many of the participants in both groups felt the patient's disinterest or lack of desire to quit was a barrier, especially when the patient had been using tobacco for many years. A few of the dental hygienists went further and suggested that in some areas of North Carolina, tobacco use is so common and mainstream, it is difficult to persuade a patient to quit. One participant discussed the move toward smoke-free environments on some hospital campuses which prohibit smoking indoors as well as outdoors on any of the grounds or parking areas included in the hospital complex. She expressed a desire for North Carolina to follow suit in other public locations such as universities and public schools.

As with OPC screenings, a couple of the participants felt that the personality of the patient could sometimes be a barrier. Some patients don't want to talk, and therefore it is difficult to get them to converse about quitting. In addition, some of the younger participants felt age was a barrier. Many reported difficulty in getting their older patients to take them seriously when trying to inform them of risks or when encouraging them to quit.

Another frequently reported barrier was the lack of written materials or resources to give the patients. One participant reported that her patient showed interest in using an over-the-counter product, but both she [the dental hygienist] and the dentist were unsure what product was best for the patient, and didn't know what to prescribe. A couple of others reported that they were timid to bring it up without having statistics to give the patient. In addition to having statistics, many of the participants thought they would feel more confident if they could hand interested patients a card with a phone number or written program to follow. 1-800-Quit cards were specifically mentioned as a useful tool when helping patients with tobacco cessation.

A barrier that came up with younger patients using tobacco was that of the parents influence on their behavior. They are setting the example and sometimes even giving the cigarettes or smokeless tobacco to their child.

At the conclusion, the dental hygienists were asked what they felt was the most important thing they could do to help control oral cancer. The most common answer stated was education. Most felt they had a responsibility to educate patients

about risk factors in order to help the patient help him or herself. One dental hygienist specifically stated, "I want my patients to help themselves...my commitment is to educate them..."

Their comments led to a discussion of the value of participation in oral cancer education in the community as well as in the private practice setting, and education to improve overall health, not just oral health. A few stated the importance of involvement in education for the entire dental team. Some expressed frustration as they were the only one in their practice promoting oral cancer awareness, and without support from the dentist, or even other team members, the patient may not take their advice seriously.

## Discussion

Focus group research is about listening and then being thoughtful and systematic about the information that has been shared. When used appropriately, the information gained from focus groups can benefit not only those who participated but also those who share the information after the fact.[59] Thoughts and opinions shared during focus groups can augment quantitative research in providing insight into a given topic. More insight is gained depending on the number of focus groups held.[59] One potential weakness of this study may be that only 2 focus groups were held. More focus groups may have further validated the themes and barriers that arose during this study. Furthermore, while participants in this study seemed to be very candid in expressing their opinions and practices, one cannot be sure if the views expressed in the focus groups would be the same as those expressed by an individual dental hygienist unaware of other colleagues' comments. The use of personal interviews with a separate group of dental hygienists addressing the same topics discussed in these focus groups could help triangulate the study. In doing so, one could be sure that themes and barriers were not necessarily determined by a group setting.

The first focus group was held following a tobacco cessation course as well as a pathology course, and some of their comments refer back to these specifically when answering prompt questions. This introduces a potential bias, and may have had some influence on opinions shared in the first group. However, similar views arose in the second group, such that themes and barriers seemed to be the same among both focus groups rather than significantly influenced by the prior CE course content.

Finally, one must be careful about extrapolating these findings outside of North Carolina. The majority of dental hygienists in this study had only practiced under North Carolina's state practice act in communities within the state. The comments from dental hygienists in other states may vary slightly due to variations in practice acts, as well as patient populations.

Regardless of previously mentioned weaknesses and bias, the views and opinions shared in these focus groups offer a strong supplement to previous research and literature in designing educational models regarding the control of OPC in the state of North Carolina and possibly in other geographic areas. The randomized mail survey conducted by Ashe et al[26,27] provides quantitative information on opinions and practices of NC dental hygienists regarding knowledge and assessments of OPC risk factors, opinions and practices regarding OPC exams, and educational counseling related to the prevention of OPC. Combined, these 3 studies provide a clear justification for improved educational methods regarding OPC prevention and early detection. Training and education in OPC screening exams, though sometimes limited, has been a part of dental hygiene curricula for some time. It is surprising that more dental hygienists are not comfortable and habitual in providing these exams.

In the field of dental hygiene, training and treatment are centered on the prevention of disease and the recognition of unhealthy circumstances. In controlling mortality rates related to OPC, prevention and recognition are needed. These services fit perfectly in the dental hygiene model of care. Participants in the current study exhibited strong beliefs that as dental hygienists, they are in an important position to help increase awareness among their patients and to help motivate patients to change. They also stated patient education to be of the utmost importance in their role as an oral health care professional.

The findings suggest the importance of developing relationships of trust between patient and provider in order to increase perceived value of the dental hygiene appointment and services provided therein. The experiences shared by participants support the concept that patients are more open with the dental hygienist regarding willingness to change behaviors that

place them at high risk for oral cancer when a relationship of trust with the practitioner has been established. When patients believe the provider is genuinely concerned about them, they are also more likely to listen to educational information regarding their health. Study participants shared experiences of being more comfortable with physicians, dentists, and even dental hygienists who remembered their names and personal details about them. Documentation of personal information helps remind the practitioner of specific details shared by the patient. This can even include opinions and changes in life situations shared during interventions to address tobacco use and/or alcohol abuse.

Time was reported as a potential barrier that determined whether or not the dental hygienist was providing risk factor counseling and/or OPC screenings. Another part of exhibiting genuine concern for the patient means taking time to address his or her needs. Not taking time to screen for OPC or address a patients' health history may convey that the provider is only interested in the current status of the teeth; when actually, dental hygienists have training to recognize that the current status of the mouth can reflect the current health of the entire body. If patients understand the dental hygienist's role in prevention of oral diseases in order to maintain overall health, perhaps they would be more likely to trust the dental hygienist when suggestions for change regarding the prevention of OPC are made. In addition, they might be more ready to share their desire and willingness to address behaviors that place them at risk for oral cancer.

Focus group participants performing regular OPC exams stated that many returning patients were very familiar with the process and could recognize the service when it was performed. It seems likely that dental hygienists can increase awareness simply by providing regular OPC exams. In addition, when the provider takes the time to explain and educate the patient about the exam, the patient becomes more familiar with the service, and perhaps in time, will come to expect, value, and demand that service during the course of a preventive re-care appointment. Also to consider, time may become less of an issue as the patient becomes more educated.

The focus group participants believed patient education was a valuable part of their role as a dental hygienist in addressing issues related to OPC. Research on adults' knowledge and perceptions of OPC and associated risk factors supports this need for oral health professionals to educate their patients regarding such topics.[9,31-32] Unfortunately, research also reports deficiencies in dental Hygienists' practices regarding prevention and detection of OPC.[6-7,53,55-58]

Dental hygienists could and should play a major role in the control of OPC, and therefore it is imperative that they be knowledgeable and comfortable in providing OPC exams as well as risk factor counseling. Dental hygiene programs have a responsibility to ensure they are providing adequate time and education regarding these practices. However, it seems apparent from this study, as well as in the survey of NC dental hygienists [6,7] and previous studies in Maryland,[53,55-56] that there is a pronounced desire and need for CE on the topic of oral cancer detection and prevention. Specifically, a request for "hands-on" courses where they are given opportunities to practice OPC exams and practice sample dialogues that could be used in risk factor counseling situations. Participants from this study also emphasized the importance of photographs displaying actual malignancies when attending CE courses.

Previous studies confirm dental Hygienists' deficits in knowledge and abilities in providing OPC exams and risk factor counseling as well as those of dentists.[6-8,55,51,53-58] Most states require a minimum number of CE hours per year to maintain licensure.[60] In North Carolina, 6 hours of CE must be directly related to patient care. Although, the survey of NC dental hygienists conducted by Ashe et al revealed that almost 10% of respondents had never dedicated any of these CE hours to a course regarding oral cancer, 96% expressed interest in attending such a course.[7] New York recently mandated dentists' attendance at a 2 hour CE course on oral health effects associated with tobacco and tobacco products.[61] No such mandate exists for dental hygienists in the US, but perhaps states could follow suit in requiring that a specified number of dental hygiene CE hours be dedicated to further training in the area of OPC control.

Finally, continued training in early detection and prevention of oral cancer could help address some of the barriers mentioned by participants in this study. Some of the dental hygienists expressed frustration that they were the only team member focused on OPC screenings and/or prevention. As dental hygienists and dentists become more focused and confident in early detection and prevention, they may be more likely to ensure time is provided for such services and support each other in such practices. Diversity issues such as language and cultural barriers could be addressed in CE courses giving dental hygienists skills to help them feel confident in developing relationships with all of their patients regardless of personality or culture.

## Conclusions

The views and opinions shared in this study offer a strong supplement to previous research and literature. This study aimed to provide further insight as to why dental hygienists in the state of North Carolina are or are not providing services that contribute to the prevention and early detection of OPC. The findings from this study as well as from other studies[6-8,62] provide information to initiate the development of a state model to help increase awareness among dentists and dental hygienists regarding the importance of risk factor assessment and regular performance of oral cancer screenings for every patient. Combined, these studies provide a clear justification for improved educational methods that will increase awareness regarding OPC prevention and early detection among oral health care providers.

It is important to begin addressing barriers related to OPC screenings and risk factor counseling. Improved educational models in schools as well as continuing education courses can address some of these barriers as well as move the profession forward in making a paradigm shift where providing these services is no longer just an additional benefit, but instead, the expectation of oral health professionals and their patients.

## Acknowledgements

***Carrie Bigelow was a master of science degree candidate at the time of this research. This project served to meet partial fulfillment of the Master of Science Degree in Dental Hygiene Education at the University of North Carolina School of Dentistry. She received the 2007 ADHA/Sigma Phi Alpha Journalism Award for this paper. Bigelow is currently an adjunct clinical lecturer in the Department of Periodontics and Oral Medicine at the University of Michigan, Ann Arbor, Mich.***

***This paper was supported by NIH grant DE14413.***

## Notes

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## References

1. Jemal A, Siegel R, Ward E, Murray T, Xu J, Thun MJ. Cancer statistics, 2007. CA Cancer J Clin. 2007. Jan-Feb;57(1): 43-66.
2. Ries LAG, Harkins D, Krapcho M, et al.. , editors. SEER Cancer Statistics Review, 1973-2003 [Internet]. Bethesda, MD: National Cancer Institute; 2006. Available from: http://seer.cancer.gov/csr/1975_2003/.
3. Ries LAG, Harkins D, Krapcho M, et al.. Incidence rates and trends for oral and pharyngeal cancer in North Carolina: 1990-1999. Oral Oncol. 2005. May;41(5): 470-9.
4. Patton L. North Carolina needs assessment for oral cancer control. 2001. NIH/NIDCR Grant R21 DE11413($436,500.00). .
5. BRFSS News Brief. Behavioral Risk Factor Surveillance System News Brief - North Carolina [Internet]. 2005. Nov [cited 2007 Jan 15]. Available from: http://www.schs.state.nc.us/SCHS/brfss/pdf/brfssgaso05.pdf.
6. Ashe TE, Elter JR, Southerland JH, Strauss RP, Patton LL. North Carolina dental Hygienists' assessment of patients' tobacco and alcohol use. J Dent Hyg. 2005 ;79(2): 9.
7. Ashe TE, Elter JR, Southerland JH, Strauss RP, Patton LL. North Carolina dental Hygienists' oral cancer knowledge and opinions: Implications for education. J Cancer Educ. 2006;21(3): 151-6.
8. Patton LL, Elter JR, Southerland JH, Strauss RP. Knowledge of oral cancer risk factors and diagnostic concepts among North Carolina dentists. Implications for diagnosis and referral. JADA. 2005. May;136(5): 602,10;quiz 682.
9. Patton LL, Agans R, Elter JR, Southerland JH, Strauss RP, Kalsbeek WD. Oral cancer knowledge and examination experiences among North Carolina adults. J Public Health Dent. 2004;64(3): 173-180.
10. Patton LL, Ashe TE, Elter JR, Southerland JH, Strauss RP. Adequacy of training in oral cancer prevention and screening as self-assessed by physicians, nurse practitioners and dental health professionals. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006;102(6): 758-64.
11. Oral Cancer: What you need to know [homepage on the Internet]. Bethesda, MD: Oral Cancer: What you need to know; c2004. [cited 2007 Jan 7]. Available from: http://www.cancer.gov/cancertopics/wyntk/oral.

12. Silverman S. Oral Cancer. (5thed). Gansler T, Steele G, Phillips T, Chabner B. , editors. Hamilton, Ontario, Canada: BC Decker Inc.; 2003.
13. Neville BW, Day TA. Oral cancer and precancerous lesions. CA Cancer J Clin. 2002. Jul-Aug;52(4): 195-215.
14. de Visscher JG, Grond AJ, Otter R, van der Waal I. Lip carcinoma. A review. Ned Tijdschr Tandheelkd. 2002. Oct;109(10): 391-5.
15. Franceschi S, Favero A, Conti E, Talamini R, Volpe R, Negri E, Barzan L, La Vecchia C. Food groups, oils and butter, and cancer of the oral cavity and pharynx. Br J Cancer. 1999. May;80(3-4): 614-20.
16. Gridley G, McLaughlin JK, Block G, Blot WJ, Gluch M, Fraumeni JF. Vitamin supplement use and reduced risk of oral and pharyngeal cancer. Am J Epidemiol. 1992. May;135(10): 1083-92.
17. Llewellyn CD, Johnson NW, Warnakulasuriya KA. Risk factors for squamous cell carcinoma of the oral cavity in young people--a comprehensive literature review. Oral Oncol. 2001. Jul;37(5): 401-18.
18. Fouret P, Monceaux G, Temam S, Lacourreye L, St Guily JL. Human papillomavirus in head and neck squamous cell carcinomas in nonsmokers. Arch Otolaryngol Head Neck Surg. 1997. May;123(5): 513-6.
19. Maden C, Beckmann AM, Thomas DB, et al.. Human papillomaviruses, herpes simplex viruses, and the risk of oral cancer in men. Am J Epidemiol. 1992. May;135(10): 1093-102.
20. Kobayashi I, Shima K, Saito I, Kiyoshima T, Matsuo K, Ozeki S, Ohishi M, Sakai H. Prevalence of Epstein-Barr virus in oral squamous cell carcinoma. J Pathol. 1999. Sep;189(1): 34-9.
21. Talacko AA, Teo CG, Griffin BE, Johnson NW. Epstein-Barr virus receptors but not viral DNA are present in normal and malignant oral epithelium. J Oral Pathol Med. 1991. Jan;20(1): 20-5.
22. Blot WJ, McLaughlin JK, Winn DM, et al.. Smoking and drinking in relation to oral and pharyngeal cancer. Cancer Res. 1988. Jun;48(11): 3282-7.
23. Tobacco smoking. IARC Monogr Eval Carcinog Risk Chem Hum. 1986;38: 35-394.
24. Alcohol drinking. Biological data relevant to the evaluation of carcinogenic risk to humans. IARC Monogr Eval Carcinog Risks Hum. 1988;44: 101-52.
25. Silverman S, Griffith M. Smoking characteristics of patients with oral carcinoma and the risk for second oral primary carcinoma. JADA. 1972. Sep;85(3): 637-40.
26. Trock B. Out of the mouths of babes: Oral premalignant lesions and use of alternative tobacco products. Cancer Epidemiol Biomarkers Prev. 2000. July;9(7): 637-8.
27. Mashberg A, Boffetta P, Winkelman R, Garfinkel L. Tobacco smoking, alcohol drinking, and cancer of the oral cavity and oropharynx among U.S. veterans. Cancer. 1993. Aug;72(4): 1369-75.
28. Jovanovic A, Schulten EA, Kostense PJ, Snow GB, van der Waal I. Tobacco and alcohol related to the anatomical site of oral squamous cell carcinoma. J Oral Pathol Med. 1993. Nov;22(10): 459-62.
29. Lewin F, Norell SE, Johansson H, Gustavsson P, Wennerberg J, Biorklund A, Rutqvist LE. Smoking tobacco, oral snuff, and alcohol in the etiology of squamous cell carcinoma of the head and neck: A population-based case-referent study in Sweden. Cancer. 1998. Apr;82(7): 1367-75.
30. Andre K, Schraub S, Mercier M, Bontemps P. Role of alcohol and tobacco in the aetiology of head and neck cancer: A case-control study in the Doubs region of France. Eur J Cancer B Oral Oncol. 1995. Sep;31B(5): 301-9.
31. Kim HY, Elter JR, Francis TG, Patton LL. Prevention and early detection of oral and pharyngeal cancer in veterans. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006. Nov;102(5): 625-31.
32. Ariyawardana A, Vithanaarachchi N. Awareness of oral cancer and precancer among patients attending a hospital in Sri Lanka. Asian Pac J Cancer Prev. 2005. Jan-Mar;6(1): 58-61.
33. Tomar SL, Logan HL. Florida adults' oral cancer knowledge and examination experiences. J Public Health Dent. 2005;65(4): 221-30.
34. Davis JM. Tobacco cessation for the dental team: A practical guide part I: Background & overview. J Contemp Dent Pract. 2005. Aug;6(3): 158-66.
35. Davis JM. Tobacco cessation for the dental team: A practical guide part II: Evidence-based interventions. J Contemp Dent Pract. 2005. Nov;6(4): 178-86.
36. Cohen SJ, Stookey GK, Katz BP, Drook CA, Christen AG. Helping smokers quit: A randomized controlled trial with private practice dentists. JADA. 1989. Jan;118(1): 41-5.
37. Dolan TA, McGorray SP, Grinstead-Skigen CL, Mecklenburg R. Tobacco control activities in U.S. dental practices. JADA. 1997. Dec;128(12): 1669-79.
38. Gorin SS, Heck JE. Meta-analysis of the efficacy of tobacco counseling by health care providers. Cancer Epidemiol Biomarkers Prev. 2004. Dec;13(12): 2012-22.
39. Hastreiter RJ, Bakdash B, Roesch MH, Walseth J. Use of tobacco prevention and cessation strategies and techniques in the dental office. JADA. 1994. Nov;125(11): 1475-84.
40. Secker-Walker RH, Solomon LJ, Flynn BS, Dana GS. Comparisons of the smoking cessation counseling activities of six types of health professionals. Prev Med. 1994. Nov;23(6): 800-8.

41. Smith SE, Warnakulasuriya KA, Feyerabend C, Belcher M, Johnson NW. Johnson . journaltitle. year. month_if_listed;vol(issue): firstpage-lastpage.
42. Kreuter MW, Chheda SG, Bull FC. How does physician advice influence patient behavior? Evidence for a priming effect. Arch Fam Med. 2000. Msy;9(5): 426-33.
43. Smith SE, Warnakulasuriya KA, Feyerabend C, Belcher M, Cooper DJ, Johnson NW. A smoking cessation programme conducted through dental practices in the UK. Br Dent J. 1998. Sep;185(6): 299-303.
44. Albert D, Ward A, Ahluwalia K, Sadowsky D. Addressing tobacco in managed care: A survey of dentists' knowledge, attitudes, and behaviors. Am J Public Health. 2002. Jun;92(6): 997-1001.
45. Cruz GD, Ostroff JS, Kumar JV, Gajendra S. Preventing and detecting oral cancer. oral health care providers' readiness to provide health behavior counseling and oral cancer examinations. JADA. 2005. May;136(5): 594,601. -quiz 681-2.
46. Silverman SJ. Demographics and occurrence of oral and pharyngeal cancers. the outcomes, the trends, the challenge. JADA. 2001. Nov;132 Suppl: :7S-11S.
47. Silverman S. Controlling oral and pharyngeal cancer. Can dental professionals make a difference?. JADA. 2005. May;136(5): 576,578.
48. Holmes JD, Dierks EJ, Homer LD, Potter BE. Is detection of oral and oropharyngeal squamous cancer by a dental health care provider associated with a lower stage at diagnosis?. J Oral Maxillofac Surg. 2003. Mar;61(63): 285-91.
49. Kujan O, Glenny AM, Oliver RJ, Thakker N, Sloan P. Screening programmes for the early detection and prevention of oral cancer. Cochrane Database Syst Rev. 2006. Jul;19(3): CD004150.
50. Sankaranarayanan R, Ramadas K, Thomas G, Muwonge R, Thara S, Mathew B, Rajan B. Trivandrum Oral Cancer Screening Study Group. Effect of screening on oral cancer mortality in Kerala, India: A cluster-randomised controlled trial. Lancet. 2005. Jun;365(9475): 1927-33.
51. Horowitz AM, Drury TF, Goodman HS, Yellowitz JA. Oral pharyngeal cancer prevention and early detection. dentists' opinions and practices. JADA. 2000. Apr;131(4): 453-62.
52. Horowitz AM, Nourjah PA. Factors associated with having oral cancer examinations among US adults 40 years of age or older. J Public Health Dent. 1996 ;56(6): 331-5.
53. Horowitz AM, Siriphant P, Canto MT, Child WL. Maryland dental Hygienists' views of oral cancer prevention and early detection. J Dent Hyg. 2002;76(3): 186-91.
54. Yellowitz JA, Horowitz AM, Drury TF, Goodman HS. Survey of U.S. dentists' knowledge and opinions about oral pharyngeal cancer.. JADA. 2000. May;131(5): 653-61.
55. Syme SE, Drury TF, Horowitz AM. Maryland dental Hygienists' knowledge and opinions of oral cancer risk factors and diagnostic procedures. Oral Dis. 2001. May;7(3): 177-84.
56. Syme SE, Drury TF, Horowitz AM. Maryland dental Hygienists' assessment of patients' risk behaviors for oral cancer. J Dent Hyg. 2001 ;75(1): 25-38.
57. Forrest JL, Drury TE, Horowitz AM. U.S. dental Hygienists' knowledge and opinions related to providing oral cancer examinations. J Cancer Educ. 2001;16(3): 150-6.
58. Forrest JL, Horowitz AM, Shmuely Y. Dental Hygienists' knowledge, opinions, and practices related to oral and pharyngeal cancer risk assessment. J Dent Hyg. 2001;75(4): 271-81.
59. Krueger RA, Casey MA. Focus groups: a practical guide for applied research. (3rded). Thousand Oaks, CA: Sage Publications; 2000.
60. Schleyer T, Eaton KA, Mock D, Barac'h V. Comparison of dental licensure, specialization and continuing education in five countries. Eur J Dent Educ. 2002. Nov;6(4): 153-61.
61. Continuing Education - Questions and Answers for Dentists and Dental Hygienists [homepage on the Internet]. New York, NY: New York State Education Department, Office of the Professions; [cited 2007 Jan 15]. Available from: http://www.op.nysed.gov/dentceques.htm.
62. Patton LL, Ashe TE, Elter JR, Southerland JH, Strauss RP. Adequacy of training in oral cancer prevention and screening as self-assessed by physicians, nurse practitioners, and dental health professionals. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 . Dec;102(6): 758-64.

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# As Assessment of Online Learning in a Dental Hygiene Baccalaureate Degree Completion Program

Wendy Moore, RDH, EFDA, MSA

***The Ohio State University's Dental Hygiene Program recently implemented a baccalaureate degree completion program (BDCP) in a web-based online format. In 2005, The Institute for Higher Education Policy set 24 benchmarks to ensure quality of internet-based distance education. To meet these benchmarks, the BDCP is continually reviewed to ensure quality learning.***

***Objectives. The objective was to assess student perceptions of the quality of learning and effectiveness of the online BDCP to meet the teaching/learning and course structure benchmarks.***

***Methods. A 16-item, 5-point Likert scale questionnaire was administered to enrolled dental hygiene students (n =13).***

***Results. Seventy-seven percent of students felt as equally challenged in an online course as in a traditional classroom course, and 85% replied that the online program is more convenient than a traditional program. One hundred percent felt the courses expanded their dental hygiene knowledge while 92% stated the online curriculum contained content not previously studied. The course objectives were clear (92%) and the syllabi contained the expectations of the assignments, deadlines, and grading criteria. Participants strongly agreed that peer interaction is important and that the courses developed critical thinking skills (92%). In discussion forums, the students felt the online learning was enhanced by other students' discussions and helped them see other viewpoints (92%). Fifty-four percent noted they are more willing to discuss topics online then in a traditional course. One hundred percent of students felt assignment feedback was constructive and provided in a timely manner.***

***Conclusion. Students feel the quality of learning and effectiveness of the online program is as equally challenging and satisfying as a traditional classroom learning format. This response demonstrates that the program strives to meet the benchmarks set to ensure quality internet-based education while providing advanced degrees to dental hygienists.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Integrating Dental and Dental Hygiene Students in an Oral Anatomy Course

Beverly A McClure, RDH, BS

***The purpose of this study was to assess dental hygiene (DH) students' perceptions regarding their oral anatomy course that integrates DH students in the first quarter of the curriculum with entering undergraduate dental students. The oral anatomy course is given to both DH and dental students in their first quarter at the same point in time. The intent of combining the classes is to foster cooperation and collaboration as well as efficiently utilizing dental and DH faculty resources. Research indicates that 2 differences between entering pre-doctoral students and beginning DH students are maturity and complexity of thought processes. With this in mind, DH students are given supplemental recitation experiences, additional quizzes, and extra lab experiences, which results in a separate grade assignment. All students attend lectures and laboratories together. At the completion of the oral anatomy course, DH students (N=33) were given a 10-item survey, using a 4-point Likert scale and open-ended questions concerning their perceptions of the combined class. Ninety-seven percent either agreed (A) or strongly agreed (SA) that they liked the integration of students while 100 % either A or SA that the lecture material was aimed at both DH and dental students. One hundred percent either A or SA that the extra lab experiences including practice tooth ID exercises were helpful. Seventy-three percent either A or SA that the recitation sessions were helpful and 88% felt the difficulty level was appropriate for DH students. A student commented, "I loved having lecture with dental students." "It makes us feel as one unit, but it is nice breaking up into a small group on Thursday mornings." The DH students appear to like the integration with dental students in the oral anatomy course. Comments did reveal some DH students felt that the additional quizzes in recitation were more difficult than those given with the dental students. Students also indicated that the additional lab exercises and practice tooth ID's were very helpful.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Dental Hygiene Clinical Assessment Incorporating Graded and Nongraded Feedback: Design, Implementation and Results

Elaine M Sanchez Dils, RDH, MA

***Clinic is a vital part of the dental hygiene curriculum. It is imperative to integrate systems that meet current educational paradigms, determine and attempt to meet the needs of the learners while adhering to the established protocols of an accredited dental hygiene program. Students expressed several concerns about their clinical experiences. In order to address these concerns, an innovative clinical assessment protocol was developed and integrated.***

***In this protocol, designated clinical requisites are divided into graded (assessed) and non-graded (feedback) requirements. Students determine on a case-by-case basis if their patient will be graded or nongraded. Assessed cases are graded according to the established Standards for Clinical Performance Criteria. Each standard has a set number of errors which constitutes a score of clinically acceptable or clinically unacceptable. The sum points attached to each acceptable or unacceptable standard gives a percentage score for the individual case. Cases that are selected to be nongraded are given formative and summative qualitative comments based upon the Standards. An additional requirement of this system is that instructors must give written remarks on each student's daily activities regardless if the patient is assessed.***

***A 14- item survey evaluating student experiences with the assessment protocol was conducted. The key findings suggest significant changes in the learning environment: 1) 91% of the total responses showed that stress was always or frequently reduced from having nongraded patients; 2) more than half of the students reported having an excellent increase in instructor feedback when compared to previous semesters; and 3) all respondents reported a greater ability to ask questions of instructors on nongraded cases. Additionally, students reported experiencing a greater sense of control of their clinical education by having the ability to choose when a patient is to be graded. This assessment system has addressed the aforementioned clinical concerns.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Evaluation of Group Assessment in a Didactic Dental Hygiene Course

Nancy T Keselyak, RDH, MA, Catherine D Saylor, RDH, BS, Melanie L Simmer-Beck, RDH, MS and Kimberly Krust Bray, RDH, MS

***Experts in curriculum design and educational methodologies encourage faculty to incorporate new strategies into their courses and practice the scholarship of teaching. One emerging strategy is group assessment. The goals of this new program were to enhance student learning and assist students in developing interpersonal relationships early in the curriculum by engaging students in collaborative and active learning strategies. Key features of the program included a group assessment strategy where 29 (n=29) dental hygiene students took 8 (n=8) individual assessments (quizzes) immediately followed by completion of the same assessment in a 5-member peer group as part of a didactic dental hygiene course during their first semester. A 2-Factor ANOVA and F-test statistical design compared student performance on individual and group assessments. At the end of the semester, students provided self-reflection data regarding their perceptions of the process. Faculty reflection and graduate student observations were recorded. Qualitative analyses were used to analyze the data. Results suggest that group scores were higher than individual scores. Students perceived the group assessment strategy as positive, helping them learn from each other, receive immediate feedback, and retain knowledge through repetition. Fairness and time constraints were raised as concerns. Group assessment benefited individual preparation, interaction with peers, and students' relationship with faculty. The group assessment strategy used in this dental hygiene course had a positive impact on student learning and student perceptions of learning. However, faculty must consider the issues regarding perceived fairness and the impact of shared assessments in determining the overall course grade.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Expanding School-Based Sealant Programs to Realize Treatment Cost Savings in Colorado

Theresa M Anselmo, BSDH, RDH, MPH(c), Diane K Brunson, MPH, BSDH, RDH, Megan E Martinez, MPH, Mathew Christensen, PhD and Joan O'Connell, PhD

***Children of lower socioeconomic status suffer a disproportionate amount of dental caries compared to their higher income counterparts. Dental sealants have been shown to be effective in preventing caries in permanent molars. Targeting school-based sealant programs using free and reduced lunch participation as a proxy for income is cost-effective in reducing decay in populations at greater risk for dental disease.***

***In 2004, the prevalence of dental sealants in first permanent molars among third-graders in Colorado was determined using a random sample of 44 schools. Approximately 34% of third-graders were found to have at least one sealant, significantly less than the desired Healthy People 2010 objective of 50%. In 2005, the Colorado Oral Health Program, Be Smart and Seal Them, embarked on an expansion of school-based sealant programs focused on meeting the Healthy People 2010 objective and incorporating the use of CDC-developed software (SEALS) to evaluate efficiencies and monitor program impact. The ground work for this expansion was based on a yet unpublished cost-effectiveness study by health economist Joan O'Connell, PhD, et al in 2004. Sealant delivery, targeted to second-graders in greatest need of oral disease prevention, was secured through contractual agreements with independently practicing dental hygienists.***

***In 2006, the efforts of the Colorado Be Smart and Seal Them program doubled the percentage of schools participating in the program and the number of children served increased by 55%. An estimated 2200 occlusal caries were averted saving an estimated $212 000 in treatment costs of single surface, occlusal, amalgams. In 2005-2006 Be Smart and Seal Them developed in capacity (contractors, coordinator, schools, students); uniform data reporting (SEALS coordinating all contractor activities); and meeting the greatest oral health needs (disparities reduced, disease averted, cost savings). Contractors and the state coordinator reported areas of growth and improvement and identified further needs.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Evaluation of Online Learning with Rubrics

Marge R Reveal, RDH, MS, MBA

***Degree completion dental hygiene students often find it difficult to adapt to a totally online environment because there is no face-to-face communication. How to study and "uncovering" material is very important in the computer-based environment. One method to enhance learning-centered teaching is the use of rubrics. A rubric is a scoring tool that provided the specific requirements for an assignment by describing the specific parts of an assignment and what constitutes acceptable and unacceptable levels of performance for each part. This poster will demonstrate sample rubrics for theory-based and service-learning within the online environment. The requirements for an effective rubric will be described. Rubrics can save teachers many hours of grading while providing meaningful and timely feedback to students. Students may use rubrics for self-evaluation of their own work before submission of their assignments. Rubrics provide a "fair" way of evaluating student learning. Rubrics have been shown to allow online students to adapt to the degree completion program and to have a better understanding of what is expected of them as critical thinkers and evidence-based learners.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Patient Knowledge of the Link Between Diabetes and Periodontal Diseases

Missy M Please, RDH, MS

***Knowledge of possible complications associated with disease is generally viewed as a precursor to positive health behaviors. The purpose of this investigation was: 1) to determine the knowledge of individuals with diabetes of the potential risk of periodontitis due to their disease; 2) to identify if a relationship exists between the frequency of positive oral self-care behaviors and knowledge related to diabetes; and 3) to ascertain if diabetics are receiving information regarding the risk of periodontal diseases from members of their health care team. The study was approved by the University of New Mexico, School of Medicine, Internal Review Board. Fifty-two persons meeting predetermined eligibility requirements were asked to participate in the study as they presented for health care appointments at participating health care sites; three were ineligible and four declined to participate (n=45). Data were collected via a 22-item, self-reported questionnaire. Data analyses including frequencies and tests of association were conducted by the statistical software program MINITAB® Release 14. The key findings of this investigation were: 1) the majority (91%) of the subjects reported a belief that oral health could be affected by diabetes; 2) the knowledge of the oral-diabetes link is not associated with frequent tooth brushing and flossing, but is associated with having a dental cleaning within the previous 12 months and the use of an OPT device (p<.05); and 3) less than half of the participants were advised by a health care provider that they should practice preventive oral-self care behaviors or received information regarding the relationship between diabetes and periodontal diseases. Findings support the need to investigate the motivational and behavioral methods related to preventive oral health practices and incorporate such strategies into diabetes educational programs and clinical settings.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# The Role of Service Learning Throughout the Dental Hygiene Curriculum

Ann L Brunick, RDH, MS and Beverly J Kennedy, RDH, MA

***The dental hygiene curriculum at the University of South Dakota is primarily service-oriented and students provide dental hygiene services in various settings as course requirements. In addition, many service-learning projects are embedded throughout the curriculum. Beginning in their preclinical course, students develop and complete a service-learning project, then reflect on what they've learned about themselves and those assisted. Projects range from basic toothbrushing instructions for preschool children to interactive education for prenatal and "Baby & Me" classes and leading an interdisciplinary team of professional students in applying fluoride varnish to over 200 elementary children. SADHA members' civic involvement has improved the quality of life of soldiers by sending kits overseas and of inmates by delivering holiday sacks. As up to 90% of the graduating class receives their BS degree, all must meet a 15-hour service-learning requirement for USD's signature IdEA (Interdisciplinary Education and Action) program. Currently, dental hygiene students in this course are making fleece blankets for those less fortunate. This project involves grant writing, matching funds, speaking at a board meeting, and comprising a budget and timeline. Students learn everyone has a role, and coordinate activities to achieve a common purpose.***

***Faculty have found students stretch beyond the classroom and learn from these real world experiences. As such, they are provided with diverse learning experiences, a goal of our program. The written reflections following completion of the projects are positive indicating greater self-esteem, more awareness of societal inadequacies, and a desire to be involved in a community as they begin their professional careers. We believe service learning enhances dental hygiene education and is an integral part of our curriculum.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Outcomes Assessment of an Education Program to Enhance Ethics and Professionalism in Dental Hygiene Practice

Denise M Bowen, RDH, MS, Carlene S Paarmann, RDH, MEd and Carole R Christie

***This project is the culmination of a long-term program to enhance student competence and program outcomes related to ethical reasoning and professionalism. The process included: 1) developing 5 supporting competencies; 2) assessing related course content and evaluation methods; 3) incorporating ethics and professionalism throughout the curriculum; 4) implementing faculty development using core values for assessing students' professional judgment in clinic; 5) evaluating students' professional judgment during patient care; and 6) surveying graduating students and recent alumni in practice.***

***Affective and tangible components of ethical reasoning and professionalism can be competitive with financial and production expectations in practice. Students must be taught ethical decision-making and critical thinking skills to resolve competing interests and provide patient-centered care. To ascertain if competence is retained effective evaluation is needed throughout the curriculum, at graduation, and after entry into practice.***

***Outcomes assessment of ethics and professionalism included graduating seniors' exit interviews (N=25) and alumni surveys one and 3 years post-graduation (N=29). Qualitative differences after program implementation were notable with 100% exit interview comments positive regarding education in ethics and professionalism, no suggestions for improvement made, and all interviewees reporting competence and confidence in ethical reasoning and decision making. Comments (49%) prior to curricular change and faculty development suggested changes needed in this aspect of their education. One year and 3 years post-graduation respondents (100%) strongly agreed or moderately agreed with the following: 1) their reasoning ability about ethical and professional dilemmas was enhanced by their dental hygiene education; 2) they demonstrated professional conduct in practice using ethical decision making and problem solving skills; and 3) their professional decisions were consistent with dental hygiene standards of care and legal regulations. This project documents long-term effectiveness of one approach for increasing awareness and competency in ethics and professional responsibility during patient care.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Developing Instructional Materials: An Independent Study Practicum for Dental Hygiene Students

Melanie L Simmer-Beck, BSDH, MS and Nancy T Keselyak, BSDH, MA

***With the recent advancements in technology, dental hygiene students are learning didactic knowledge in a much different way. Platforms such as Blackboard allow students to learn and study core classroom materials at remote sites. The goals of this practicum were to create interactive instructional videos for junior dental hygiene students based on established teaching competencies, to engage students in peer mentoring, and to explore alternative career options for dental hygiene graduates. The key features of this practicum were for 3 (n=3) senior dental hygiene students to: understand the elements necessary to develop quality educational materials using current technology, experience the process of developing instructional and evaluation resources, and participate in classroom and clinic teaching activities using the resources they developed. The practicum defined content area, reviewed current literature for evidence to support the content of the videos, developed a logical sequence for teaching the instructional information, and collaborated with content experts to create instructional videos. Each video was evaluated by the practicum students, faculty mentors, and content experts and revisions were made. The practicum students produced teaching videos for cubical preparation, the intra- and extra-oral examination, wheelchair transfer techniques, use of the explorer, and use of the probe. The practicum students will evaluate their work by surveying the Dental Hygiene Class of 2008 to determine how instructional materials were used, frequency of use, and ways to improve in the future. The faculty mentors will evaluate the goals of the practicum at the end of the semester through a focus group session with the practicum students.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Quantitative Analysis of Learner Performance in a Distance Educational Program

Jodi L Olmsted, RDH, PhD

***Colleges and universities are using various distance learning (DL) formats for program and course delivery. Around the country, health education, including dental and dental hygiene training programs, are employing these types of program delivery models. University of Missouri-Kansas City (UMKC), 35 undergraduate, and 12 graduate programs in the US use various forms of DL for degree completion (ADHA, 2006). Several programs, including Waukesha County Technical College (WCTC), offered their entire lecture classes in dental hygiene via distance technology. Interactive television (ITV) was the distance media used. From a program perspective, quantitative evaluation of student performance on benchmark assessments was necessary to identify if students located at a distance were performing statistically differently than students taking courses with an instructor using a traditional face-to-face format.***

***Three research questions were asked: a) Were there statistically significant differences in learner performance on the National Board of Dental Hygiene Examination (NBDHE)?; B) Were there statistically significant differences in learner performance when considering GPAs?; and C) Did statistically significant differences in performance exist relating to individual course grades? A longitudinal assessment for a 10-year period was conducted to answer these questions.***

***T-tests were used for data analysis. While examining benchmark data from a cumulative perspective, and year-by-year, no statistically significant differences were apparent for the NBDHE and GPAs. From a cumulative perspective, similar results were found for individual courses. Interactive Television (ITV) was considered effective for delivering education to learners if similar performance outcomes were the evaluation criteria.***

***Mixed results were identified when individual course data by year and course-by-course data were considered. These various mixed results identify potential future research.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# A Delphi Study to Update the American Dental Hygienists' Association National Dental Hygiene Research Agenda (NDHRA)

Ann Eshenaur Spolarich, RDH, PhD and Jane L Forrest, RDH, EdD

***Objective. The purpose of this study was to update the NDHRA to reflect current research priorities aimed at meeting national health objectives and to systematically advance dental hygiene's unique body of knowledge.***

***Methods. 49 dental hygiene experts and key opinion leaders representing all domains of the profession agreed to participate in a Delphi study to update and gain consensus on the NDHRA. IRB approval was obtained from USC. The study was carried out electronically in 3 phases: a development phase, 2 rounds of mailed questionnaires to gain consensus on topics, and one round to prioritize topics. Responses were analyzed using descriptive statistics, and instrument reliability was analyzed using the Pearson Product Moment Correlation Coefficient and Cronbach's Alpha for internal consistency.***

***Results. 112 topics reflecting 5 research agenda categories were identified during phase one. Through phase 2, 36 topics were eliminated and consensus was reached on 40 of the remaining 76 topics. Return rates of 100% and 95% were achieved for the 2 survey rounds. Instrument reliability was established at .76 and internal consistency at .87. Priorities for the 5 NDHRA categories were identified based on the importance of the topic to improving the health of the public and to advancing dental hygiene.***

***Outcomes. Each category comprising the NDHRA was well represented by the 40 topics. Thus, consensus on the national agenda was achieved. Identified priorities will be used to revise the NDHRA, direct future research efforts, identify research funding initiatives and guide education and practice.***

***This project is funded by the ADHA.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Assessment of Clinic Journal Writing

Winnie Furnari, RDH, BS and Lerilei Kirby, RDH, BS

***Journal writing is utilized as a teaching method. It is a reflective project, which should reveal gaps in student understanding yet encourage learning the skills of the profession. The purpose of this study was to garner graduate and faculty input to determine the degree of value, satisfaction, and worth each put on the requirement. Graduates were asked if they thought journal writing gave a clearer picture of patient needs, if it contributed to preparation to practice dental hygiene, if it stimulated an intellectual effort, if useful and positive feedback was given and received, and if journal writing should be a part of the dental hygiene program. Data were collected with 2 survey instruments, one for the graduates and one for the faculty. The response rate for the graduates was 46% and for the faculty 67%. Twenty-five percent of the graduates saw enhancement of their clinical experience, or were able to see a clearer picture of their patients' needs than those who weren't. Half of the graduates felt it should not be a part of the program, yet 86% of the faculty did. The variation in answers from graduates may indicate that the numbers are too small to draw any robust conclusions. We conclude that 41% of the faculty were not stressing the value or the performance of this task. The differences in the responses indicate a need to have students utilize the journal writing to their benefit and the need for more faculty members to be involved with the requirement. With more faculty involvement, we anticipate students utilizing this task as an additional learning tool for their clinic experience. A review of the requirement and its benefits will be instituted and necessary for the students to utilize it for its intended purpose.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# The Role of the Student Professional Organization in Mentoring Dental Hygiene Students

Danielle Furgeson, RDH, MS, Rebecca S Wilder, RDH, MS, Mary George, RDH, MEd, Charlotte A Peterson, RDH, MS, Diane S Peterson, RDH, MEd and Samuel Nesbit, DDS

***The purpose of this study was to determine the role of the Student American Dental Hygienists' Association (SADHA) in mentoring dental hygiene students for the future. This project also assessed attitudes of SADHA advisors towards the utilization of SADHA as a mechanism for mentoring dental hygiene students' professional development to meet the oral health needs of the public, and the goals of the ADHA. These goals include promotion of education beyond the baccalaureate level to develop qualified faculty, encouraging dental hygiene research, and promoting leadership.***

***After IRB exemption, a pilot-tested questionnaire was administered using Survey Monkey, an online survey website, to 277 individual contacts at American Dental Association (ADA) accredited dental hygiene (DH) programs. A response rate of 68% was achieved with 186 individual responses. Eighty percent of respondents indicated offering no mentoring opportunities while incongruously, 58.3% felt they actively mentor through SADHA. When asked what the main focus of SADHA should be, SADHA advisors ranked community service/philanthropy as number one. SADHA chapters at institutions that offer a Bachelor of Science in Dental Hygiene (BSDH) degree completion program offer more mentoring opportunities (p=<.001). Programs offering the BSDH offer a wider variety of topics from guest speakers (p=.038). SADHA chapters in western states have a higher graduate conversion rate than other regions (p=.018).***

***The majority of SADHA chapters are not offering mentoring opportunities outside of the traditional curriculum for leadership and career development. What is clear is that both students and advisors desire more interaction with the local ADHA organizations. In order to address these issues, efforts should be made to provide networking support among SADHA advisors, and increase perception of the importance of the student professional association through the development of Best Practices for SADHA. This could benefit students by increasing mentoring opportunities and partnerships with local ADHA organizations.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Effects of Five Different Finger Rest Positions on Arm Muscle Activity During Scaling

Mary E Cosaboom-Fitzsimons, RDH, BS, MS, Susan Lynn Tolle, BSDH, MS, Michele Darby, BSDH, MS and Martha Walker, PT, PhD

***With the increased incidence of repetitive strain injuries in dental practitioners, dental hygienists must make informed decisions regarding instrumentation practices and procedures. The use of finger fulcrums may impact on muscle activity when scaling and influence the ergonomic practice of dental hygiene. The purpose of the research was to determine the effects of 5 different finger rest positions on forearm muscle activity during a simulated periodontal scaling experience. A convenience sample of 32 consenting senior dental hygiene students who met inclusion criteria participated. Using a 4 x 5 counter balanced research design each participant used a Gracey 11/12 curet to scale up to one cc of artificial calculus from the first permanent molar typodont teeth (#3, 14, 19, 30). Five different typodonts were set up for each participant with a different fulcrum randomly assigned for use on each typodont. Muscle activity was measured by surface electromyography. Data analysis with 2-way ANOVA revealed no statistically significant interaction effect between area of the mouth scaled and fulcrum used. The upper right quadrant produced the most muscle activity (p=0.0101) and the lower left quadrant produced the least (p=<.0001). When comparing the overall muscle activity generated with each fulcrum only the cross arch fulcrum when compared to the opposite arch fulcrum produced statistically significant results (p=0.0110). Based on the results of this simulated clinical study similar muscle activity is produced while scaling when using all of the 5 fulcrums tested in each area of the mouth. Clinicians appear to experience minimal ergonomic advantages in terms of fulcrums used and area of the mouth scaled during a simulated scaling experience. Characteristics of the patient may be more important when choosing a fulcrum than the amount of muscle activity generated.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Digital Radiography: Is it the Technique of Chicago?

Christine A Dominick, RDH, MOcEd

***Purpose. To assess the level of implementation of digital radiography in dental hygiene programs. To find out if the placement of digital radiology instruction in the curriculum influences user preference.***

***Hypothesis. Introducing instruction in digital radiography technique before film will result in increased student usage of digital radiography.***

***Method. Observation of current instruction methods (digital first) in first-year radiology lab inspired the author to see if similar results were being witnessed in other programs. Electronic surveys were created to gather data from first-and second-year students, recent graduate hygienists, and dental hygiene program directors.***

***Results. 141 surveys were sent to program directors, 44 were completed; 91 were sent to students, 41 were completed. 93.1% of hygiene schools teach radiology the first year; 72.7% teach digital radiography to laboratory competence; 84.8% of these programs use sensors. 100% teach film technique first. Of the programs allowing students to choose technique on patients(34.3%) 92.9% chose film. Students responded (45% yes, 40% no) when asked if learning one technique first influenced their preference. When allowed to choose technique, students choose film (60%) over sensors (42.5%). 87.5% expect to take digital radiographs when they are employed. 26.8% reported feeling comfortable, 53.7% fairly comfortable with digital.***

***Conclusion. Teaching digital before film does not influence student acceptance. Students overwhelmingly expect to take digital radiographs when employed. Dental hygiene programs (3:1) have implemented hands on instruction in digital.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Interdisciplinary Collaboration: The Dental Hygienists' Role

Kelli Swanson Jaecks, RDH, BSDH

***Recent scientific studies show strong correlations between oral and systemic disease, creating a crucial need for increased communication between the medical and dental professions. Interdisciplinary collaboration between medical and dental providers is emerging as a critical component to effective patient care. The role of the dental hygienist in interdisciplinary collaboration has been under-utilized and understudied. The objectives of this research are to access dental Hygienists' perceptions of (1) their role in interdisciplinary collaboration, (2) the barriers to effective collaboration, and (3) communication skills needed to better participate in interdisciplinary collaboration. After Institutional Review Board approval from Oregon State University, data were gathered using a quantitative survey instrument. Variables measured regarding the dental hygienist's role included experience, confidence, importance, leadership, knowledge utilization, and the future of interdisciplinary collaboration. Participants consisted of a volunteer sample of Oregon dental hygienists (N=103), recruited from 2 large dental hygiene meetings. The overall response rate was 60%. To better understand the nature of relationships between variables, and to make comparisons among groups, statistical analyses included correlation analysis and t-tests.***

***Results show that dental hygienists perceive their role in interdisciplinary collaboration as valuable, both now and in the future. Barriers to collaboration include insufficient time and insufficient knowledge of medical diseases. Speaking, listening and leadership skills are necessary to effectively participate in interdisciplinary collaboration. Analyses of these findings elucidate a call for greater education in communication skills. The results of this study will be used to develop skill-building interventions to train dental hygienists in effective interdisciplinary collaboration.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Computerized Digital Imaging Analysis of the Effectiveness of a Locally Applied Anti-Plaque Agent

Janet M Wehrli, RDH, Floyd C Knoop, PhD, Frank A Driscoll, DDS, MS and Stephen M Gold, DDS

***This study utilized advanced computerized digital imaging software to evaluate photographs of the teeth and gums of subjects after their typical oral hygiene routine ('before') and compared them to subsequent photographs taken after the introduction of a tray-delivered anti-plaque agent for a 2-week time period ('after'). The scope of this study was limited to analysis of the photographic data of 27 subjects (54 photographs). The method used to gather data required that subjects apply the anti-plaque agent (Oraparx®) to both sides of a preformed foam dental tray. The tray was placed over the dental arches covering all teeth for a period of 10 minutes. Instructions emphasized that no other changes were to be made in their normal oral hygiene routine. The before and after photographs were analyzed using a modified Quigley-Hein Plaque Index correlated with the Navy Plaque Index. Computerized digital imaging analysis was performed on a typical photograph. Analysis produced mathematical comparisons of all photographs. Computerized pixilated images measured both the area of plaque-covered tooth surface and the density of the plaque. All photographs showed a visual, clinical, and mathematically significant decrease in dental plaque biofilm. The mean and median reduction in biofilm was 48% and 43%, respectively. Specifically, subject photographs that demonstrated normal daily oral hygiene 'before' showed a significant absence of dental plaque biofilm 'after' use of the anti-plaque agent. The results of this study demonstrate that the addition of a tray-delivered anti-plaque agent is significantly more effective in the removal of dental plaque than normal oral hygiene methods alone.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# A Study of Aseptic Techniques in a Dental Hygiene Educational Clinic

Sandra B Helmly, RDH, MPH, Kimberly M Coulton, RDH, MS and David P Adams, PhD, MPH

***Infection control is a critical component in the process of care for patients. Dental hygiene students must receive thorough instruction concerning aseptic techniques. Ongoing evaluations must be utilized to determine if students are performing these techniques. The purpose of this study was to evaluate possible areas of cross-contamination in a dental hygiene clinic and to determine if improvements needed to be made in the infection control protocols taught to the students. The study was conducted in an educational setting with IRB approval given on an exempt status. A dental hygiene clinic at a local University provided a purposive sample. Weekly, surfaces were cultured to determine the presence or absence of Staph or Strep spp. Pre test and post test swabbings were taken. The results of the study indicated that cross-contamination was evident in the radiology room and on the dental radiographic processor. On a percentage basis, cross-contamination was evident on 5% of the environmental surfaces during Week 1, with the lead apron showing positive for Staph spp. Week 2 results showed 10% of environmental surfaces contaminated with Staph spp. (lead apron and radiographic processor). Weeks 3 and 4 both had positive tests with 5% of the environmental surfaces showing cross-contamination of Staph spp. SPSS was used to design tables showing the Weekly Log Reports for the environmental surfaces cultured for the presence (+) or absence (-) of Staph and Strep spp. Results indicated that the cross-contamination may have occurred due to insufficient aseptic techniques by the students during the cleaning process. It was concluded that ongoing training in aseptic techniques should be taught to students in the clinical setting.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Bactericidal Effects of Cold Plasma Technology on Geobacillus Stearothermophilus and Bacillus Cereus Microorganisms

Angela D Morris, RDH, MS, Gayle B McCombs, RDH, MS, Susan L Tolle, RDH, MS, Mounir Laroussi, PhD and Wayne L Hynes, PhD

***Cold plasma is a state of matter that contains a large number of particles that are electrically charged. Plasmas generate chemically reactive species and ultraviolet radiation making them useful in decontamination applications (Kong & Laroussi, 2003). Research regarding the inactivation of gram-positive bacteria by cold plasma has been studied by Laroussi et al (2003); however, there is limited research regarding the germicidal effectiveness of cold plasma on Geobacillus stearothermophilus and Bacillus cereus microorganisms. The purpose of this study was to determine if cold plasma technology inactivates Geobacillus stearothermophilus and Bacillus cereus vegetative cells and spores. This study consisted of 981 samples; 762 experimental samples exposed to cold plasma at various times and 291 controls. Experimental samples were inoculated and exposed either directly or indirectly/remotely to cold plasma. After exposure the samples were incubated for 12 to 16 hours and colony forming units (CFU) were quantified. The percentage kill and log concentration reductions were calculated from the CFU counts. Data was analyzed using one-way ANOVA, Kruskal Wallis and Tukey's tests at the .05 level. There was a statistically significant difference in the inactivation of Geobacillus stearothermophilus vegetative cells for indirect exposure (p=.0001), direct exposure (p=.0013), as well as for Bacillus cereus vegetative cells and spores (p=.0001). Exposure of Geobacillus stearothermophilus spores to cold plasma demonstrated no statistically significant differences in inactivation for indirect exposure (p=.7208) and direct exposure (p=.0835). Results indicate that cold plasma exposure significantly inactivated Geobacillus stearothermophilus (vegetative) and Bacillus cereus; however, Geobacillus stearothermophilus spores were not significantly inactivated. Funding for this project was provided by ADHA IOH.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Employment Trends of Dental Hygiene Graduates from a Southeast Georgia University

Suzanne M Edenfield, EdD, RDH and Kimberly Coulton, MS, RDH

***The purpose of this retrospective study was to determine the existence of employment trends with respect to benefits, salary, and work environment of Armstrong Atlantic State University dental hygiene graduates within a 10-year period. Following IRB approval, an ex post facto review of the 1997 through 2006 graduate surveys (46 item) was conducted. A limitation was indicated regarding slight revisions to specific survey items due evolving trends in salary and adjunct duties. Analyzing nominal data, based on percentages, the sample (N= 126), revealed that the majority of graduates practiced in a small city (50 000-200 000 population), in one dental office, 32-40 hours weekly, treating 9 patients daily. Similarly, the majority of graduates were paid salary wages, with only a small percentage receiving commission or a combination thereof. Further, it was found that sick leave, paid vacation, holidays, and raises remained relatively constant from 1997-2004; from 2005, a downward trend was indicated. Likewise, from 1997-2004 there was a relative increase for the provision of medical and liability insurance, with a noticeable decline thereafter. The number of graduates receiving free dental care decreased by nearly half in 2006 as compared to the years of 1997 and 1998. Over the years, the number of graduates eligible for discounted dental care increased. Between the years 1997 and 2005, performance of adjunct duties (use of desensitizing agents, antimicrobials, local delivery antibiotics, and sealants) tended to fluctuate, where in 2006 there was a sharp decline. Nutritional counseling and treatment planning services demonstrated a declining trend over the 10-year span. In conclusion and unexplainable, the year 2004 indicated the most favorable results in the aforementioned categories. Further concluded, the terms of employment, throughout the years, reflected that graduates tended to work full time in one dental practice.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# In Vitro Evaluation of the Reciprocating Disposable Prophylaxis Angle Versus the Rotating Disposable Prophylaxis Angle in Extrinsic Stain Removal Effectiveness

Inma LaCross, BSDH, Michele Darby, BSDH, MS, Sharon S Stull, RDH, MS and Carlene M Lynch, RDH, MSDH, MPH

***This study determined the extrinsic tooth stain removing effectiveness of a 90° counter-rotational disposable prophylaxis angle (DPA) with rubber cup compared to the traditional 360° unirotational DPA with rubber cup. Four randomly-assigned groups of cleaned, sterilized, extracted human teeth, artificially stained with coffee, tea, tobacco, and red wine, were polished on the buccal and lingual surfaces using one of the 2 DPAs. Each dependent variable (4 different stain types) was tested 4 times with each prophylaxis angle, using 4 prophylaxis paste conditions, and 3 different rpm; therefore, 2 trials x 2 angles x 3 speeds x 4 stains x 4 grits = 192 trials on 96 teeth. For each trial, a DPA attached to a handpiece controlled by an eStylus™ was mounted on a testing apparatus that together controlled handpiece rpm and rubber cup pressure against the tooth. Stain removal effectiveness was measured with a Bioform Color Ordered Shade Guide both before and after the DPA was used with one of three different grits of prophylaxis pastes and a trial using no paste at 1500, 2000, and 3000 rpm. The evaluator was blind to the treatment status. Data were analyzed using a 3-way analysis of variance at p= .05 level. Results revealed no statistically significant difference between the two DPAs in extrinsic tooth stain removal. There was a statistically significant interaction among rpm (3000) of the DPA and the grit abrasivity of the prophylaxis paste suggesting that additional study may be indicated since coarse prophylaxis pastes remove stain more rapidly, but in doing so, can scratch and roughen the tooth enamel. Extrinsic stain removal effectiveness of the 2 DPAs were comparable when using different abrasivity prophylaxis paste and different rpm.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Vital Tooth Whitening: Effects on Tooth Color Satisfaction, Beliefs about Dentofacial Appearance, and Self-Esteem in Older Adults

Michele Darby, BSDH, MS, Gayle B McCombs, RDH, MS, Carlene M Lynch, RDH, MSDH, MPH and Kelly Seeber, BSDH

***The purpose of this study was to explore the effects of vital tooth whitening on tooth color satisfaction, beliefs about dentofacial appearance, and self-esteem in a population 50 years of age and older. A 2-group, randomized, pre-test, post-test, single-blind design was utilized following IRB-approval. Sixty-two participants were enrolled. Fifty-three participants (N=53) completed the study with no adverse events reported. Both the control and experimental groups received instructions for a 3-week oral self-care regimen, a toothbrush, toothpaste, and floss. The experimental group also received a tooth whitening product (independent variable) to be used during the same 3-week period. Dependent variable measures collected at baseline and at week three were: (1) tooth color measured using the Trubyte New Hue Vitality Scale, (2) tooth color satisfaction measured using the Tooth Color Satisfaction Scale, (3) beliefs about dentofacial appearance measured using The Beliefs about Appearance Questionnaire (ASI-R Short Form), and (4) self-esteem measured using the Rosenberg Self-Esteem Scale. Statistical analysis revealed significant differences (p< .001) in the experimental group for tooth color improvements and tooth color satisfaction. Tooth whitening did not significantly (p<.05) affect beliefs about dentofacial appearance or self-esteem. Additionally, a correlation was not demonstrated among tooth color, tooth color satisfaction, beliefs about dentofacial appearance, and self-esteem in an older adult population. Overall, tooth whitening had little psychosocial effect in this sample of older adults.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Dental Hygiene Faculty Calibration in the Evaluation of Calculus Detection

Kandis V Garland, RDH, BS and Kathleen J Newell, RDH, PhD

***The purpose of this pilot study was to explore the impact of a dental hygiene faculty calibration training program on intra- and inter-examiner reproducibility levels on calculus detection using an 11/12 explorer. Inconsistency among clinic faculty members is frustrating for students. After Institutional Review Board approval, 12 dental hygiene faculty members were recruited for participation in the study and randomized to two groups (experimental and control). All subjects provided pre- and post-test measurements twice on three typodonts. Measurements were recorded on answer sheets. The experimental group received 3, 2-hour, training sessions which consisted of practicing a prescribed exploring sequence and technique for calculus detection. Subjects immediately corrected their answers with a key, received feedback from the trainer, and reconciled missed areas. Intra- and inter-examiner reproducibility levels (pre- and post-) were measured using Cohen's Kappa and compared between experimental and control groups using repeated measures (split-plot) ANOVA. The experimental and control groups did not differ in their change in reproducibility (self-agreement) from pre- to post-training (p = 0.64). Also, the experimental and control groups did not differ in their change in agreement with true presence/absence of simulated calculus from pre- to post-training (p = 0.20). Although the results of this study failed to reject the null hypothesis that training has no effect on the reproducibility levels for simulated calculus detection, further studies of clinical faculty calibration need to be implemented with larger and more representative samples. The impact of calibration on students' learning and satisfaction should also be examined.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Bisphenol A Blood and Saliva Levels Prior To and After Dental Sealent Placement in Adults: An Exploratory Study

Joyce M Downs, RDH, MS(c), Deanne Shuman, RDH, PhD, Sharon S Stull, RDH, MS and Robert E Ratzlaff, PhD

***Placement of dental sealants is an effective therapy for tooth decay prevention and is widely accepted as a standard of care throughout the United States. Sealants are manufactured using the resin component of composite dental materials, formed by reacting glycidyl methacrylate with bisphenol A. Bisphenol A (BPA) is a hormonally active, synthetic chemical that is part of a broad group of chemicals known as endocrine disrupting compounds, xenoestrogens, which mimic bioactivity of estrogen. Laboratory studies using rodents with BPA exposure as low as 2.5 ug/kg body weight/day have revealed increased fertility and mammary and prostate cancer. BPA can leach from a dental sealant if it is not completely polymerized and is released into the oral cavity as a degradation product resulting from enzymatic activity within saliva. This exploratory study examined the presence of BPA systemically in saliva and blood after the placement of pit and fissure sealants in 30 subjects, as measured by the use of a direct-competitive bisphenol A Enzyme Linked ImmunoSorbent Assay (ELISA) and spectrophotometry analysis. Subjects ranged in age from 18-40 years of age and were of mixed gender and ethnicity. Differences in bisphenol A comparing low-dose (1-sealant) and high-dose (4-sealants) groups were examined one hour prior, one hour post, 3 hours post and 24 hours after sealant placement. Data were analyzed using a parametric, 2-way analysis of variance for repeated measures. Results reveal presence of bisphenol A one-hour prior to sealant placement in all saliva samples tested. Salivary BPA concentration levels were highest at the one-hour post time period, remained high at the 3-hour time period and decreased at the 24-hour time period. Bisphenol A was not detected at statistically significant levels in the serum samples after dental sealant placement. Results for salivary BPA revealed statistically significant differences at all post sealant placement time periods for the high dose sealant group. Further research is needed to examine the cumulative estrogenic effects of BPA from dental sealants. Funding for this project through ADHA IOH.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# An Evidence-Based Self-Assessment Educational Module for Dental Hygiene Curricula

Sarah C Jackson, RDH, BS, Denise M Bowen, RDH, MS and Linda D Boyd, RDH, RD, EdD

***Literature on self-assessment presents substantial evidence regarding the impact of self-assessment on practitioners and quality of care. Related dental hygiene research documents a need to enhance curricula; however, no published curriculum module exists to effectively teach self-assessment. The purpose of this study was to explore the impact of a self-assessment educational module for dental hygiene curricula designed using evidence from the literature and adult learning principles. This module was implemented with 33 junior dental hygiene students as a guest presentation with active learning strategies followed by a clinical practice time period. A one-group, pretest-posttest design was employed using a 2-part pretest and three-part posttest to determine if the module affected dental hygiene students' perceptions about self-assessment and their voluntary application of it in the clinical environment. The relationship between students' perceptions and voluntary application of self-assessment also was examined. In addition, students' comments on daily clinical self-assessment forms were evaluated to determine if the module affected the quality of those comments.***

***Results using the Mann-Whitney test indicated the self-assessment module was effective ($p<0.05$) in improving the students' perceptions and voluntary clinical application of self-assessment. No statistically significant relationship was found between the students' perceptions and their application of self-assessment using Pearson's Correlation. The quality of self-assessment comments on the students' daily clinical evaluation forms was enhanced after module implementation ($p<0.05$). This change in quality before and after module implementation was demonstrated by a quantitiative analysis using a self-designed rubric and a qualitative thematic analysis of student comments to identify predominant themes. Students also were surveyed to determine which module components were most effective. Findings indicate a self-assessment educational module enhanced these dental hygiene students' self-assessment perceptions and skills. Future studies using other methods with other populations and educational settings are indicated.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Vital Tooth Whitening Effects on Quality of Life in Older Adults

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***This study's purpose was to determine if vital tooth whitening affects oral health-related quality of life (OHRQOL) in adults < 50 years old, and if tooth whitening influences regular professional dental care and increased participation in social activities. Using a 2-group, single blind, randomized, pre-test multiple post-test design, 62 participants were enrolled. The experimental group used a whitening product twice daily for 3 weeks (WG); the control group used no whitening products (NWG). The Oral Health Impact Profile (OHIP) served as the pre-test and post-test measure. The OHIP measures OHRQOL on seven subscales: functional factors, psychological disabilities, psychological discomforts, physical disabilities, social disabilities, handicaps, and physical pain. Additional questions measured the subjects' social activities and dental care encounters at baseline, 3-weeks, and three months. Data from 53 participants who completed the study were analyzed using paired t-tests and ANOVA at p= .05. Statistical significance was observed for the OHIP physical pain subscale (p=.0029) and the handicap subscale (p=.05). Pre- to post-test means of the physical pain subscale increased in the WG (4.84 to 7.10), suggesting a lower OHRQOL, most likely related to tooth sensitivity experienced by the WG. Means from pre- to post-test of the handicap subscale (1.96 to 1.19) reveal that the WG reported an improved OHRQOL and felt they were more willing to work. Repeated measures ANOVA and Tukey's post-hoc tests revealed that the WG reported significantly less (p= .04) social activities at the three-month post-test (3.92 to 3.45). No statistically significant between-group differences were observed in the overall OHIP score for functional factors, psychological disabilities, psychological discomforts, physical disabilities, and social disabilities. In conclusion, tooth color does not improve overall OHRQOL in older adults.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Who is the Dental Consumer? Dental Hygiene Students' Perspective

W. Gail Barnes, RDH, PhD and Janice Arruda, RDH, MPH

***"To increase the proportion of children and adults who use the oral healthcare system each year by 83%" was the target goal set for Objective 10 during the Healthy People 2010 conference. At the end of the dental public health class, a survey was administered to the senior hygiene students (N=27) to determine who they perceived to be the dental consumer. The response rate was 100%. The survey consisted of quantitative questions (5 point Likert-type scale) and qualitative open-ended questions (to help with interpretation of the qualitative results) and was downloaded on the course's Assessment section of the Blackboard site. The mean for each question was automatically calculated by Blackboard. The hygiene students reported that "adults" were most likely to seek and receive dental care (N=11,42%) and "children" were 37% (N=9) likely to receive dental care. Conversely, the population category that the students reported that they perceived would least likely receive dental care was the "elderly" (N=23,84%); followed by "teenagers" (N=3,11%).***

***The results of the survey indicated that the dental hygiene students' perceptions and target goal of Objective 10 of Healthy People 2010 were significantly opposed. The researchers believe that creating opportunities for access to care will help bridge the divide that exists in regard to dental need. Future studies would be beneficial to investigate dental hygiene students' and their perceived role as practicing hygienists in addressing the issue of access to dental care. Also of interest would be a longitudinal study, at five year intervals, of practicing dental hygienists and their efforts in bridging the population gap of those receiving dental care.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Distance Education and the Shortage of Graduate Degree Dental Hygiene Faculty

W. Gail Barnes, RDH, PhD

***The profession of dental hygiene is experiencing an unprecedented faculty shortage in the US. To address this issue some hygiene programs are developing "homegrown educators" by recognizing and mentoring undergraduate students and encouraging them to pursue a graduate education. Another strategy is the use of distance education, in which the graduate student can practice full-time as a clinician or faculty member, would not have to relocate, and when learner-centered techniques are applied, there is no diminished knowledge base. To assess the students' perception of the faculty shortage and determine their likelihood of pursuing a hygiene graduate online degree, an Internet mail survey was developed and administered to the summer registrants of an online degree completion class (N=29). The survey consisted of 20 items. The data sample consisted of 22 useable responses (76%). Data were downloaded from the WEB and manually entered into SPSS 10.0. The results indicated that the students were aware of the faculty shortage (100%). Eighty-six percent (N=19) of the students indicated that they would "pursue a graduate hygiene degree online to alleviate the faculty shortage." Nine percent (N=2) indicated that they "might" pursue a graduate hygiene degree online. No student responded negatively to the question and one student did not respond.***

***According to the results of the present study, baccalaureate dental hygiene students are significantly aware of the dental hygiene faculty shortage in the US and would enroll in gradate hygiene programs via distance learning methodologies. This program format would address the personal concerns of future graduate dental hygiene students and the paucity of qualified dental hygiene applicants and faculty.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Antimicrobial Effectiveness of an Herbal Mouthrinse Against Predominant Oral Bacteria Species In Vitro

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***Aim. The aim of the study was to compare the antimicrobial effectiveness of 2 herbal mouthrinses, Listerine and Peridex (0.12% chlorhexidine gluconate) as determined by the Minimum Inhibitory Concentration (MIC) against predominant oral bacteria in vitro.***

***Material and Methods. S. An agar dilution method was employed to assess the inhibitory effect of the test agents against 40 oral bacteria. Serial dilutions of the 4 test mouthrinses [The Natural Dentist Healthy Gums Oral Rinse, The Natural Dentist Healthy Gums Oral Rinse minus bloodroot (sanguinaria), Listerine and Peridex] were prepared at concentrations of 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 µ g/ml. Filter-sterilized test agents were added to basal medium in petri plates and inoculated with suspensions of the test species using an MIC 2000 inoculator. Inoculated plates were incubated anaerobically at 35 degrees C and examined daily. The MIC was interpreted as the lowest concentration of the agent that completely inhibited the growth of the test species. MICs were performed in duplicate.***

***Results. The 2 Natural Dentist formulations effectively inhibited the growth of the majority of the 40 test species. Compared with Listerine, The Natural Dentist Healthy Gums Oral Rinses exhibited significantly lower MICs (> a 2 fold difference in MICs) for Actinomyces species, periodontal pathogens, E. nodatum, T. forsythia and Prevotella species as well as the cariogenic pathogen, S. mutans. Peridex had the lowest MICs compared with Listerine and The Natural Dentist Healthy Gums Oral Rinse for all test species examined.***

***Conclusion. Although less potent than Peridex, The Natural Dentist Healthy Gums Oral Rinse was a more effective antimicrobial than Listerine in inhibiting the growth of oral bacteria in vitro.***

Source: Journal of Dental Hygiene, Vol. 81, No. 4, October 2007


# Knowledge, Attitudes, and Confidence Levels of Dental Hygiene Students Regarding Teledentistry

Brigette R Cooper, MS and Lynette M Engeswick, MS

***Teledentistry provides a viable option for dental professionals to increase care in underserved areas. Dental hygiene students at a state university complete a course in teledentistry that includes performing oral health screenings on Head Start children using intra-oral cameras and electronically submitting dental images to an off-site dentist for diagnosis. The objective of this study was to examine student knowledge, attitudes, and confidence levels regarding teledentistry. A 5-point Likert scale survey consisting of 10 items was administered to white females ages 22 to 25 (N=24) in a teledentistry course the first and last day of class. The survey included current knowledge of teledentistry and access to care, attitudes regarding effectiveness of teledentistry in identifying dental needs, the role dental hygienists play in access to care, and confidence in acquiring the necessary technical skills. Survey results analyzed by a matched pairs t test and Wilcoxen signed rank test found a significant increase in student knowledge, attitudes, and confidence level in 9 of the 10 questions ($p<.02$). Question 5 had a pre-test mean of 4.667 and a post-test mean of 4.875, demonstrating very little room for improvement. This survey supports that student attitudes were positively changed in their knowledge of the effectiveness of teledentistry in identifying dental needs in rural and underserved areas, the role dental hygienists play in access to care, and confidence in acquiring and submitting dental images. Research conducted in teledentistry supports continued implementation in dental hygiene education.***