



American
Dental
Hygienists'
Association

Journal of Dental Hygiene

THE AMERICAN DENTAL HYGIENISTS' ASSOCIATION

FALL 2012 VOLUME 86 NUMBER 4

- Medical Screenings in Dental Settings
- The Role of Dental Hygienists in Conducting Rapid HIV Testing
- Treatment Modalities for Drug-Induced Gingival Enlargement
- Tooth Jewelry in an 8 Year Old Child: Case Report
- A Randomized Controlled Trial of the Effect of Standardized Patient Scenarios on Dental Hygiene Students' Confidence in Providing Tobacco Dependence Counseling
- Maryland Dental Hygienists' Knowledge, Opinions and Practices Regarding Dental Caries Prevention and Early Detection
- Identifying Barriers to Receiving Preventive Dental Services: Expanding Access to Preventive Dental Hygiene Services Through Affiliated Practice
- Dental Hygienist Attitudes toward Providing Care for the Underserved Population
- Effects of Dental Magnification Lenses on Indirect Vision: A Pilot Study

Journal of Dental Hygiene

VOLUME 86 • NUMBER 4 • FALL 2012

STATEMENT OF PURPOSE

The *Journal of Dental Hygiene* is the refereed, scientific publication of the American Dental Hygienists' Association. It promotes the publication of original research related to the profession, the education, and the practice of dental hygiene. The journal supports the development and dissemination of a dental hygiene body of knowledge through scientific inquiry in basic, applied, and clinical research.

SUBSCRIPTIONS

The *Journal of Dental Hygiene* is published quarterly online by the American Dental Hygienists' Association, 444 N. Michigan Avenue, Chicago, IL 60611. Copyright 2010 by the American Dental Hygienists' Association. Reproduction in whole or part without written permission is prohibited. Subscription rates for nonmembers are one year, \$45.

SUBMISSIONS

Please submit manuscripts for possible publication in the *Journal of Dental Hygiene* to JoshS@adha.net.

2010 – 2011 ADHA OFFICERS

PRESIDENT

Susan Savage, RDH, BSDH

PRESIDENT-ELECT

Denise Bowers, RDH, MSED

VICE PRESIDENT

Kelli Swanson Jaecks, RDH, BSDH, MA

TREASURER

Louann M. Goodnough, RDH, BSDH

IMMEDIATE PAST PRESIDENT

Pamela Quinones, RDH, BS

EXECUTIVE DIRECTOR

Ann Battrell, RDH, BS, MSDH
annb@adha.net

STAFF EDITOR

Josh Snyder
joshs@adha.net

EDITOR EMERITUS

Mary Alice Gaston, RDH, MS

LAYOUT/DESIGN

Josh Snyder

EDITOR-IN-CHIEF

Rebecca S. Wilder, RDH, BS, MS
rebeccaw@adha.net

EDITORIAL REVIEW BOARD

Celeste M. Abraham, DDS, MS
Cynthia C. Amyot, BSDH, EdD
Joanna Asadoorian, AAS, BScD, MSc
Caren M. Barnes, RDH, BS, MS
Phyllis L. Beemsterboer, RDH, MS, EdD
Stephanie Bossenberger, RDH, MS
Linda D. Boyd, RDH, RD, LS, EdD
Kimberly S. Bray, RDH, MS
Colleen Brickle, RDH, RF, EdD
Lorraine Brockmann, RDH, MS
Patricia Regener Campbell, RDH, MS
Dan Caplan, DDS, PhD
Marie Collins, RDH, EdD
Barbara H. Connolly, PT, EdD, FAPTA
Valerie J. Cooke, RDH, MS, EdD
MaryAnn Cugini, RDH, MHP
Susan J. Daniel, AAS, BS, MS
Michele Darby, BSDH, MS
Janice DeWald, BSDH, DDS, MS
Susan Duley, BS, MS, EdS, EdD, LPC, CEDS
Jacquelyn M. Dylla, DPT, PT
Kathy Eklund, RDH, BS, MHP
Deborah E. Fleming, RDH, MS
Jane L. Forrest, BSDH, MS, EdD

Jacquelyn L. Fried, RDH, BA, MS
Mary George, RDH, BSDH, MEd
Kathy Geurink, RDH, BS, MA
Joan Gluch, RDH, PhD
Maria Perno Goldie, RDH, BA, MS
Ellen Grimes, RDH, MA, MPA, EdD
JoAnn R. Gurenlian, RDH, PhD
Linda L. Hanlon, RDH, BS, MEd, PhD
Kitty Harkleroad, RDH, MS
Lisa F. Harper Mallonee, BSDH, MPH, RD/LD
Harold A. Henson, RDH, MEd
Alice M. Horowitz, PhD
Laura Jansen Howerton, RDH, MS
Olga A.C. Ibsen, RDH, MS
Mary Jacks, MS, RDH
Wendy Kerschbaum, RDH, MA, MPH
Salme Lavigne, RDH, BA, MSDH
Jessica Y. Lee, DDS, MPH, PhD
Madeleine Lloyd, MS, FNP-BC, MHNP-BC
Deborah Lyle, RDH, BS, MS
Ann L. McCann, RDH, BS, MS, PhD
Stacy McCauley, RDH, MS
Gayle McCombs, RDH, MS
Tanya Villalpando Mitchell, RDH, MS

Tricia Moore, RDH, BSDH, MA, EdD
Christine Nathe, RDH, MS
Kathleen J. Newell, RDH, MA, PhD
Johanna Odrich, RDH, MS, DrPh
Pamela Overman, BSDH, MS, EdD
Vickie Overman, RDH, BS, MEd
Fotinos S. Panagakos, DMD, PhD, MEd
M. Elaine Parker, RDH, MS, PhD
Ceib Phillips, MPH, PhD
Marjorie Reveal, RDH, MS, MBA
Kathi R. Shepherd, RDH, MS
Deanne Shuman, BSDH, MS PhD
Judith Skeleton, RDH, BS, MEd, PhD
Ann Eshenaur Spolarich, RDH, PhD
Rebecca Stolberg, RDH, BS, MSDH
Sheryl L. Ernest Syme, RDH, MS
Terri Tilliss, RDH, BS, MS, MA, PhD
Lynn Tolle, BSDH, MS
Margaret Walsh, RDH, MS, MA, EdD
Donna Warren-Morris, RDH, MS, MEd
Cheryl Westphal, RDH, MS
Karen B. Williams, RDH, PhD
Charlotte J. Wyche, RDH, MS
Pamela Zarkowski, BSDH, MPH, JD

BOOK REVIEW BOARD

Sandra Boucher-Bessent, RDH, BS
Jacqueline R. Carpenter, RDH
Mary Cooper, RDH, MSED
Heidi Emmerling, RDH, PhD
Margaret J. Fehrenbach, RDH, MS
Cathryn L. Frere, BSDH, MSED

Patricia A. Frese, RDH, BS, MEd
Joan Gibson-Howell, RDH, MSED, EdD
Anne Gwozdek, RDH, BA, MA
Cassandra Holder-Ballard, RDH, MPA
Lynne Carol Hunt, RDH, MS
Shannon Mitchell, RDH, MS

Kip Rowland, RDH, MS
Lisa K. Shaw, RDH, MS
Margaret Six, RDH, BS, MSDH
Ruth Fearing Tornwall, RDH, BS, MS
Sandra Tuttle, RDH, BSDH
Jean Tyner, RDH, BS

Features

Linking Research to Clinical Practice

260 Medical Screenings in Dental Settings

Denise M. Bowen, RDH, MS

Short Report

265 The Role of Dental Hygienists in Conducting Rapid HIV Testing

Anthony J. Santella, DrPH, MPH, CHES; Susan H. Davide, RDH, MS, MEd; Marilyn Cortell, RDH, MS, FAADH; Winnie Furnari, RDH, MS, FAADH; Janet Tuthill, RDH, MA

272 Treatment Modalities for Drug-Induced Gingival Enlargement

Michelle Moffitt, RDH; Davide Bencivenni, DDS, MS; Robert Cohen, DDS, PhD

Case Report

278 Tooth Jewelry in an 8 Year Old Child: Case Report

R. Constance Wiener, DMD

Research

282 A Randomized Controlled Trial of the Effect of Standardized Patient Scenarios on Dental Hygiene Students' Confidence in Providing Tobacco Dependence Counseling

Jennifer L. Brame, RDH, MS; Robbyne Martin, RDH, MS; Tabitha Tavoc, RDH, PhD; Margot Stein, PhD; Alice E. Curran, DMD, MS

292 Maryland Dental Hygienists' Knowledge, Opinions and Practices Regarding Dental Caries Prevention and Early Detection

Joanne B. Clovis, RDH, PhD; Alice M. Horowitz, RDH, PhD; Dushanka V. Kleinman, DDS; Min Qi Wang, PhD; Meredith Massey, MED

306 Identifying Barriers to Receiving Preventive Dental Services: Expanding Access to Preventive Dental Hygiene Services Through Affiliated Practice

Michelle L. Gross-Panico, RDH, MA, DHSc; Wilbur K. Freeman III, BSE, MBA

315 Dental Hygienist Attitudes toward Providing Care for the Underserved Population

Lynn A. Marsh RDH, EdD

323 Effects of Dental Magnification Lenses on Indirect Vision: A Pilot Study

Sarah B. Hoerler, RDH, MS; Bonnie G. Branson, RDH, PhD; Anne M. High, RDH, MS; Tanya Villalpando Mitchell, RDH, MS

331 DENTSPLY Posters

336 CLL Poster Session

Departments

258 Editorial



2012: A Year In Review

The Journal of Dental Hygiene continues to grow! We could not see such success without the participation of a large number of individuals! We have experienced more submissions than the previous year and we hope to do so again in 2013! We have a lot of people to thank for the success we have enjoyed this year starting with our contributors! Many professionals are writing and making contributions to our literature. We would not exist without you!

I wish to gratefully acknowledge the support and valuable contributions of the American Dental Hygienists' Association for their commitment to the Journal of Dental Hygiene and for recognizing the value of scholarship to the growth of the profession. Specifically, I wish to thank our Journal Staff Editor, Josh Snyder for his attention to detail and professional manner. Also, thanks to

Ann Battrell, Executive Director of the ADHA for her support of the Communications Divisions and her leadership at the ADHA.

We are proud of the peer review process and the quality publications that culminate from the efforts of the editorial review board and the other academicians who assist us with quality reviews. These volunteers, whether regular members or guest reviewers, make our publication one that all of us can be proud of as we strive to continuously grow our body of knowledge.

Thank You!

Sincerely,

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

2012 Journal of Dental Hygiene Review Board

Celeste M. Abraham, DDS, MS
Cynthia C. Amyot, BSDH, EdD
Joanna Asadoorian, AAS, BScD, MSc
Caren M. Barnes, RDH, BS, MS
Phyllis L. Beemsterboer, RDH, MS, EdD
Stephanie Bossenberger, RDH, MS
Linda D. Boyd, RDH, RD, LS, EdD
Kimberly S. Bray, RDH, MS
Colleen Brickle, RDH, RF, EdD
Lorraine Brockmann, RDH, MS
Patricia Regener Campbell, RDH, MS
Dan Caplan, DDS, PhD
Marie Collins, RDH, EdD
Barbara H. Connolly, PT, EdD, FAPTA
Valerie J. Cooke, RDH, MS, EdD
MaryAnn Cugini, RDH, MHP
Susan J. Daniel, AAS, BS, MS
Michele Darby, BSDH, MS
Janice DeWald, BSDH, DDS, MS
Susan Duley, BS, MS, EdS, EdD, LPC, CEDS
Jacquelyn M. Dylla, DPT, PT
Kathy Eklund, RDH, BS, MHP
Deborah E. Fleming, RDH, MS
Jane L. Forrest, BSDH, MS, EdD
Jacquelyn L. Fried, RDH, BA, MS
Mary George, RDH, BSDH, MEd

Kathy Geurink, RDH, BS, MA
Joan Gluch, RDH, PhD
Maria Perno Goldie, RDH, BA, MS
Ellen Grimes, RDH, MA, MPA, EdD
JoAnn R. Gurenlian, RDH, PhD
Linda L. Hanlon, RDH, BS, MEd, PhD
Kitty Harkleroad, RDH, MS
Lisa F. Harper Mallonee, BSDH, MPH, RD/LD
Harold A. Henson, RDH, MEd
Alice M. Horowitz, PhD
Laura Jansen Howerton, RDH, MS
Olga A.C. Ibsen, RDH, MS
Mary Jacks, MS, RDH
Wendy Kerschbaum, RDH, MA, MPH
Salme Lavigne, RDH, BA, MSDH
Jessica Y. Lee, DDS, MPH, PhD
Madeleine Lloyd, MS, FNP-BC, MHNP-BC
Deborah Lyle, RDH, BS, MS
Ann L. McCann, RDH, BS, MS, PhD
Stacy McCauley, RDH, MS
Gayle McCombs, RDH, MS
Tanya Villalpando Mitchell, RDH, MS
Tricia Moore, RDH, BSDH, MA, EdD
Christine Nathe, RDH, MS
Kathleen J. Newell, RDH, MA, PhD
Johanna Odrich, RDH, MS, DrPh

Pamela Overman, BSDH, MS, EdD
Vickie Overman, RDH, BS, MEd
Fotinos S. Panagakos, DMD, PhD, MEd
M. Elaine Parker, RDH, MS, PhD
Ceib Phillips, MPH, PhD
Marjorie Reveal, RDH, MS, MBA
Kathi R. Shepherd, RDH, MS
Deanne Shuman, BSDH, MS PhD
Judith Skeleton, RDH, BS, MEd, PhD
Ann Eshenaur Spolarich, RDH, PhD

Rebecca Stolberg, RDH, BS, MSDH
Sheryl L. Ernest Syme, RDH, MS
Terri Tilliss, RDH, BS, MS, MA, PhD
Lynn Tolle, BSDH, MS
Margaret Walsh, RDH, MS, MA, EdD
Donna Warren-Morris, RDH, MS, MEd
Cheryl Westphal, RDH, MS
Karen B. Williams, RDH, PhD
Charlotte J. Wyche, RDH, MS
Pamela Zarkowski, BSDH, MPH, JD

2012 Journal of Dental Hygiene Review Board Volunteers

In addition, the following individuals assisted the Journal of Dental Hygiene with the review process in 2009:

Migliorati Cesar, DDS, MS, PhD
Charles Cobb, DDS, PHD
Larry Cohen, DDS

Gregory Essick, DDS, PhD
Lisa Moravec, RDH, MSDH
Jodi Olmsted, RDH, PhD
Ricardo Padilla, DDS
David Paquette, DMD, MPH, DMSc
David Rubin, DDS
June Sadowsky, DDS, MPH, FASGD, DABSCD

Linking Research to Clinical Practice

Medical Screenings in Dental Settings

Denise M. Bowen, RDH, MS

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.

Greenberg BL, Kantor ML, Shuying SJ, Glick M. Patients' attitudes toward screening for medical conditions in a dental setting. *J Public Health Dent.* 2012;72(1):28–35.

Objectives: Previous studies demonstrated the efficacy of chairside medical screening by dentists to identify patients who are at increased risk for developing cardiovascular-associated events and the favorable attitude of dentists toward chairside medical screening. This study assessed patient attitudes toward chairside medical screening in a dental setting.

Methods: A self-administered 8-item questionnaire was given to a convenience sample of adult patients attending an inner-city dental school clinic and two private practice settings. A 5-point response scale was utilized. Wilcoxon-Mann-Whitney tests and t-tests were used to compare responses between study groups. Friedman non-parametric analysis of variance was used to compare response items within each question.

Results: Regardless of setting, the majority of respondents were willing to have a dentist conduct screening for heart disease, high blood pressure, diabetes, human immunodeficiency virus infection and hepatitis infection (55 to 90%); discuss results immediately (79 and 89%); provide oral fluids, finger-stick blood, blood pressure measurements and height and weight (60 to 94%) and pay up to \$20 (50 to 67%). Respondents reported that their opinion of the dentist would improve regarding the dentist's professionalism, knowledge, competence and compassion (48 to 77%). The fact that the test was not done by a physician was ranked as the least important potential barrier. While all re-

spondents expressed a favorable attitude toward chairside screening, the mean score was significantly lower among clinic patients across most questions/items. The priority rankings within an item were similar for both groups.

Conclusions: Acceptance by patients of chairside medical screening in a dental setting is a critical element for successful implementation of this strategy.

Commentary

Dental hygienists, dentists and others providing oral health care are responsible for prevention, assessment and treatment of oral diseases. The association between oral and systemic health has increased our role in early identification and referral of patients with potential chronic medical conditions, and collaboration with other health professionals for comprehensive patient care. The U.S. Department of Health and Human Services selected oral health as one of 12 Leading Health Indicators for Healthy People 2020.¹ Oral health objectives address several areas for public health improvement, including the need to:

- Increase awareness of the importance of oral health to overall health and well-being
- Increase acceptance and adoption of effective preventive interventions²

Prevalence of diseases, such as cardiovascular diseases and diabetes, is increasing, and the population is aging. For many years, oral health practitioners have been screening patients for elevated blood pressure readings and referring them to their primary health care provider for medical evaluation

and diagnosis of hypertension. Recently, broader-based medical screenings for heart disease risk, diabetes, human insufficiency virus (HIV) and hepatitis in dental settings have been suggested.

This study evaluated patients' perceptions toward these screenings. Patients in outpatient dental school clinics in New Jersey (n=288) and two dental offices in Newark, New Jersey and Mesa, Arizona (n=182) were asked to complete a self-administered questionnaire when they arrived for an appointment; 90% agreed to participate. Surveys were returned to the front desk in sealed envelopes to provide confidentiality. Each question included a series of items assessing the respondents' attitudes, acceptability, and perceived barriers concerning screening for medical conditions by a dentist. Responses were favorable for both settings; however, clinic patients (CP) differed from private practice patients (PP) on some items.

Regardless of setting, patients were willing to have a dentist screen for common medical conditions about which they were unaware or to monitor existing conditions. They were willing to have screenings in dental settings for diabetes mellitus (CP 83.3%, PP 57.4%), hepatitis (CP 80.8%, PP 56.8%), heart disease (CP 81.7%, PP 57.3%) and HIV (CP 80.0%, PP 54.8%). Positive responses were significantly lower for all items in the private sector. The majority of CP and PP respondents said they would provide blood pressure measurements (CP 94%, PP 80%), weight and height (CP 89%, PP 77%), oral fluids (CP 87%, PP 79%) and finger-stick blood (CP 77%, PP 60%) for chairside medical screenings in dental settings. If the scope of practice for oral health professionals is to be re-conceptualized and expanded, patients will need to be receptive to primary health care activities in dental settings. Barriers identified by at least 80% of all respondents included confidentiality, time and insurance coverage. These responses indicate that successful implementation of chairside medical screenings in the dental settings would require an efficient, inexpensive system while also assuring patient confidentiality. Patients did not perceive the dentist-provider as a barrier and reported their opinion of the dental professional's knowledge, professionalism and compassion would be enhanced by chairside medical screening and monitoring.

Likely, some insurance companies would not reimburse patients for medical screenings in dental practice, at least until clear benefits for clients and/or cost savings are demonstrated. Most of these respondents would pay up to \$20 for chairside medical screening; however, CP patients (77%) were more willing to pay \$10 to \$20 than PP (50%). This difference increased with fees of \$21 to \$30 with 65%

CP versus 34% PP willing to pay. Plausible explanations for this difference might be that patients in private dental offices are more likely to have access to a primary care health care provider and/or insurance that would pay for screening tests in medical settings, whereas inner-city clinic patients might not. Data were not collected regarding reasons for responses. Interestingly, older patients were significantly less willing to pay any amount – no other item was significantly different by age. Many elderly patients in the U.S. are on limited or fixed incomes, and Medicare potentially would cover medical tests administered in primary care settings. An assessment of how much time and materials would be required to perform these screening tests in oral health care settings is needed to determine feasibility. These findings indicate, however, that most patients were open to receiving chairside medical screenings if time and cost were minimal and confidentiality was protected. Results cannot be generalized to other settings and groups because a convenience sample was employed.

The findings imply there may be challenges for dental hygienists and other oral health care providers who want to implement chairside medical screenings, but it can be accomplished. Cost needs to be low. Respondents reported being least willing to provide finger-stick blood, and heart disease screening was least important for PP. Finger sticks are needed for diabetes and cholesterol screenings. These issues need further exploration. Oral health professionals need strategies to foster patient acceptance and reduce perceived barriers. The goals of increasing awareness of the importance of oral health to overall well-being and increasing the adoption of effective preventive interventions warrant that commitment.

Barasch A, Safford MM, Qvist V, et al. Random blood glucose testing in dental practice: A community-based feasibility study from the Dental Practice-Based Research Network. J Am Dent Assoc. 2012;143(3):262-269.

Background: The prevalence of diabetes mellitus (DM) has been increasing. Instances of patients not having received a diagnosis have been reported widely, as have instances of poor control of DM or prediabetes among patients who have the disease. These facts indicate that blood glucose screening is needed.

Methods: As part of the Dental Practice-Based Research Network, the authors conducted a study in community dental practices to test the feasibility of screening patients for abnormal random blood glucose levels by means of glucometers and fin-

ger-stick testing. Practitioners and staff members were trained to use a glucometer, and they then screened consecutive patients older than 19 years at each practice until 15 patients qualified for the study and provided consent. Perceived barriers to and benefits of blood glucose testing (BGT) were reported by patients and dental office personnel on questionnaires.

Results: A total of 28 practices screened 498 patients. A majority of the respondents from the 67 participating dental offices considered BGT useful and worth routine implementation. They did not consider duration of BGT or its cost to be significant barriers. Among patients, more than 80% thought BGT in a dental practice was a good idea and found it easy to withstand; 62% were more likely to recommend their dentists to others if BGT was offered.

Conclusion: BGT was well received by patients and practitioners. These results support the feasibility of implementation of BGT in community dental practices.

Clinical Implications: Improved diagnosis and control of DM may be achieved through implementation of BGT in community dental practices.

Commentary

DM is a worldwide endemic, and undiagnosed cases are considered to be highly prevalent. Oral health professionals have the capability and responsibility for early identification, assessment and management of patients with diagnosed DM or patients at risk of developing DM. An estimated 60 to 70% of individuals in the U.S. saw a dental professional within the past year; therefore, there is a tremendous opportunity for detecting and monitoring DM.³ Monitoring of patients with DM and addressing their oral and general health care needs requires assessment and management during dental hygiene appointments and collaboration with their primary health care professionals. The result is better control of the oral/periodontal complications of DM and better management of patients' overall health. Screening for DM for high risk patients in dental offices was proposed by the International Diabetes Federation in 2007. Regardless, the practice of chairside testing and monitoring by dentists and dental hygienists is rare.

This study was conducted to examine the feasibility of BGT in community dental practices. Dentists (n=28) and staff members (n=44) were trained to perform finger stick tests and use glucometers. BGT was administered in practices by dentists only (n=19), dentists and hygienists (n=7) and dentists

and dental assistants (n=17). After BGT, practitioners (n=72) and patients (n=498) were asked to complete a questionnaire regarding their perceptions of benefits and barriers to chairside BGT in dental settings. BGT was offered to patients at risk for abnormal blood glucose levels according to American Diabetes Association recommendations. All patients with a body mass index (BMI) greater than 25 kilograms/square meter, self-reported history of hypertension or hypercholesterolemia, or with diagnosed DM/prediabetes were invited to participate. Both questionnaires used a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Responses were received from 67 practitioners (93%) responded. The majority (60 to 88%) agreed or strongly agreed with these benefits of chairside BGT in descending order: promotes patients' opinion of them as being interested in their overall health, provides benefits for patients, helps identify patients at risk for periodontal disease, leads to better glycemic control and helps determine timing of invasive dental procedures. Most also believed BGT was not too time consuming (57%) or expensive (51%) to offer in a dental setting. Average time reported for chairside BGT was 2 to 5 minutes, and most did not believe the procedure was disruptive to their normal appointment. The majority (57%) of practices reported lack of insurance coverage as a barrier to implementation, and 28% reported a lack of patient demand. In the end, however, the vast majority (93%) recommended implementing DM screenings in practice, and all practices reported BGT was easy and well-received by patients.

Ninety percent of screened patients thought BGT demonstrated a high level of care by their dental professional. Patients reported BGT was easy for them (86%) and believed the information provided to them was useful (79%). The authors did not discuss patients' perceptions of cost for BGT or insurance concerns reported by practitioners. It would be interesting to know whether the fee exceeded the \$20 limit previously reported as acceptable to patients, and what percentage of insurance plans covered BGT in dental practices.

The biggest limitation was the use of BGT rather than HbA1c testing at chairside. Both require a finger stick. BGT is affected by recent carbohydrate intake and medication use. The HbA1c is more precise and reflects two to three months of glycemic control. Home tests and chairside professional tests are now available, so associated time and costs have been decreased recently. Dental hygienists considering in-office DM testing should

consider using HbA1c rather than BGT. Nonetheless, the purpose of the study was to examine the feasibility of chairside DM testing, and the procedure was easily implemented and well-received by most of the providers and patients.

These results only apply to patients at risk for DM whereas the previous patient survey regarding chairside medical testing proposed general health screenings. Patients who are diagnosed with DM or at risk might have a more positive attitude about chairside testing because of their association with the disease and the heightened probability of a potential problem. Dental hygienists could offer this preventive general health service to patients at risk or use HbA1c testing to determine relationships between existing periodontal disease and poorly controlled or undiagnosed DM. The bidirectional relationship is clear: periodontal disease affects glycemic control in DM and poor glycemic control affects periodontal disease severity and treatment. Although HbA1c is a diagnostic test for DM/pre-diabetes, dental hygienists would use it for screening purposes, making referrals for medical diagnosis and treatment. Addition of this chairside test would enhance our role as preventive professionals and potentially improve diagnosis and control of DM in the future.

The Bottom Line

Each of these studies examined attitudes toward general health screenings in oral health care settings. Prevalence of cardiovascular diseases, DM/prediabetes, and hepatitis C is increasing worldwide. A critical component of any health care initiative is prevention, and dental hygienists are preventive oral health specialists. Health care reforms are enhancing opportunities for integrated oral and general health initiatives as well as interprofessional collaborations. Additionally, dental hygienists are increasingly found providing oral health care to underserved populations where individuals may be at greater risk for oral and systemic diseases. The majority of patients surveyed reported being willing to have a dentist do medical screenings at chairside if cost and time were nominal and their confidentiality was protected. Challenges to implementation included patients' acceptance of finger sticks and cost over \$20. Patients reported a heightened positive opinion of their dental care provider when general health screening was an option. The authors concluded that patient acceptance of chairside medical screening in dental settings is critical for successful implementation.

The second study examined chairside BGT for

patients at high risk of DM/prediabetes. General population screenings are not recommended for DM. Dental hygienists have the potential to identify patients at risk or those with undiagnosed DM and refer them to their primary care provider for diagnosis and treatment. Early diagnosis and better metabolic control through lifestyle changes and health care interventions can reduce complications, morbidity and mortality associated with DM. The bi-directional relationship between periodontal disease and DM makes it particularly relevant for dental hygienists. Improvement in rates of undiagnosed DM/prediabetes and poorly controlled DM will require interprofessional efforts beyond the capacity of medical care providers. Both patients and providers found chairside BGT for DM easy and desirable for implementation in dental settings. The oral health care professionals perceived lack of insurance coverage as a barrier. The authors concluded that BGT was well received by patients and practitioners. Results support the feasibility of BGT for DM screenings in community dental practices. Improved diagnosis and control of DM may be achieved through implementation.

Based on the findings of these two studies, the following conclusions can be drawn:

- Patients are receptive to general health screenings in dental settings.
- Patients' opinions of the professionalism, knowledge and compassion of their oral health professional are enhanced by addressing the oral-systemic health link and offering chairside general medical or DM screenings.
- Dental professionals who provided finger sticks for DM screenings did not believe that the procedure, requiring two to five minutes, was disruptive to their normal appointment.
- Most patients were willing to pay up to \$20 for medical screening test(s), with the exception of elderly patients. The actual cost of testing needs to be determined.
- Chairside medical screenings in oral health care settings are feasible. DM screenings for patients at risk may be the easiest and most relevant point to begin.

Summary

Dental hygienists are preventive professionals responsible for the oral and general health of their patients. Chairside medical screenings would be a positive addition to comprehensive preventive care plans and interprofessional collaboration. The goals and oral health objectives of Health People 2020 include increasing the proportion of people receiving preventive interventions in dental offices, awareness

of the importance of oral health to overall health and acceptance and adoption of preventive interventions. All of these are within the realm of dental hygiene practice. Results of these studies show that patients would be receptive to general medical testing in oral health care settings. Patients at risk for DM are particularly receptive to chairside testing and information. General health screenings in dental hygiene practice could be an effective component of disease prevention/control and enhance integration of health care across disciplines.

Denise M. Bowen, RDH, MS, is Professor Emerita in Dental Hygiene at Idaho State University. She has served as a consultant to dental industry, as well as numerous government, university and private organizations and presently is a member of the National Advisory Panel for the National Center for Dental Hygiene Research in the U.S. She has served as Chair of the American Dental Hygienists' Association Council on Research and Chair of the Research Committee for the Institute for Oral Health and has received national awards for excellence in dental hygiene.

Acknowledgments

The author acknowledges Mary Bossart, RDH, BS, whose research regarding dental hygienists' chairside HbA1c screenings for periodontal patients inspired this manuscript.

References

1. Healthy People 2020. U.S. Department of Health and Human Services [Internet]. [cited 2012 October 12]. Available from: <http://www.healthypeople.gov/2020/default.aspx>
2. Healthy People 2020. U.S. Department of Health and Human Services [Internet]. [cited 2012 October 12]. Available from: <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=32>
3. Lalla E, Lamster IB. Assessment and management of patients with diabetes mellitus in the dental office. *Dent Clin North Am.* 2012;56(4):819–829.

The Role of Dental Hygienists in Conducting Rapid HIV Testing

Anthony J. Santella, DrPH, MPH, CHES; Susan H. Davide, RDH, MS, MEd; Marilyn Cortell, RDH, MS, FAADH; Winnie Furnari, RDH, MS, FAADH; Janet Tuthill, RDH, MA

Introduction

In the U.S., over half a million people are living with Human Immunodeficiency Virus (HIV) or Acquired Immune Deficiency Syndrome (AIDS).¹ The Centers for Disease Control and Prevention (CDC) estimates that approximately 50,000 people are newly infected with HIV each year in the U.S. In 2009 (the most recent year that data are available), there were an estimated 48,100 new HIV infections. Of those infected with HIV, 21% are unaware of their serostatus because they have not been recently tested for HIV.² Data from the 2005 National Health Interview Survey found that 3.6 million Americans report that they are at significant risk for contracting HIV, yet have never been tested.³ Of importance, 75% of these individuals have seen a dental provider within the past 2 years. Another national survey found that 64% of the general population see an oral health professional in the course of a year compared to 39% who went to a medical office.⁴ Thus, the dental office may be a suitable setting to expand rapid HIV testing. Dental office staff, specifically the dental hygienist, may be able to engage patients and, if willing, perform HIV rapid tests.⁵ The published literature includes scholarly articles on the roles and attitudes of dentists on conducting rapid HIV testing in the dental setting, but there is little research and information on the roles of dental hygienists in providing HIV testing.^{6,7}

Background

HIV Testing

Early detection through HIV pre-screening of patients in health care settings is imperative to receiving the necessary treatment and care. To facilitate timely detection, the CDC revised HIV testing guidelines in 2006 to recommend routine HIV testing in all health care settings for patients aged 13 to 64 years.⁸ HIV

Abstract

Purpose: In the U.S., an estimated 21% of people living with HIV/AIDS do not know their positive HIV status. Expanding rapid HIV testing in the dental setting may increase the number of individuals who are aware of their HIV status and can begin medical care and social support services if seropositive and appropriate. As a member of the dental team, the dental hygienist, with the proper knowledge and training, may be suitable to conduct rapid HIV testing.

Keywords: HIV, AIDS, HIV Testing, Oral Hygiene, Dental Hygiene Education

This study supports the NDHRA priority area, **Health Services Research:** Assess the impact of dental hygiene services on the outcomes of care for patients with special needs.

can be detected using reliable, inexpensive and non-invasive screening tests. HIV seropositive individuals have increased longevity if treatment regimens are initiated early before the appearance of symptoms.⁹

Conducting HIV rapid tests is an important part of the HIV disease management continuum — from primary and secondary prevention to care and treatment. HIV-infected individuals who are aware of their seropositive status may practice risk reduction strategies such as using condoms consistently and correctly, reducing the number of sexual partners, using clean syringes if injecting drugs and learning about their disease to prevent further transmission.¹⁰ In response for the growing demand in evidence-based strategies for “prevention with positives,” the CDC developed the Serostatus Approach to Fighting the HIV Epidemic (SAFE) strategy, which not only increases the availability of prevention services for HIV-infected people but also teaches clinicians to perform HIV and sexually transmitted infection risk assessments.¹⁰ It is possible to extend these screenings and assessments into the dental setting. Finally, it is important to engage and retain HIV-infected persons in primary care so that their disease is appropriately managed with regards to primary medical care and social services.^{8,11}

Table I: Food and Drug Administration Rapid HIV Antibody Screening Tests

Test Name	Date of FDA Approval	Specimen Type	CLIA Category	List Price per Device (Price for recipients of CDC Grants)	Manufacturer
OraQuick ADVANCE Rapid HIV-1/2 Antibody Test	November 2002	Oral fluid	Waived	\$17.50	OraSure Technologies, Inc.
		Whole blood (finger stick or venipuncture)	Waived		
		Plasma	Moderate Complexity		
Uni-Gold Recombigen HIV	December 2003	Whole blood (finger stick or venipuncture)	Waived	\$15.74 (\$8.00)	Trinity Biotech
		Serum and Plasma	Moderate Complexity		
Reveal G-3 Rapid HIV-1 Antibody Test	April 2003	Serum	Moderate Complexity	\$14.00	MedMira, Inc.
		Plasma	Moderate Complexity		
MultiSpot HIV-1/HIV-2 Rapid Test	November 2004	Serum	Moderate Complexity	\$25.00	BioRad Laboratories
		Plasma	Moderate Complexity		
Clearview HIV 1/2 STAT-PAK	May 2006	Whole blood (finger stick or venipuncture)	Waived	\$17.50 (\$8.00)	Inverness Medical Professional Diagnostics
		Serum and Plasma	Non-waived		
Clearview COMPLETE HIV 1/2	May 2006	Whole blood (finger stick or venipuncture)	Waived	\$18.50 (\$8.00)	Inverness Medical Professional Diagnostics
		Serum and Plasma	Non-waived		

Source: U.S. Centers for Disease Control and Prevention, <http://www.cdc.gov/hiv/topics/testing/rapid/#chart>

Although the first AIDS case was reported in 1981, and the first HIV case in 1984, it was not until 1985 that the first HIV test kit, the enzyme-linked immunosorbent assay (ELISA), was developed.¹² In 1987, the first Western Blot test kit was released. Rapid tests have changed over time, resulting in the first rapid oral fluid test in 2004. Currently, there are also home "do it yourself" HIV test kits.¹²

The Clinical Laboratory Improvement Amendments (CLIA) of 1988 established quality standards for laboratory testing. CLIA requires that any facility which handles specimens for diagnosis, prevention or treatment of a disease must register with the Centers for Medicare and Medicaid Services and obtain a CLIA certification or waiver. The Food and Drug Administration (FDA) has approved several rapid HIV tests as waived tests under CLIA. Waived rapid HIV tests are defined as "simple laboratory examinations and procedures that have an insignificant risk of erroneous result."¹³ Waived tests must use unprocessed speci-

mens (whole blood or oral fluid), be easy to use and have little risk of an incorrect result. Dental settings are eligible to receive this waiver or certification from CLIA to conduct rapid HIV tests.¹³

HIV rapid testing is completed using a relatively simple process. The provider swabs the patient's buccal mucosa and gingiva. Next, the provider places the end of the swab device in a vial that holds an enzyme solution that reacts to any antibody-antigen binding. As the oral fluid and the enzymes make their way up the test strip, they encounter the HIV-antigen substance. If there are HIV antibodies in the oral fluid, they start to bind to the antigens, and the enzyme reacts, causing a color change on the strip. This produces a line on the read-out portion of the device. This line indicates a reaction, but is not considered to be a definite positive. As with all other HIV tests, rapid tests require a repeat test before a patient is considered to be HIV positive.¹⁴ Table I provides information on the current FDA approved HIV rapid tests.^{15,16}

Dental Hygiene Student Exposure to HIV Education

A dental hygiene student will first encounter HIV-infected patients when taking an initial medical history or reviewing an established patient's record. He or she will be educated to ask state-of-health questions and utilize established protocol for possible medical clearance, which is taught didactically in the classroom. The Commission on Dental Accreditation (CODA) sets the standards all accredited programs must follow to "ensure the quality and continuous improvement of dental and dental-related education and reflect the evolving practice of dentistry."¹⁷ Any program change, whether at the associate, bachelors or Masters degree level, must reflect CODA guidelines. Such foundation knowledge, which includes both cognitive skills and clinical applications for patients with HIV and other diseases and conditions, is integral to dental hygiene education, as is the connection between oral health and total health and the effects each has on the other. This is established early and continuously reinforced in the dental hygiene curriculum.¹⁸

All basic dental related core curricula include HIV as a topic or sub-topic.¹⁹ Much of the prevention and counseling efforts of the HIV testing process are rooted in psychology, psychoanalytic and behavioral approaches, and sociology, where students learn sociological theory as a means for understanding human behavior and the human condition.²⁰ Other general education course work, such as math, English, chemistry, biology and microbiology, among others, are necessary for degree completion.

Dental specific courses include such courses as principles of dental hygiene, oral pathology, epidemiology, pharmacology, immunology, disease etiology, nutrition, preventive dentistry, periodontics, public health and pharmacology. Specific to oral pathology is the recognition of many oral manifestations that occur in both disease and health that may exhibit in the earliest stages of disease.²¹ In pharmacology, antiretroviral therapy (ART), among other HIV and viral related pharmacologic agents, are included.²² This enhanced knowledge prepares the dental hygienist to establish an appropriate treatment plan, make informed decisions and collaborate on referrals when necessary.

Patient assessment, asepsis, disease transmission prevention, professionalism and ethics are applied in a day-to-day clinical setting where direct supervised patient care in ongoing and didactic learning is integrated within the clinical setting. Students are continuously exposed to a variety of patient types presenting with a broad range of

systemic conditions and diseases. Students are expected to apply the American Dental Hygienists' Association (ADHA) Code of Ethics to all interactions with patients, colleagues and the public at large, along with understanding established legislation relative to protecting and aiding patient and hygienist against discrimination in dentistry.¹⁷

Education of dental hygienists in the U.S. already addresses HIV in significant depth including the infection, its transmission, the life cycle of the virus, the disease classifications in children, adolescents and adults, the clinical categories, the clinical course, the oral manifestations, the treatment and management of an infected patient and modes of prevention.²² Coupled with their knowledge and mandated compliance in the use of standard precautions, with proper training in the administration of the rapid HIV test and in appropriate counseling skills and protocol, the dental hygienist is ideally positioned to engage their patients in a conversation that might result in the earliest detection of a serious health matter needing attention by the medical community at large.

The Potential Role of Dental Hygienists' in HIV Prescreening and Referral

Dental Hygienists' Professional Roles and Oral-Systemic Disease Manifestations

A dental hygienist is a member of the dental team whose primary role is a public health advocate in the prevention and maintenance of oral health and disease.²³ This encompasses multifaceted functions that are inter-related and include clinician, educator, researcher, administrator and advocate (Figure 1). As clinicians, dental hygienists screen and assess oral health conditions and plan and implement treatment on a patient-to-patient individualized needs basis.²⁴ All of these services are important and applicable skill sets if dental hygienists were to routinely provide HIV rapid tests.

Common oral manifestations of AIDS and HIV include Kaposi sarcoma, candidiasis (thrush), herpes simplex and oral hairy leukoplakia.²⁵ Since the initiation and use of HAART, there has been decreased occurrence of HIV-related oral lesions, although some still occur.^{25,26} Current oral manifestations associated with HIV disease include human papillomavirus and xerostomia.²⁷ Many signs and symptoms of HIV infection are exhibited initially in the mouth and the dental hygienist is most often the dental care provider scheduled with the patient initially and thus the first to detect any

noticeable signs and symptoms during a thorough recall assessment.²⁶

HIV Testing and New York City and State Health Care

The New York City Comprehensive Strategic Plan for HIV/AIDS Services 2009–2012, New York Eligible Metropolitan Area, fulfills the Ryan White HIV/AIDS Treatment Modernization Act with the development of a plan for the organization and delivery of HIV-related services. Goal 1 is to increase the number of individuals who are aware of their HIV status. Objective 1A states: "To increase the number of individuals receiving voluntary HIV rapid testing across health care and social support service providers, by 2010."²⁸ "The Bronx Knows" and most recently "The Brooklyn Knows" projects administered by the New York City Department of Health and Mental Hygiene illustrates that when HIV becomes a routine part of medical care, the number of people who know their status increases and the stigma surrounding HIV and testing declines.²⁹

On July 30, 2010, former Governor David Paterson signed S8227 into law simplifying the informed consent process and requiring health professionals to offer voluntary HIV tests to all patients from 13 to 64 years old. "This State law will have its greatest impact here in New York City, where more than 107,000 residents are living with HIV/AIDS and thousands more do not know they are infected," said Dr. Thomas Farley, New York City Health Commissioner. Patients must still provide written consent for HIV testing for results that go beyond an hour and still allows patients the opt-out of HIV testing.³⁰

Dental Hygienists' Role on HIV Testing and Referral

Rapid HIV testing in the dental health care environment would be advantageous because the screening technology allows individuals to learn their HIV status in approximately 20 minutes, within the scheduled time frame that a patient is treated by a dental hygienist. The dental hygienist could easily incorporate this procedure in their appointment schedule and begin during the review of the patient's medical history form. The established and often long-term patient-provider relationship (patient/hygienist) will facilitate the likelihood of a patient consenting to the test when offered by the dental staff who treats them regularly.³¹

As oral hygiene specialists, dental hygienists

Figure 1: Professional Roles of the Dental Hygienist



This graphic is used with the permission of the American Dental Hygienists' Association

play a principal role in educating patients and would be the ideal personnel in the office to perform the HIV rapid testing with support from the dental team. Previous barrier concerns were lack of test training, lack of knowledge and training in HIV, counseling confidentiality and reimbursement.³² The New York/New Jersey AIDS Education and Training Center offers clinicians and dental facilities training and certification on how to accurately perform the rapid HIV test and an understanding of the significance of preliminary results, counseling measures and referral recommendations.³³ This tested training program may be suitable for incorporation in dental hygiene curricula.

Conclusion

Advancements in technology, specifically biomarker research, recognize saliva as a diagnostic medium that can be collected simply and non-invasively, and oral fluid-based screening tests for systemic diseases are becoming more widespread.³⁴ This, coupled with the fact that dental hygiene students receive a scientific education and basic knowledge about HIV/AIDS, makes dental hygienists an appropriate profession to conduct HIV rapid tests. These new diagnostic tools have the potential for expanding and enhancing the role of the dental team in HIV testing with the dental hygienist positioned to provide HIV rapid tests and refer HIV infected persons to medical care and social services, as appropriate. This also enhances their participation in promoting the advancement of total health and well-being of all

patients. With minimum effort, dental hygienists can learn the test techniques and protocols to fulfill this role. Ethical, legal, consent, confidentiality protocols and training need further exploration and research.^{31,35} In addition, this topic requires additional research, including nationwide data collection to ascertain dental hygienists' knowledge of HIV/AIDS, comfort level with treating people with HIV/AIDS and testing those unaware of their possible disease status. Rapid HIV testing by dental hygienists remains an important oral health and public health issue. Further collaborations among these 2 professions may yield acceptance of this practice. By collaborating in a synergistic manner and by clearly delineating the roles and responsibilities of each profession, there is hope for advancing the science of rapid HIV testing in the dental setting.

Anthony Santella, DrPH, CHES, Lecturer of HIV/STIs and Sexual Health, University of Sydney, Sydney Medical School. Susan Davide, RDH, MS, MEd, Assistant Professor of Dental Hygiene, New York College of Technology. Marilyn Cortell, RDH, MS, FAADH, Associate Professor of Dental Hygiene, New York College of Technology. Winnie Furnari, RDH, MS, FAADH, Associate Professor of Dental Hygiene, New York University, College of

Table II: CODA dental hygiene standards

Number	Name	Areas of Compliance	Application to HIV Education
1	Institutional Effectiveness	Planning & Assessment Financial Support Institutional Accreditation Community Resources	
2	Educational Program	Instruction Admissions Curriculum Patient Care Competencies Curriculum Management Plan	X X X
3	Administration, Faculty and Staff	Program Administrator Faculty Support Staff	
4	Educational Support Services	Clinical Facilities Radiography Facilities Laboratory Facilities Extended Campus Facilities Classroom Space Office Space Learning Resources Student Services	X X
5	Health and Safety Provisions	Infectious Disease/Radiation Management Emergency Management	X
6	Patient Care Services	Patient Care Quality Assurance	

Dentistry. Janet Tuthill, RDH, MA, Director, Dental Assistant Program, Stony Brook University, School of Dental Medicine.

Acknowledgments

The authors would like to acknowledge Gwen Cohen Brown, DDS, FAAOMP, Associate Professor of Dental Hygiene at the New York City College of Technology for her editorial support on this manuscript.

References

1. Cases of HIV Infection and AIDS in the United States and dependent areas. Centers for Disease Control and Prevention [Internet]. 2009 [cited 2011 September 7]. Available from: <http://www.cdc.gov/hiv/surveillance/resources/reports/2009report/>
2. Prejean J, Song R, Hernandez A, et al. Estimated HIV Incidence in the United States, 2006–2009. *PLoS One*. 2011;6(8):e17502.
3. Pollack HA, Metsch LR, Abel S. Dental Examinations as an Untapped Opportunity to Provide HIV Testing for High-Risk Individuals. *Am J Public Health*. 2010;100(1):88–89.
4. Reznik D. Health Screenings in the Dental Setting. OSAP [Internet]. 2011 [cited 2011 November 7] Available from: http://c.ymcdn.com/sites/www.osap.org/resource/resmgr/Symposium_2011/Reznik_locked.pdf
5. Glick M. Rapid HIV testing in the dental setting. *J Am Dent Assoc*. 2005;136(9):1206–1208.
6. Greenberg BI, Glick M, Frantsve–Hawley J, Kantor ML. Dentists' attitudes toward chairside screening for medical conditions. *J Am Dent Assoc*. 2010;141(1):52–62.
7. Patton LL, Santos A, McKraig RG, Shugars DC, Strauss RP. Education in HIV risk screening, counseling, testing, and referral: survey of U.S. dental schools. *J Dent Educ*. 2002;(66)10:1169–1177.
8. Branson BM, Handsfield HH, Lampe MA, et al. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health care settings. *MMWR Recomm Rep*. 2006;55(RR-14):1–17.
9. Del Rios C. New challenges in HIV care: prevention among HIV-infected patients. *Top HIV Med*. 2003;11(4):140–144.
10. Janssen RS, Holtgrave DR, Valdiserri RO, Shepherd M, Gayle HD, De Cock KM. The serostatus approach to fighting the HIV epidemic: prevention strategies for infected individuals. *Am J Public Health*. 2001;91(7):1019–1024.
11. Saraiya M, Glanz K, Briss P, et al. Preventing skin cancer: findings of the task force on community preventive services on reducing exposure to ultraviolet light and counseling to prevent skin cancer: recommendations and rationale of the U.S. preventive services task force. *MMWR Recomm Rep*. 2003;52(RR-15):1–12.
12. HIV policy program: global HIV/AIDS timeline. Kaiser Family Foundation [Internet]. 2011 [cited 2011 March 9.]. Available from: www.kff.org/hivaids/timeline
13. CLIA certificate of waiver fact sheet. Centers for Disease Control and Prevention [Internet]. 2007 [cited 2011 March 9]. Available from: www.cdc.gov/hiv/topics/testing/resources/factsheets/roltclia.htm
14. Infectious Disease Products. Orasure Technologies [Internet]. 2011 [cited 2011 March 3]. Available from: <http://www.orasure.com/products-infectious/products-infectious.asp>
15. Greenwald JL, Burstein GR, Pincus J, Branson B. A rapid review of rapid HIV antibody tests. *Curr Infect Dis Rep*. 2006;8(2):125–131.
16. FDA-approved rapid HIV antibody screening tests as of February 4, 2008. Centers for Disease Control and Prevention/Health Research and Educational Trust [Internet]. 2009 [cited 2011 March 9]. Available from: http://www.centerforhealthtraining.org/documents/e09_NatvTAB7.pdf
17. Accreditation standards for dental hygiene education programs. Commission on Dental Accreditation [Internet]. 2010. [cited 2011 April 5]. Available from: <http://www.ada.org/sections/educationAndCareers/pdfs/dh.pdf>
18. Wilder RS, Thomas KM, Jared H. Periodontal–Systemic Disease Education in United States Dental Hygiene Programs. *J Dent Educ*. 2008;72(6):669–679
19. Shuman D. AIDS education in dental hygiene programs in the United States and Canada. *J Dent Hyg*. 1991;65(3):124–129.
20. Johnson NW. The mouth in HIV/AIDS: markers of disease states and management challenges for the dental profession. *Aust Dent J*. 2010;55(Suppl 1):85–102
21. Reznik DA. Recognition and management of the most common oral manifestations of HIV infection. The Body Website [Internet]. 1999 [cited 2011 September 29]/ Available from: <http://www.thebody.com/content/art2806.html>
22. Vanable ED. The professional role of the dental hygienist as viewed by accreditation commissioners and consultants. *J Dent Educ*. 1977;41(12):730–734
23. Reznik DA. Rapid HIV testing in the dental setting. *Inside Dentistry*. 2009;5(7):76–78.

24. Swanson Jaecks KM. Current perceptions of the role of dental hygienists in interdisciplinary collaboration. *J Dent Hyg.* 2009;83(2):84–91.
25. Reznik DA, Bednarsh H. HIV and the Dental Team: The role of the dental professional in managing patients with HIV/AIDS. *Dimensions Dent Hyg.* 2006;4(6):14–16.
26. Palazzolo MJ, Poth ME, Palazzolo DJ. Saving lives with early detection: The critical role of the dental hygienist in decreasing the morbidity and mortality associated with oral cancer. *Dimensions Dent Hyg.* 2009;7(9):56–59..
27. Cohen–Brown G. Oral Lesions and Treatment Recommendations for the HIV–infected Patient. New York State AIDS Institute [Internet]. 2010 [cited 2011 September 15]. Available from: <http://www.nyn-jaetc.org/on-demand/documents/OralHealth-CommunityVersion.pdf>
28. Comprehensive Strategic Plan for HIV/AIDS Services 2009–2012. HIV Health & Human Services Planning Council of New York, New York City Department of Health and Mental Hygiene [Internet]. 2009 [cited 2010 October 28]. Available from: <http://www.nyhiv.org/pdfs/ny-ema-comp-plan-12-22-08>
29. The Bronx Knows: Bronx–Wide HIV Testing Initiative. New York City Department of Health and Mental Hygiene [Internet]. 2011 [cited 2011 April 15]. Available from: http://www.nyc.gov/html/doh/html/ah/bronx_test.shtml
30. HIV Testing is Now a Routine Part of Health Care in New York. New York City Department of Health and Mental Hygiene [Internet]. 2010 [cited 2010 September 1]. Available from: <http://www.nyc.gov/html/doh/html/pr2010/pr043-10.shtml>
31. Report on recent strategies to increase implementation of routine HIV screening. American Academy of HIV Medicine. [Internet]. 2009 [cited 2011 January 9]. Available from: <http://www.aahivm.org/testing-toolkit>
32. Vernillo AT, Caplan AL. Routine HIV testing in dental practice: can we cross the rubicon? *J Dent Educ.* 2007;71(12):1534–1539.
33. General HIV Testing. AIDS Education and Training Centers Natural Resource Center. [Internet]. 2011 [cited 2011 February 15]. Available from: <http://nyn-jaetc.org/oralhealthprogram.html>
34. Streckfus CF. Salivary diagnostics and the role of the dental hygienist. *Access.* 2009;23(8):32–33.
35. Gostin LO, Webber DW. HIV infection and AIDS in the public health and health care systems: the role of law and litigation. *JAMA.* 1998;279(14):1108–1113.

Treatment Modalities for Drug-Induced Gingival Enlargement

Michelle Moffitt, RDH; Davide Bencivenni, DDS, MS; Robert Cohen, DDS, PhD

Introduction

Gingival enlargement, regardless of its etiology, may be problematic and contribute to an increased risk for dental decay and periodontal disease.¹ Gingival overgrowth may decrease the efficacy of plaque control since enlarged gingival tissue often results in a periodontal pocket coronal to the cemento-enamel junction. The resulting pseudopocket represents overgrown gingival tissue rather than loss of periodontal attachment.²⁻³

The local conditions at the base of the pseudopocket, such as low oxygen tension, decreased access and inflammatory mediators, all may facilitate the growth of periodontopathic bacteria. Consequently, patients with gingival overgrowth are at a higher risk for harboring periodontal pathogens (Figure 1).⁴⁻⁵

While increased dental decay and periodontal disease are the primary risks associated with gingival enlargement, speech, mastication and alteration of tooth eruption patterns in children also can be affected. Extreme, although rare, consequences of drug-induced gingival enlargement have been documented. Bolger et al described a case of pronounced phenytoin-induced gingival overgrowth causing glossoptosis and subsequent airway obstruction in a child.⁶ Gingival enlargement more frequently represents an esthetic concern for patients, especially if located in an anterior sextant or if the enlarged tissue extends to the occlusal margin. In cases where gingival enlargement is a long-standing condition, the tissue may become fibrotic, which has the potential to cause tooth migration. Secondary malocclusion is also possible with masticatory function alterations.⁷

Medications associated with gingival enlargement typically belong to 3 different therapeutic

Abstract

Purpose: This paper identifies 3 specific classifications of commonly prescribed medications that are known to cause gingival enlargement and describes surgical and non-surgical treatment therapies. Primary risks associated with drug-induced gingival enlargement, including increased dental decay and periodontal disease are also discussed.

The precise bacterial etiology in gingival enlargement remains unclear, although sufficient evidence exists to support the role of good oral hygiene in decreasing the incidence and severity of gingival enlargement and improving overall gingival health. Etiology, treatment planning and coordination of care between physician, dentist or dental hygienist when indicated are important factors determining whether a surgical or non-surgical course of treatment should be considered.

Keywords: Gingiva, gingivectomy, calcium channel blockers, immunosuppressants

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Validate and test assessment instruments/strategies/mechanisms that increase health promotion and disease prevention among diverse populations.

classes: calcium channel blockers, immunosuppressants and anticonvulsants. Although those classes are unrelated to one another, it remains unclear whether the inflammatory component is the cause or the effect of the enlargement.^{7,8} Treatment planning is based on the patient's medical history and expectations, with the main focus being prevention and plaque control.⁹ Some patients with drug-induced gingival enlargement may have serious systemic conditions, such as cardiovascular disease, and in those cases consultation with the patient's physician may be indicated to determine if an alternate drug might be considered. Treatment of drug-induced gingival enlargement may include non-surgical periodontal treatment, surgical therapy and, if necessary, drug modification. Consequently, in order to minimize the incidence of gingival alterations and to diminish possible side effects, prophylactic treatment can be considered whenever a patient is taking an at-risk medication.¹⁰

Non-Surgical Treatment of Drug-Induced Gingival Enlargement

Adequate plaque control is a primary factor in the prevention and control of drug-induced gingival enlargement.¹¹ Non-surgical treatment may include oral hygiene instructions, scaling and root planing,¹² drug substitution⁴ and the use of antibiotics.¹⁰ The exact role played by bacteria in the mechanism of such gingival changes is still unclear, although sufficient evidence exists to support the role of good oral hygiene and frequent professional maintenance in decreasing the incidence and severity of gingival enlargement and improving overall gingival health.^{9,11,13} Appropriate post-surgical plaque control may aid in the prevention of gingival enlargement by reducing the presence and growth of pathogenic bacteria. A three month maintenance interval is often warranted to avoid plaque-related loss of attachment that can form as a result of enlarged gingiva.¹⁴⁻¹⁵

As an adjunct to mechanical plaque removal, studies have shown chlorhexidine rinses to be an effective aid in the non-surgical management of drug-induced gingival enlargement.¹⁵⁻¹⁷ Chlorhexidine 0.12% bid (2 times a day) can substitute for daily mechanical cleansing in patients with impaired manual dexterity, while other mouth rinses, such as those containing phenolic compounds, essential oils and sanguinaria, can be used as an alternative to chlorhexidine, although their ability to inhibit plaque accumulation is generally inferior.⁷

In the last few years, systemic antibiotics have been gaining popularity in the management of drug-induced gingival enlargement. Case reports have indicated that short time courses of antibiotics, such as metronidazole or azithromycin,¹⁶⁻¹⁸ may reduce the bacterial load in the gingival sulcus and consequently diminish the inflammatory component in individuals with gingival enlargement.^{19,20} Wong et al evaluated a small group of women undergoing cyclosporin-A (CsA) therapy and reported complete resolution of drug-induced gingival alterations after only 1 week of metronidazole (1.2 g/day).²¹ Gomez et al reported improvement of CsA-associated gingival enlargement in 27 patients treated for 1 week with azithromycin.²² Nowicki et al documented partial resolution of severe CsA-induced gingival enlargement after 3 days of azithromycin administration, although recurrent gingival enlargement was evident 6 months post-treatment.²³ Wahlstrom et al also confirmed the efficacy of azithromycin in the management of drug-associated

Figure 1: Example of gingival overgrowth as a result of periodontal pathogens



gingival conditions.¹⁶ However, the outcome of antibiotic therapy has not always been consistent with such positive results. In a double-blind, controlled, randomized study, Mesa et al studied the effect of systemic metronidazole and azithromycin on patients with CsA-induced gingival enlargement. At 30 days, none of the patients showed complete remission and no clinical differences were observed when patients were compared to untreated control subjects.²⁴ Auffericht et al also reported no improvement in patients treated with metronidazole.²⁵ Such varying results may be attributable to the multifactorial etiology of drug-induced gingival enlargement. Local or systemic antibiotics may be effective in reducing or eliminating drug-associated gingival alterations when plaque-associated inflammation is present, but other therapeutic strategies, such as drug substitution or surgery, may be indicated in the absence of contributing plaque.²⁶ As there may be a recurrence of gingival manifestations after only a few months, potential side effects associated with long-term or extended use of antibiotics should be considered.

When attempting to control gingival enlargement, drug substitution in consultation with the patient's physician also can be considered when no significant improvement occurs after implementation of proper plaque control. Carbamazepine and valproic acid may be acceptable substitutes for phenytoin as both are associated with minimal gingival alteration.^{27,28} Tacrolimus is a valid alternative to CsA and its use has been associated with an absence of gingival alteration. Resolution could take up to 1 year and during this time the patient's oral hygiene should be closely monitored.²⁹

Nifedipine-induced gingival enlargement can often be controlled by substituting another calcium channel blocker, or a different anti-hypertensive drug. Figure 2 shows localized gingival

enlargement due to nifedipine. Calcium channel blocker alternatives to nifedipine include diltiazem and verapamil. The incidence of drug-induced gingival enlargement associated with those drugs is considerably below the 44% observed with nifedipine (20% and 4% for diltiazem and verapamil, respectively).³⁰ Alternative anti-hypertensive drugs might include diuretics, non-selective and selective β -antagonists, and angiotensin converting enzyme inhibitors. Those are all considered efficient medications in the treatment of high blood pressure and constitute possible alternatives to calcium channel blocking agents since they are normally not associated with alterations of the gingival tissue.³¹

Surgical Treatment of Drug-Induced Gingival Enlargement

Indications for surgical treatment of drug-induced gingival enlargement include failure of non-surgical treatment, aesthetic considerations and soft tissue impaction of erupting teeth.

Failure of non-surgical therapy may be apparent by lack of resolution or continuous gingival enlargement, despite drug substitution or adequate plaque control. Refractory cases may be managed by periodontal surgical procedures to achieve more definitive results.³²

Aesthetic concerns, such as enlarged gingival tissue that masks the natural shape and contour of the clinical crown, may be an indication for surgical treatment. Removal of enlarged tissue allows for more precise gingival recontouring, and can establish an ideal architecture for both better plaque control and improved esthetics. While non-surgical therapy typically requires between 2 and 3 months for the effects to be clinically apparent, a surgical approach allows for more rapid results, with immediate patient satisfaction.^{9,12}

Selection of the surgical technique, typically gingivectomy/gingivoplasty, or a periodontal flap procedure, is based upon the extent of gingival enlargement, the presence of osseous defects and the relationship between the base of the pseudopocket and mucogingival junction. Gingivectomy is ideal where gingival enlargement is confined to a limited area, usually fewer than 6 teeth.⁸ This technique is typically quicker and easier than a flap procedure, but does not allow for contouring of intra-bony osseous defects. In order to avoid mucogingival defects, gingivectomy is contraindicated if the initial incision falls in close proximity to, or at, the mucogingival junction. A gingivectomy procedure classically is initiated by marking

Figure 2: Example of severe nifedipine gingival overgrowth



the deepest point of each pseudopocket on the external gingival wall with a pocket marker or periodontal probe. A series of bleeding points is produced to function as a guide for the initial external beveled incision. An intra-sulcular incision then follows to free the band of enlarged tissue. Once the redundant tissue is removed, a gingivoplasty can be performed to remove tissue tags and recreate the physiologic gingival contour.⁸

An alternative to blade gingivectomy is the use of argon, carbon dioxide or diode lasers. Advantages associated with the use of lasers include the of coagulation and sealing of blood vessels resulting in a significant reduction of post-operative bleeding, which can be particularly beneficial with less cooperative patients such as children.³³⁻³⁶ Compared to patients treated with conventional gingivectomy, laser patients reportedly display less intra- or post-operative bleeding, have a reduced need for periodontal dressing and require less post-operative analgesics.³⁵ Similarly, lasers have also found applications in cases of gingival enlargement associated with orthodontic treatment.^{36,37} However, a limiting factor in laser treatment may be equipment cost.

The periodontal flap technique is frequently considered when large areas (more than 6 teeth) require treatment, osseous defects are present or in cases where gingivectomy would remove excessive amounts of keratinized tissue resulting in the development of a mucogingival defect.⁹ A periodontal flap technique used to eliminate enlarged gingival tissue is similar to the procedure employed for periodontal pocket reduction.

Pilloni et al compared the long-term efficacy of periodontal flap surgery to gingivectomy in 10 patients. Clinical measurements were taken at

baseline, 6 weeks, 6 months and 1 year post-surgically. Results showed that probing depths were similar for both procedures at 6 weeks, but at 6 months and 1 year there were significantly greater numbers of teeth with probing depths within 1 to 3 mm in the flap surgery group compared to the gingivectomy group.³⁸

To assist tooth eruption, when tooth impaction is a consequence of gingival enlargement, flap surgery allows for complete exposure of the impacted tooth by apically repositioning a thinned gingival flap. In such cases, gingivectomy could result in complete elimination of the keratinized tissue with possible creation of a mucogingival defect.³⁹

Drug-induced gingival enlargement has potential to recur if proper oral hygiene is not performed. Meticulous oral hygiene, chlorhexidine rinses and regular maintenance can diminish the rate of recurrence. Although recurrence may be evident as early as 3 months post-surgery, surgical results have, in general, been maintained for at least 12 months.⁸ Ilgenli et al followed a group of 38 CsA and nifedipine-treated patients displaying drug-induced gingival enlargement. Gingivectomy was performed at baseline and during the post-operative period. During that time patients were scheduled for periodontal maintenance at 3 month intervals. An average recurrence rate of 34% was observed 18 months following gingivectomy. Multiple regression anal-

ysis indicated that patients' age, oral hygiene status and attendance at recall appointments were important determinants in the recurrence of drug-induced gingival enlargement.³¹ Similarly, Nishikawa et al observed no recurrence at 12 months in nifedipine-treated patients who underwent surgical therapy and were maintained at 4 month intervals.³⁶

Conclusion

The management of drug-induced gingival enlargement is often multidisciplinary in nature. Modification of drug or dosage, in consultation with the patient's physician, should be considered as a first option. Removal of local predisposing factors, such as plaque, also can be attempted prior to considering a surgical approach. Aesthetic concerns and unsatisfactory outcomes of non-surgical therapy are indications for surgical treatment, via gingivectomy or periodontal flap procedures.

Michelle L. Moffitt, RDH, is a research assistant at the Department of Periodontics and Endodontics at the University at Buffalo, the State University of New York, School of Dental Medicine. Davide Ben-civenni, DDS, MS, is a professor at the School of Dental Medicine, University of Modena and Reggio Emilia, Modena, Italy. Robert E. Cohen, DDS, PhD, is a professor at the Department of Periodontics and Endodontics at the University at Buffalo, the State University of New York, School of Dental Medicine.

References

1. Doufexi A, Mina M, Ioannidou E. Gingival Overgrowth in Children: Epidemiology, Pathogenesis, and Complications. *J Periodontol*. 2005;76(1):4–10.
2. Grant MM, Kolamunne RT, Lock FE, Matthews JB, Chapple IL, Griffiths HR. Oxygen tension modulates the cytokine response of oral epithelium to periodontal bacteria. *J Clin Periodontol*. 2010;37(12):1039–1048.
3. Page RC. The role of inflammatory mediators in the pathogenesis of periodontal disease. *J Periodontol Res*. 1991;26(3 Pt 2):230–242.
4. Dongari-Bagtzoglou A; Research, Science and Therapy Committee, American Academy of Periodontology. Drug-associated gingival enlargement. *J Periodontol*. 2004;75(10):1424–1431.
5. Dannewitz B. Proliferation of the gingiva: aetiology, risk factors and treatment modalities for gingival enlargement. *Perio*. 2007;4(2):83–91.
6. Bolger WE, West CB Jr, Parsons DS, Gates GA. Upper airway obstruction due to massive gingival hyperplasia. A case report and description of a new surgical technique. *Int J Pediatr Otorhinolaryngol*. 1990;19(1):63–72.
7. Parameters of Care. *J Periodontol*. 2000;71(Suppl 5):847–883.
8. Camargo PM, Melnick PR, Pirih FQ, Lagos R, Takei HH. Treatment of drug-induced gingival enlargement: aesthetic and functional considerations. *Periodontol 2000*. 2001;27:131–138.
9. Dongari A, McDonnel HT, Langlais RP. Drug-induced gingival overgrowth. *Oral Surg Oral Med Oral Pathol*. 1993;76(4):543–548.
10. Axelsson P, Lindhe J. Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. Results after 6 years. *J Clin Periodontol*. 1981;8(3):239–248.
11. Ilgenli T, Atilla G, Baylas H. Effectiveness of periodontal therapy in patients with drug-induced gingival overgrowth. Long-term results. *J Periodontol*. 1999;70(9):967–972.
12. Research, Science and Therapy Committee of the American Academy of Periodontology. Treatment of plaque-induced gingivitis, chronic periodontitis, and other clinical conditions. *J Periodontol*. 2001;72(12):1790–1800.
13. Babcock JR. The successful use of new therapy for Dilantin gingival hyperplasia. *Periodontics*. 1965;149:196–199.
14. Pilatti GL, Sampaio JE. The influence of clorexedine in the severity of cyclosporin A-induced gingival overgrowth. *J Periodontol*. 1997;68(9):900–904.
15. Cohen RE. Research, Science and Therapy Committee, American Academy of Periodontology. Position paper periodontal maintenance. *J Periodontol*. 2003;74(9):1395–1401.
16. Santi E, Bral M. Effect of treatment on cyclosporine- and nifedipine-induced gingival enlargement: clinical and histologic results. *Int J Periodontics Restorative Dent*. 1998;18(1):80–85.
17. Rossmann JA, Ingles E, Brown RS. Multimodal treatment of drug-induced gingival hyperplasia in a kidney transplant patient. *Compendium*. 1994;15(10):1266, 1268–1270, 1272–1274.
18. Wahlstrom E, Zamora JU, Teichman S. Improvement in cyclosporine-associated gingival hyperplasia with azithromycin therapy. *N Engl J Med*. 1995;332(11):753–754.
19. Wong W, Hodge MG, Lewis A, Sharpstone P, Kingwood JC. Resolution of cyclosporin-induced gingival overgrowth with metronidazole. *Lancet*. 1994;343(8903):989.
20. Jugclà A, Moreso F, Sais G, et al. The use of azythromycin for cyclosporine-induced gingival overgrowth. *Br J Dermatol*. 1998;138(1):198–199.
21. Hassell TM, Hefti AF. Drug-induced gingival overgrowth: old problem, new problem. *Crit Rev Oral Biol Med*. 1991;2(1):103–107.
22. Kantarci A, Cebeci I, Tuncer O, Carin M, Firatli E. Clinical effects of periodontal therapy on the severity of cyclosporin-A-induced gingival hyperplasia. *J Periodontol*. 1999;70(6):587–593.

23. Gómez E, Sánchez–Nuñez M, Sánchez JE, et al. Treatment of cyclosporin–induced gingival hyperplasia with azithromycin. *Nephrol Dial Transplant*. 1997;12(12):2694–2697.
24. Nowicki M, Kokot F, Wiecek A. Partial regression of advanced cyclosporin–induced gingival hyperplasia after treatment with azithromycin. A case report. *Ann Transplant*. 1998;3(3):25–27.
25. Aufricht C, Hogan EL, Ettenger RB. Oral metronidazole does not improve cyclosporin A–induced gingival hyperplasia. *Pediatr Nephrol*. 1997;11(5):525–555.
26. Mesa FL, Osuna A, Aneiros J, et al. Antibiotic treatment of incipient drug–induced gingival overgrowth in adult renal transplant patients. *J Periodontal Res*. 2003;38(2):141–146.
27. Dahllöf G, Preber H, Eliasson S, Rydén H, Karsten J, Modéer T. Periodontal conditions of epileptic adults treated long–term with phenytoin or carbamazepine. *Epilepsia*. 1993;34(5):960–964.
28. Anderson HH, Rapley JW, Williams DR. Gingival overgrowth with valproic acid: a case report. *ASDC J Dent Child*. 1997;64(4):294–297.
29. Hernández G, Arriba L, Lucas M, de Andrés A. Reduction of severe gingival overgrowth in a kidney transplant patient by replacing cyclosporin A with tacrolimus. *J Periodontol*. 2000;71(10):1630–1636.
30. Fattore L, Stablein M, Bredfeldt G, Semla T, Moran M, Doherty–Greenberg JM. Gingival hyperplasia: a side–effect of nifedipine and diltiazem. *Spec Care Dentist*. 1991;11(3):107–109.
31. Dental Therapeutics. 2nd ed. Chicago: ADA Publishing Company; 2001.
32. Colombo AP, Boches SK, Cotton SL, et al. Comparisons of subgingival microbial profiles of refractory periodontitis, severe periodontitis, and periodontal health using the human oral microbe identification microarray. *J Periodontol*. 2009;80(9):1421–1432.
33. Mattson JS, Blankenau R, Keene JJ. Case Report. Use of an argon laser to treat drug–induced gingival overgrowth. *J Am Dent Assoc*. 1998;129(1):78–83.
34. Guelmaan M, Britto LR, Katz J. Cyclosporin–induced gingival overgrowth treated with CO2 laser: a case report. *J Clin Pediatr Dent*. 2003;27(2):123–126.
35. Roed–Petersen B. The potential use of CO2 laser gingivectomy for phenytoin–induced gingival hyperplasia in mentally retarded patients. *J Clin Periodontol*. 1993;20(10):729–731.
36. Barak S, Katz J, Kaplan I. The CO2 laser in surgery of vascular tumors of the oral cavity in children. *ASDC J Dent Child*. 1991;58(4):293–296.
37. Convissar RA, Diamond LB, Fazekas CD. Laser treatment of orthodontically induced gingival hyperplasia. *Gen Dent*. 1996;44(1):47–51.
38. Piloni A, Camargo PM, Carere M, Carranza FA Jr. Surgical treatment of cyclosporin A– and nifedipine–induced gingival enlargement: gingivectomy versus periodontal flap. *J Periodontol*. 1998;69(7):791–797.
39. Saravia ME, Svirsky JA, Friedman R. Chlorexidine as an oral hygiene adjunct for cyclosporine–induced gingival hyperplasia. *ASDC J Dent Child*. 1990;57(5):366–370.

Tooth Jewelry in an 8 Year Old Child: Case Report

R. Constance Wiener, DMD

Introduction

Body modifications are becoming very common. They include tattooing, piercing, scarification, compression, implants and the permanent application of jewelry.¹ Some of these body modifications, such as the piercing of the earlobe for aesthetic purposes, have been accepted in many cultures for millennia.^{1,2} In some societies, body modifications were common with rites of passage, membership, religious devotion or special social classes (shamans, royalty, etc.).¹ In general, body modification was considered against societal norms, shocking, provocative and unattractive until the mid-1980s, when fashion designers, such as Vivienne Westwood and Jean Paul Gaultier took body modifications and punk styles and introduced them as avant-garde fashion statements.¹ Currently, 13% of the U.S. population have a body modification.¹ Many people in mainstream America, from teenagers to older adults, have perioral/oral body modifications. Health care professionals must be aware of cultural preferences and the implications in patient care from complications and hazards to the ability to quickly unfasten body jewelry in an urgent situation.³ Health care professionals must also educate their patients that in emergency situations requiring a defibrillator, there is no time to unfasten body jewelry and tissue is often torn to remove the adornment.

Tooth adornment dates to the 9th century Mayan culture where teeth were embellished with jade and turquoise, but current trends in tooth jewelry include the addition of gold, jewels or crowns that appear similar to stainless steel crowns (previously considered non-aesthetic).⁴ Teeth are also adorned with grills – plates worn over the teeth that are made of gold or base metal and often covered with real or fashion jewels.⁵ Adolescents know how to find grills, from jewelers, to internet sources, to do-it-yourself kits, while not necessarily having the knowledge about tooth and gingival tissue damage.⁵

Abstract

Purpose: The number of perioral/oral body modifications has been increasing over the previous 30 years. The dental impact upon adults and adolescents has been documented previously. The purpose of this case study was to report the dental impact of a child's self-reported tooth decoration. The study is a case report of an 8-year old child who reported for dental care with discomfort in the mandibular left second primary molar. She embedded a stick-on rhinestone stud into the tooth for aesthetics. It fractured the tooth and led to its loss. Anticipatory guidance about perioral/oral body modification risks to children, as well as to adolescents and adults, should be included in the discussion of interventions that influence oral wellness.

Keywords: perioral/oral jewelry, body modifications, tooth jewelry

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Identify optimal time periods for interventions that influence pathology, function and oral wellness.

Thirteen states regulate tattooing and 6 states regulate piercing.¹ Body modifications are often self-administered or are done by friends. In one study of adolescents, 22% of teens with piercings and 18% with tattoos self-performed the procedures or had them done by a friend or relative.⁶ In the same study, 10% of the piercings and tattoos were done with unsterile needles, 46% of the tattoos were done in a tattoo parlor and 36% were done at a tattoo party.⁶ Medical complications to perioral/oral body modifications occur. Local infections occur in 10 to 30% of piercings.¹ Body modifications may have systemic bacterial infections (such as tetanus, tuberculosis, streptococcal endocarditis, etc.).^{2,6-8} They are also associated with viral infections (such as hepatitis, HSV, Epstein-Barr and HIV) and fungal infections (Candida).^{2,6-8} Autoimmune reactions can occur with body modifications, including edema, allergies (nickel in particular), inflammation, tissue overgrowth, sarcoid-like foreign body reactions, epidermal cysts (from penetration of epidermal cells into the dermis during piercing), cellulitis of the submandibular, sublingual and submental facial spaces (Ludwig's angina).^{2,6-8} Additionally they have been associated with speech impairment, swallowed/aspirated jewelry, fractured teeth, gingival recession and embedded jewels.^{2,6-8} Contact dermatitis to

nickel is common and may have symptoms ranging from a rash to asthma. Contact sensitivity to gold may result in lymphocytoma, or granulomatous responses. And silver may leech and form silver salts (localized argyria).⁸

Children and adolescents may consider the wearing of perioral/oral jewelry as a way to emulate a role model (generally an actress or singer), as an extension of body ornamentation and/or as a means to be part of a particular group.⁹ This article describes an unusual case of a child's self-application of oral jewelry.

Case Report

Preparation of this report was approved by the Aberdeen Area IRB/Research and Publication Committee of the Indian Health Service. An 8-year-old girl presented complaining of a broken tooth with a pain level 3/10 on a numeric visual analog rating scale for pain. She was in discomfort, with the tooth having "bothered" her for 3 days. She had not missed school or had difficulty eating before she presented. She did not exhibit any lethargy, or present with any extra-oral swelling. Her parent stated he thought she "had a small cavity" and he wanted to have her evaluated. She had no significant medical considerations. Aside from the tooth in question, the limited problem-focused evaluation revealed no additional significant oral findings. The tooth that was bothering her was the mandibular left second primary molar. Clinically, there was no intra-oral swelling or obvious caries. A vertical fracture line was visible along the mesial marginal ridge, and a similar vertical fracture line was visible along the distal marginal ridge, separating the tooth into buccal and lingual segments. While examining the tooth, we noted what appeared to be an unusual, glistening, water-filled appearance inside the tooth. Radiographically, the tooth was definitely fractured, and non-restorable.

The mandibular left second primary molar was extracted without complications. The parent received post-operative instructions for the care of the extraction site and no pain medications or antibiotics were prescribed. Healing was uneventful and the child was scheduled for space maintenance.

The extracted tooth was examined and found to have a rhinestone stud embedded inside (Figure 1). It was the rhinestone which created the reflected, water-filled appearance and was the cause of the tooth fracture. When questioned, the patient explained she had stick-on rhinestone studs that were used to embellish her clothes and books and she placed one in her tooth to make it look pretty. There was no indication of self-inflicted injury. She said

Figure 1: Extracted mandibular left second primary molar with embedded rhinestone



that she did not remember when she placed it. She had not told her parents that she did so. The rhinestone stud, placed into a deep central groove, had been forced deep into the tooth. Over some period of time, it fractured the tooth and was imbedded within the tooth.

Discussion

Sociologically, there are many reasons for perioral/oral body modification: fashion, for daring, personal statements and peer pressure/declaring allegiance.^{1,6} There are also masochistic, sadistic, exhibitionistic or narcissistic reasons.^{1,6} Health care providers should assess if the motivation was self-destructive and requires referral/intervention.⁶ Body modification and risk-taking behavior in adolescents are often related. Adolescents with piercings at locations other than the ears were 4.5 times more likely to report a history of sexual intercourse, and 3 times as likely to report tobacco or marijuana use in the last month.¹⁰ They are also 2.5 times as likely to report school truancy or running away from home during the last year, and are 2.5 to 3 times as likely to report suicidal ideation and action during the year.¹⁰ As the popularity of body modification increases, dental professionals need to be aware that younger and younger children are also influenced by the trend. Children are introduced to body art with face painting, stick-on jewelry, and commercial rub-on temporary tattoos. Face painting is usually done by adults as a form of entertainment at parties or street fairs.⁹ Children, wanting a permanent body modification, generally do not have consent or access to a capable provider. They have improvised with needles, straight pins, paper clips, pens, pencils, charcoal, soot, mascara, carbon, soldering irons in boiling oil, heated coat hangers or, as in this case report, a stick-on rhinestone stud into a tooth.⁹

The American Academy of Pediatric Dentistry and the American Dental Association recognize the need to educate the public on the health implications of perioral/oral modifications and strongly oppose such practices due to the associated potential for pathological conditions and sequelae.^{6,11} Body modification is often an impulsive decision¹² made under peer pressure and the influence of alcohol or drugs.⁶ Dental professionals have frequent contacts with pediatric patients. They should discuss decision-making, including risk-taking behaviors.⁴ Dental professionals should ascertain the feelings that their pediatric patients have about perioral/oral body modifications. Information should be provided on the child or adolescent's level of understanding.

It should include the complications and hazards of body modification as well as the possible negative perceptions that the child, adolescent, or others may have in the future about the body modifications. Many people who paid good money to get a body modification also pay good money for its removal.¹³ Education is a primary method to intercept or prevent risky behavior, and dental professionals have a major role in providing guidance about perioral/oral body modification.⁴

R. Constance Wiener, DMD is an assistant professor in the Department of Dental Practice and Rural Health at West Virginia University.

References

1. Stirn A. Body Piercing: Medical Consequences and Psychological Motivations. *Lancet*. 2003;361(9364):1205–1215.
2. Price S, Lewis M. Body Piercing Involving Oral Sites. *J Am Dent Assoc*. 1997;128(7):1017–1020.
3. Atkinson M. Figuring out body modification cultures: interdependence and radical body modification processes. *Health (London)*. 2004;8(3):373–386.
4. Ranalli D, Elderkin D. Oral Health Issues for Adolescent Athletes. *Dent Clin N Am*. 2006;50(1):119–137.
5. Hollowell WH, Childers NK. A New Threat to Adolescent Oral Health: The Grill, Case Report. *Pediatr Dent*. 2007;29(4):320–322.
6. Brooks TL, Woods ER, Knight JR, Shier LA. Body modification and substance use in adolescents: is there a link? *J Adolesc Health*. 2003;32(1):44–49.
7. Chambrone L, Chambrone LA. Gingival Recessions Caused by Lip Piercing: Case Report. *J Can Dent Assoc*. 2003;69(8):505–508.
8. Koenig LM, Carnes M. Body Piercing: medical Concerns with Cutting-Edge Fashion. *J Gen Intern Med*. 1999;14(6):379–385.
9. Selekman J. A New Era of Body Decoration: What Are Kids Doing to Their Bodies? *Pediatr Nurs*. 2003;29(1):77–79.
10. Roberts TA, Auinger P, Ryan SA. Body piercing and high-risk behavior in adolescents. *J Adolesc Health*. 2004;34(3):224–229.
11. American Academy of Pediatric Dentistry Council on Clinical Affairs. Policy on Intraoral and Perioral Piercing. *Pediatr Dent*. 2005–2006;27(7 Suppl):44.
12. Nathanson C, Paulhus DL, Williams KM. Personality and misconduct correlates of body modification and other cultural deviance markers. *J Res Personal*. 2006;40:779–802.
13. Gilbert D. *Stumbling on Happiness*. New York: Vintage Books; 2007.

A Randomized Controlled Trial of the Effect of Standardized Patient Scenarios on Dental Hygiene Students' Confidence in Providing Tobacco Dependence Counseling

Jennifer L. Brame, RDH, MS; Robbyne Martin, RDH, MS; Tabitha Tavoc, RDH, PhD; Margot Stein, PhD; Alice E. Curran, DMD, MS

Introduction

The Centers for Disease Control and Prevention (CDC) estimates that approximately 46 million Americans currently smoke cigarettes.¹ Each year, smoking or exposure to secondhand smoke accounts for 443,000 premature deaths and the development of 8.6 million serious illnesses.² Health issues arising from cigarette smoke account for approximately \$96 billion in medical expenses each year in the U.S.²

The harmful effects of smoking cigarettes are more clearly understood, including harm among non-smokers who are exposed to second-hand cigarette smoke either regularly or briefly.² Complications from smoking and secondhand smoke include serious diseases such as cancer, heart disease, stroke, sudden infant death syndrome, respiratory diseases and infections.¹ Since the 1970s, dental professionals have known the signs and symptoms related to tobacco use, including increased risk for periodontal health, delayed wound healing, discoloration of teeth and restorative materials, leukoplakia, hairy tongue and oral cancers.³

The best way to reduce the risk of smoking-related illness is to promote smoking abstinence and cessation. Many governmental and independent organizations offer programs to assist patients with tobacco cessation. Local and state governments are also involved in this process by incorporating smoke-free policies and offering control programs that include comprehensive

Tobacco Dependence Counseling (TDC). A major component of these TDC programs includes education on the effects of smoking and quitting.²

Abstract

Purpose: Dental hygienists report a lack of confidence in initiating Tobacco Dependence Counseling (TDC) with their patients who smoke. The purpose of this study was to determine if the confidence of dental hygiene students in providing TDC can be increased by Standardized Patient (SP) training, and if that confidence can be sustained over time.

Methods: This 2-parallel group randomized design was used to compare the confidence of students receiving SP training to students with no SP training. After a classroom lecture, all subjects (n=27) received a baseline test of knowledge and confidence. Subjects were randomly assigned to test and control groups with equivalent mean knowledge scores. The test group subjects participated in a SP TDC session. Both groups gained parallel experience to treating patients who were smokers and giving TDC in clinical scenarios during the 6 month time period. One week end-training and 6 month post-training assessments were administered to both groups. ANCOVA compared mean confidence scores.

Results: End-training scores at 1 week showed a statistically significant increase ($p=0.002$) in overall mean confidence following SP training for individuals in the test group. The 6 month follow-up test results showed a slight decline in confidence scores among subjects in the test group and an overall gain in confidence for control group participants. However, overall confidence scores were comparable for the groups.

Conclusion: SP training improved dental hygiene students' initial confidence in providing TDC and was sustained, but not to a significant degree. Clinical experience alone increased confidence. Further studies may help determine how the initial confidence gained by SP training can be sustained and what the role of clinical experience plays in overall confidence in providing TDC.

Keywords: Tobacco, Tobacco Dependence Counseling, Tobacco Dependence Education, dental hygiene education, dental hygiene students, standardized patients, Confidence

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Develop and test interventions to reduce the incidence of oral disease in special at-risk populations (diabetics, tobacco users, cardiac patients and genetically susceptible).

A significant role of an oral health care provider is to assess risk factors for tobacco-related illness and to examine patients for tobacco-related oral diseases, such as periodontal disease and oral cancer. The dental hygienist has an integral role in this process and is ideally positioned to provide TDC for smokers as demonstrated in previous studies of dental health professionals. Success rates of patients in the Indiana University Nicotine Dependence Program who have made attempts to quit in response to a quit message from their dental professionals has been reported as high as 58%.³ Another study that included an 8 week smoking cessation intervention by a dentist demonstrated the acceptability of the dental intervention was very high, with 94% of the subjects agreeing to the appropriateness for this type of TDC by the dental team.⁴

Health care professionals generally believe that TDC should be provided to all patients; however, studies show they do not routinely offer these interventions.⁵⁻⁷ A general lack of training among health care professionals in prevention and TDC has been documented.⁸⁻¹³ However, when training is provided, its long-term effects may not be sustained. For example, in a study of medical students, Fried et al found that when health care providers felt more prepared, they were more likely to provide TDC. However, students often felt unprepared to implement TDC upon graduation.^{14,15} This may imply that although they had obtained the necessary knowledge to provide the counseling during their education, they did not either retain the knowledge or have a high level of confidence in providing the counseling. Confidence levels may play a large role in inhibiting one from providing TDC to patients. A study of Kentucky dental hygienists showed that 63% of respondents felt somewhat comfortable discussing tobacco cessation with their patients; however, 53% were either not at all comfortable assisting patients with the development a tobacco cessation plan or not too comfortable doing so (14% and 39%, respectively).¹⁶ Methods to help improve health professionals' skills in TDC include the use of the Stages of Change Model developed by James Prochaska and Carlo Di Clemente, which theorizes that, when the patient's Stage of Change is recognized, the success of the quit attempt will increase.¹⁷ Also, standardized patients (SPs) have been used to improve health care student performance and confidence in a variety of clinical encounters including TDC.^{6,18-21}

Dental schools have employed SPs in various aspects of training, including Tobacco Dependence Education (TDE) curriculum.²² However, there are

no studies that report the use of SPs in dental hygiene TDE curriculum. Therefore, it is not known to what degree dental hygiene students can benefit from SP training, what methods for incorporating SP training in dental hygiene programs are ideal or if there are special circumstances that dental hygiene education must consider when using SPs for TDC training. Also, the long-term benefits of SP training have not been measured in this population.

This pilot study was designed to assess how SP experiences affect dental hygiene student confidence in providing TDC. The purpose of this study was to determine if the confidence of dental hygiene students in providing TDC can be increased by SP training, and if that confidence can be sustained over time.

Methods and Materials

This study was approved by the University of North Carolina (UNC) Institutional Review Board. All baseline and end-training tests in this study were assessed for readability and reliability only – no validity measures were performed. Figure 1 demonstrates the study design.

Phase 1

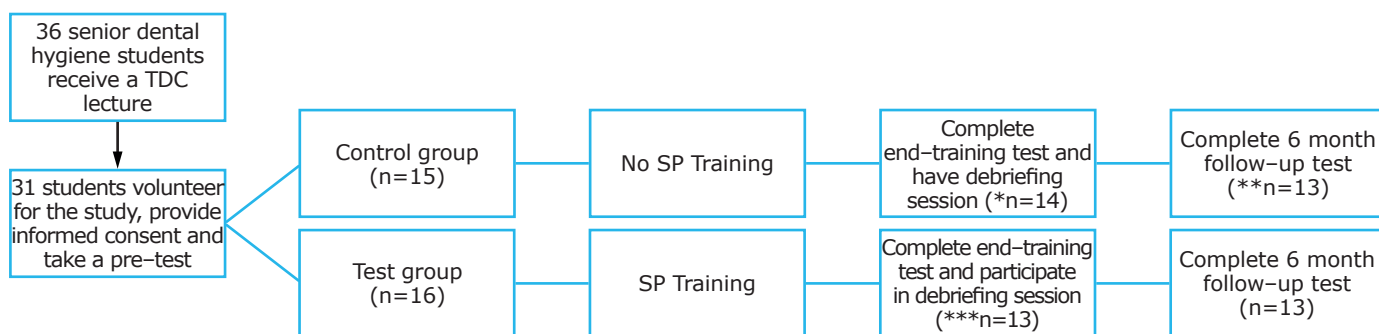
Baseline: As part of the standard curriculum, dental hygiene students receive 3 hours of tobacco cessation education. For the purposes of this study, a 3 hour TDC lecture that addressed use of both Prochaska and DiClemente's Transtheoretical Stages of Change¹⁷ and behavior modification interviewing techniques was added to the curriculum of 36 senior dental hygiene students. Following this lecture, the study was explained to all 36 students. Of the convenience sample (36 dental hygiene students), 31 (86.1%) volunteered to participate. Each provided written informed consent.

One week after the TDC lecture, volunteers were administered a baseline evaluation which consisted of 2 parts. A Visual Analog Scale (VAS) that ranged from 0 to 10 was used to score confidence in performing a series of 16 TDC-related tasks. Confidence was assessed in 3 domains:

1. Initiating a dialogue with patients on their smoking habits
2. Identifying the patient's current stage of change
3. Follow-up on the patient's progress

Each VAS was scored by 2 calibrated examiners using a 100 mm ruler. To measure the knowledge levels

Figure 1: Study design assessing the influence of SP training



*1 subject in the Control Group dropped out of the study

**1 subject in the Control Group did not complete the 6 month follow-up test

***3 subjects in the Test Group dropped out of the study and did not participate in the SP training

for TDC, subjects were given a series of 4 scenarios involving smokers in various stages of change. They were asked a series of 15 multiple choice questions to assess their knowledge in 3 domains:

1. Identification of stages of change characteristics
2. TDC referral and follow-up procedures
3. Tobacco dependence resources available to the patient

ANCOVA was used to compare the average scores of the 2 groups after adjusting for effect of the baseline scores. SAS 9.1 statistical package was used to analyze all data.

Randomization: Knowledge scores were calculated as percent correct of 15 multiple choice questions. The knowledge baseline was used as a method to help assure that baseline knowledge would be equivalent in both test and control groups. To remove knowledge as a possible confounder for variation in confidence scores, the test and control groups were randomized using equal numbers of subjects scoring above and below the median score on knowledge. The resulting test group had 16 subjects and the control group had 15 subjects with similar knowledge backgrounds on TDC. The test group was assigned to participate in a single SP TDC session.

Standardized Patient Sessions: This study utilized the UNC School of Medicine's Clinical Skills and Patient Simulation Center for SP training. This is a facility used for teaching and assessing clinical skills to students in the UNC medical, nursing and pharmacy schools. It is an 18,000 square foot center that includes 15 patient examination rooms, a room for viewing student encounters, a 30 person classroom, a 10 person auxiliary classroom and a patient simulation lab with a wide array of simulators. Each SP session is recorded by 2 cameras – all

video and written session information is recorded by the B-Line Medical Clinical Skills System for assessments. The UNC Clinical Skills and Patient Simulation Center is a member school of the Association of Standardized Patient Educators (ASPE).

SPs are professional actors that are trained to portray patients in scenarios specific to the academic goals of the students receiving the training.²² The 4 SPs in this study portrayed patients returning to their dental hygienist for a second visit following an initial exam as a new patient. Each patient had identical documentation that included medical history, radiographs showing moderate periodontitis and an intra-oral photograph of a suspicious lesion on the lateral border of the tongue. The patient reported a history of smoking 1.5 packs of cigarettes per day for 11 years and reported shortness of breath. The actors were given a prepared text and participated in a training session with SP center staff and study investigators. All aspects of smoking history, health and dental issues were discussed. This calibration was designed to reduce variation among actors and to increase the chance that all subjects would have a similar experience with their SP.

Subjects in the test group reported to the SP training center and were sequestered in a classroom. They received a 15 minute orientation to the SP session process. Subjects were randomly assigned to 1 of 4 SPs by the SP training center staff. Each subject entered the examination room upon verbal cue from the facility staff. The session simulated that of a dental patient and dental hygienist in a general office setting. There were no absolutes in method or dialogue. The subjects were to approach the SPs as returning patients to their practice and to address the patient's situation as presented to them.

The 15 minute SP session was observed remotely through cameras in each examination room. With

subject consent, the session was videotaped to allow for viewing by the subject and/or instructor for education enhancement. To reduce contamination bias, the subjects were asked to exit the building immediately following completion of their session and to have no contact with their sequestered classmates. All subjects were instructed not to discuss their experience until the debriefing session the following week.

End-training Test (1 week post-training): Six days following the SP training session, the first end-training test was administered to both test and control subjects. End-training test content was identical to the baseline test with slight variation in item sequence and case study details. The purpose of this evaluation was to determine changes in self-reported confidence in TDC skills.

Phase 2

Six Month Follow-up Test (6 months post-training): Six months following the end-training test and immediately prior to graduation, a second post-test was administered. This 6 month follow-up test assessed self-reported confidence using the same VAS method. In addition, they were asked about their actual TDC experience with patients in the clinical setting in the months following the conclusion of the initial phase of the study. Subjects were asked questions, including the number of patients assigned who were smokers, number of patients for whom they provided TDC, if they felt TDC was a part of the dental hygienist's job, if they felt they had enough experience to provide TDC, and if they planned on participating in continuing education courses on TDC following graduation.

Results

Thirty-one dental hygiene students originally enrolled in the study, however, 4 withdrew consent (3 from the test group and 1 from the control group) and did not complete the study. One control group subject did not complete the 6 month follow-up test, resulting in n=13 for the control group at time of the 6 month follow-up. Both Intent to Treat (ITT) and Efficacy Analyzable (EA) statistics were completed. ITT results are being provided as there were no differences in interpretation between ITT and EA.

Table II compares the changes for test and control groups in confidence scores for each domain

Table II: Self-perceived confidence assessment results between Control and Test Groups for baseline, end-training and the 6 month follow-up

Confidence Domain	Baseline			
	Test		Control	
	Mean	Standard Deviation	Mean	Standard Deviation
Initiate Dialogue	6.2	1.3	6.1	2.1
Identify Stages	5.9	1.7	5.8	2.2
Follow-up	6.3	2.1	5.7	2.4
Overall	6.1	1.4	5.9	2.1
Confidence Domain	End-Training			
	Test		Control	
	Mean	Standard Deviation	Mean	Standard Deviation
Initiate Dialogue	8.4	1.2	7.6	1.6
Identify Stages	8.2	1.3	6.6	2.6
Follow-up	8.3	1.6	7.3	2.1
Overall	8.3	1.2	6.9	2.1
Confidence Domain	Six month follow-up			
	Test		Control	
	Mean	Standard Deviation	Mean	Standard Deviation
Initiate Dialogue	8.5	1.2	8.4	0.9
Identify Stages	7.6	1.5	7.7	1.5
Follow-up	8.2	1.5	8.4	1.2
Overall	8.0	1.3	8.1	1.2

ANCOVA was used separately for each confidence domain with group, initial domain score and interaction between group and initial domain as explanatory variables. Each item was measured on a visual analog scale from 0 to 10, with 0 representing no confidence and 10 representing very confident.

between the baseline, end-training and the 6 month follow-up tests. Table III depicts the estimated p-values for these changes. Initial end-training test scores showed the test group exhibited statistically significant higher confidence scores in the ability to identify the stage of change ($p=0.04$) and in overall confidence ($p=0.002$) compared with the control group. Both the test and control groups showed an initial increase for confidence in all 3 domains and overall confidence following initial training. However, those in the test group showed an overall higher amount of confidence change.

Confidence levels at the 6 month follow-up varied. The test group exhibited a loss of confidence from end-training in 2 domains and the control

Table III: P-Values for explanatory variables comparing baseline, end-training and 6 month follow-up tests

Confidence Domain	*End-Training			**Six Month Follow-Up		
	Pre-score	Group	Interaction	Pre-score	Group	Interaction
Initiate Dialogue	0.001	0.31	0.54	0.04	0.33	0.29
Identify Stages	0.0001	0.006	0.04	0.06	0.29	0.29
Follow-up	0.0001	0.06	0.15	0.33	0.32	0.39
Overall	0.0001	0.002	0.37	0.008	0.09	0.09

Students in the Test group showed a significant difference in Overall Confidence levels ($p=0.02$) and in the confidence to identify the Stage of Change a patient is in ($p=0.04$) between Baseline and End-Training.

*P-Values comparing Baseline and End-training Scores

**P-values comparing End-training and Six Month Follow-up Scores

Table IV: 6 month follow-up survey response comparison

Question/Statement	Question Selection Options	Control Group Responses (n=13)	Test Group Responses (n=13)
Number of patients assigned to you were current smokers	None	0	0
	1 to 3 patients	15% (n=2)	31% (n=4)
	4 to 6 patients	38% (n=5)	23% (n=3)
	>6 patients	46% (n=6)	46% (n=6)
Number of patients that you provided TDC to	None	7% (n=1)	7% (n=1)
	1 to 3 patients	38% (n=5)	46% (n=6)
	4 to 6 patients	38% (n=5)	23% (n=3)
	>6	15% (n=2)	23% (n=3)
Do you think TDC is part of the job of a dental hygienists?	Yes	100% (n=13)	100% (n=13)
	No	0	0
Do you think you have enough experience to provide TDC to your patients who smoke?	Yes	69% (n=9)	85% (n=11)
	No	7% (n=1)	0
	Maybe, still not sure	23% (n=3)	15% (n=2)
Do you plan to take CE courses on TDC after graduation?	Yes	85% (n=11)	69% (n=9)
	No	15% (n=2)	31% (n=4)

group gained in all domains. The 6 month overall confidence levels were 8.0, 1 and 3 SD for the test group and 8.1, 1 and 2 SD for the control group. The test group had higher scores in confidence in the ability to initiate dialogue, but lower scores in confidence from the end-training evaluation (8.3, 1 and 2 SD and 8 and 1.3 SD, respectively).

The 6 month follow-up survey included additional questions regarding clinical experience and opinions regarding TDC in the 6 months following the initial training. Table IV compares the control and test groups responses to these questions. In addition, those in the test group reported additional information regarding their SP training experience. Of the test group, 69% (n=9) reported that the SP training improved their skills in providing TDC, and 85% (n=11) stated that the SP training improved their confidence in TDC.

Discussion

Dental hygienists report multiple barriers inhibiting routine TDC for patients, including lack of time, lack of reimbursement and concerns about the effectiveness of intervention.¹⁶ Additionally, dental hygienists may be more likely to provide TDC when they feel prepared and are confident in their TDC skills.¹⁴ The use of SPs may be helpful in increasing student confidence during training in TDC, therefore increasing the likelihood of training a confident practitioner to provide TDC to their patients clinically. In this study, subjects who participated in a TDC lecture followed by a SP training session with a smoking patient in the Contemplation Stage of Change initially experienced a statistically significant increase in overall self-reported confidence in their ability to deliver TDC when compared to their peers who partook in the lecture alone. These findings are consistent with earlier studies that reported an increase in self-reported confidence following a TDE in

lecture and SP training format of a combined group of medical residents, dental students, nursing students and dental hygienists. However, data specific to the dental hygiene students were not reported.²²

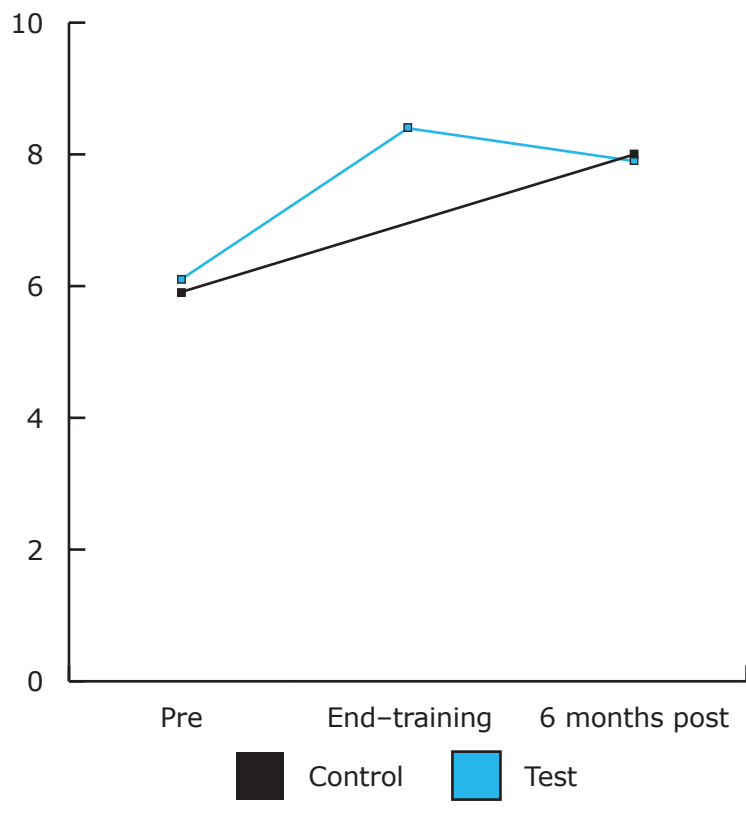
The purpose of the SP Program is to give students the ability to practice and develop competency in professional behaviors and clinical skills prior to treating actual patients that smoke. This type of learning is supported by the work of Kolb in whose 4-stage learning cycle theorizes that experience leads to reflection from which concepts are conceived.²³ These concepts guide the learner through active experimentation and the choice of new experiences. In concrete experiences, such as SP training, the learner actively experiences the learning opportunity and moves on to reflect back on the experience (reflective observation).

Similarly, Rogers' interpretation of Experiential Learning theorizes that learning is facilitated when the learner fully involves themselves in the process, controlling the direction and nature of the process, is able to face the task at hand through direct confrontation and where progress or success is measured best through self-evaluation.²⁴ The SP experience would give the learner the ability to actively learn by doing and practicing the skill.

When asked for perceived barriers to providing TDE, faculty and students report lack of training and confidence.¹⁴ Ramseier et al reported several barriers to TDE offered to dental hygiene students. Among these were dental hygiene educators' lack of integration between the didactic content and the clinical practice, a failure to provide supportive intervention skills and lack of faculty expertise in teaching TDE.²⁵ Researchers in the current study hypothesized that confidence in TDC could be improved by offering a method of integrating the didactic information and clinical application for the dental hygiene student. Results from the end-training test showed that both the test and control groups exhibited an initial increase for confidence in all 3 domains and overall confidence following initial training. However, those with the SP experience showed an overall higher amount of confidence change, supporting the initial hypothesis.

Although initial end-training results showed a significant gain in confidence for the test group, the 6 month follow-up evaluations revealed an overall loss of confidence for subjects in the test group and an increase in confidence for the control group. Comparison of the overall confidence levels for the test and

Figure 2: Comparison of the mean overall confidence scores from pre (baseline), end-training and 6 months post (6 month follow-up) between Control and Test Groups



control groups showed little difference with mean values at 8 and 1.3 SD and 8.1 and 1.2 SD (Table III). Figure 2 shows a comparison of the confidence scores between groups from baseline, end-training and the 6 month follow-up. This would indicate that although the initial overall confidence scores of the test group were higher than those in the control group, control group subjects continued to gain confidence in the 6 months following training, without having the initial SP training. The test group subjects did show a slight increase in confidence in the ability to initiate dialogue, which may suggest their clinical practice gave them the experience, and therefore confidence, to start a conversation regarding smoking cessation with their patients.

Confidence scores for those in the control group may have increased over the 6 month period as a result of patient experience. Subjects in both groups gained experience working with patients who were smokers in the clinical setting. And though both groups had similar experiences in the number of patients that smoked, some students may have had a better learning experience than others with particular patients. A positive patient experience may give a student additional confidence, whereas a negative patient encounter may cause the student to feel a lack

of confidence and/or desire to initiate TDC. Subjects in the test group may have felt an initial confidence boost related to their SP experience; however, individuals in the control group may have also gained clinical confidence as they worked with smoking patients in the clinical setting. This may indicate that practical experience may be more impactful long-term on a student's confidence in TDC than SP training. With this information, dental hygiene programs may see merit in increasing the exposure that students have to working patients who are smokers in the clinical setting in order to increase their confidence and ability in giving TDC.

Another factor that may have influenced test group confidence levels was that the SP experience only focused training in 1 of the Stages of Change, Contemplation Stage of Change. The test group individuals may have initially increased confidence by gaining the patient experience; however, not all patients they treat will display similar characteristics or be in the same stage of change as the SP. It is also noteworthy that test group subjects only had 1 SP experience, rather than multiple visits with patients in various stages of change.

In evaluating attitudes toward TDC at the 6 month follow-up, 69% (n=9) of the test group and 84% (n=11) of the control group reported that they planned on taking continuing education courses related to TDC. One hundred percent of both groups agreed that providing TDC is a part of a dental hygienists' role. This is a positive and noteworthy response, as it shows by having the presence of study in the curriculum it reinforced to the class that smoking cessation was an integral part of the dental hygiene process of care. Subjects became more aware of their relevance in TDC and the study proved to be beneficial by placing emphasis on the importance of TDC to dental hygienists.

Subject response in the knowledge assessment reflected awareness of 1-800 quit line telephone numbers (100%) and the knowledge to refer patients for further counseling (97%). TDE instruction in the schools of dental hygiene often includes ADHA's Ask, Advise, Refer counseling strategies, and generally incorporate stages of change behavior modification techniques.²⁶ On the knowledge portion of the baseline and end-training tests, the subjects were not specifically asked to define or list the 5 A's or the Ask, Advise, Refer protocol, but they were given scenarios in which knowledge of these actions steps was necessary in order to answer correctly.

Feedback on SP Training

This study is the first to report on dental hygiene

student feedback on SP training. Students in this study were given the opportunity to submit written anonymous remarks, questions and evaluations. In addition, a group debriefing was conducted during which the majority of subjects reported feeling anxious when meeting the SP but were soon comfortable and felt overall that the encounter was much more comfortable than TDC with real patients they might encounter in their clinical education environment. They also reported that they would have appreciated the opportunity for self-assessment. They agreed they would participate again and would benefit from additional sessions.

Study Limitations

Small sample size is one limitation of this study. Other biases inherent in a study of this type include attention bias that occurs because people who are part of a study are aware of their involvement and, as a result, may give more favorable responses or perform better than people who are unaware of the study's intent. Contamination bias occurs when members of the control group inadvertently receive the treatment or are exposed to the intervention, thus potentially minimizing the difference in outcomes between the 2 groups. Attempts to control this bias were to minimize the time between the baseline and end-training tests; however, the 6 month follow-up test was administered 6 months after the initial assessment. Contamination was controlled during the SP training session by requiring subjects to leave the facility without contacting subjects who had not completed the training. Withdrawal bias occurs when subjects who leave the study (drop-outs) differ significantly from those that remain. This study had 4 drop-outs following initial consent for reasons that included schedule conflict and personal health. None of the drop-outs displayed any varying characteristics from the rest of the subjects in the study. Proficiency bias occurs when the interventions or treatments are not applied equally to subjects due to skill or training differences among personnel, in this case the SP actors. Attempts to reduce this bias included conducting a mock training session to calibrate the SPs to help assure they each were equally proficient in portraying the dental patient scenario.

Because this was a pilot study, limitations were easy to identify, as well as ways to improve additional testing in this subject matter. For a follow-up study design, an ongoing data collection during the 6 months following initial training is supported, to gain objective data rather than relying on student subjective memory. Asking subjects to remember patient data from a 6 month time period may have resulted in inaccuracies in reported patient numbers related to smoking exposure and TDC rendered. It would be more appropriate

to include a study design that more closely monitored subject experience with these patients in clinic and followed-up with them on a timed schedule. Additional studies are needed to determine the appropriate number and type of SP sessions before stating that SP training is recommended routinely in dental hygiene curriculum to increase long-term confidence levels.

Cost may impact the feasibility of implementing a SP program into a curriculum. The cost for implementing this study was approximately \$2,000. Although initial costs are high due to training of the SPs, once they are trained, the costs may go down because the same actors may be utilized again, and once the curriculum is developed, those costs will not recur. Investing in 1 SP session may not be worth the cost; however, if utilizing the SPs for multiple sessions, it may prove to be cost-effective. The benefits of keeping the course in the curriculum would have to be weighed against the costs of the additional fees.

Conclusion

This pilot study aimed to see how SP experiences would affect students' confidence in giving TDC. Results indicate that SP intervention or an increase in practical experience will help improve confidence in providing TDC that may translate

into higher levels of TDC in private practice. Future studies of SP training for TDC that include more integrated clinical application and reinforcement of TDC may produce more improved results. Long-term studies of graduates are also needed to determine if the self-confidence gained while in school will translate into an increase in TDC interventions in practice.

Jennifer L. Brame, RDH, MS Clinical Assistant Professor, Department of Dental Ecology, UNC School of Dentistry. Robbyne Martin, RDH, MS is a practicing dental hygiene clinician. Tabitha Tavoc, RDH, PhD Assistant Professor, East Tennessee State University. Margot Stein, Ph.D., Clinical Associate Professor, Department of Dental Ecology, UNC School of Dentistry. Alice E. Curran, DMD, MS, is an associate professor at the UNC School of Dentistry.

Acknowledgments

The authors would like to thank Mr. Joey Woodyard and the staff of the UNC-CH School of Medicine Standardized Patient Program for their assistance in the conduct of this study. We would like to thank the members of the UNC - Chapel Hill Dental Hygiene Class of 2009 for volunteering their time.

References

1. Tobacco Use: Targeting the Nation's Leading Killer: At a Glance 2010. Centers for Disease Control and Prevention [Internet]. 2010 [cited 2012 October 30]. Available from: www.cdc.gov/chronicdisease/resources/publications/aag/osh.htm
2. Clinical Practice Guideline Treating Tobacco Use and Dependence 2008 Update Panel, Liaisons and Staff. A clinical practice guideline for treating tobacco use and dependence: 2008 update: A U.S. public health service report. *Am J Prev Med*. 2008;35(2):158–176.
3. Christen AG. Tobacco cessation, the dental profession, and the role of dental education. *J Dent Educ*. 2001;65(4):368–374.
4. Gonseth S, Abarca M, Madrid C, Cornuz J. A pilot study combining individual-based smoking cessation counseling, pharmacotherapy, and dental hygiene intervention. *BMC Public Health*. 2010;10:348.
5. Dolan TA, McGorray SP, Grinstead-Skigen CL, Mecklenburg R. Tobacco control activities in U.S. dental practices. *J Am Dent Assoc*. 1997;128(12):1669–1679.
6. Spangler JG, George G, Foley KL, Crandall SJ. Tobacco intervention training: Current efforts and gaps in US medical schools. *JAMA*. 2002;288(9):1102–1109.
7. Abrams Weintraub T, Saitz R, Samet JH. Education of preventive medicine residents: Alcohol, tobacco, and other drug abuse. *Am J Prev Med*. 2003;24(2):101–105.
8. 2008 PHS Guideline Update Panel, Liaisons, and Staff. Treating tobacco use and dependence: 2008 update U.S. public health service clinical practice guideline executive summary. *Respir Care*. 2008;53(9):1217–1222.
9. Yip JK, Hay JL, Ostroff JS, Stewart RK, Cruz GD. Dental students' attitudes toward smoking cessation guidelines. *J Dent Educ*. 2000;64(9):641–650.
10. Barker GJ, Williams KB. Tobacco use cessation activities in U.S. dental and dental hygiene student clinics. *J Dent Educ*. 1999;63(11):828–833.
11. Weaver RG, Whittaker L, Valachovic RW, Broom A. Tobacco control and prevention effort in dental education. *J Dent Educ*. 2002;66(3):426–429.
12. Sarna L, Brown JK, Lillington L, Wewers ME, Brecht ML. Tobacco-control attitudes, advocacy, and smoking behaviors of oncology nurses. *Oncol Nurs Forum*. 2000;27(10):1519–1528.
13. Kraatz ES, Dudas S, Frerichs M, Paice J, Swenson C. Tobacco-related instruction in undergraduate nursing education in Illinois. *J Nurs Educ*. 1998;37(9):415–417.
14. Fried JL, Reid BC, DeVore LE. A comparison of health professions student attitudes regarding tobacco curricula and interventionist roles. *J Dent Educ*. 2004;68(3):370–377.
15. Kristeller JL, Ockene JK. Tobacco curriculum for medical students, residents and practicing physicians. *Indiana Med*. 1996;89(2):199–204.
16. Studts JL, Burriss JL, Dearn DK, Worth CT, Sorrell CL. Evidence-based Tobacco Cessation Treatment by Dental Hygienists. *J Dent Hyg*. 2011;85(1):13–21.
17. Prochaska JO, Di Clemente CC, Norcross JC. In search of how people change. Applications to addictive behaviors. *Am Psychol*. 1992;47(9):1102–1114.
18. Keefe CW, Thompson ME, Wadland WC. A comprehensive approach to teaching smoking-cessation strategies. *Acad Med*. 2001;76(5):520–521.
19. Koerber A, Crawford J, O'Connell K. The effects of teaching dental students brief motivational interviewing for smoking-cessation counseling: A pilot study. *J Dent Educ*. 2003;67(4):439–447.
20. Brown RL, Pfeifer JM, Gjerde CL, Seibert CS, Haq CL. Innovations in Education and Clinical Practice: Teaching patient-centered tobacco intervention to first-year medical students. *J Gen Intern Med*. 2004;19(5 pt 2):534–539.
21. Brender E, Burke A, Glass RM. JAMA patient page. Standardized patients. *JAMA*. 2005;294(9):1172.

22. Walsh SE, Singleton JA, Worth CT, et al. Tobacco cessation counseling training with standardized patients. *J Dent Educ.* 2007;71(9):1171–1178.
23. Kolb DA. *Experience as the Source of Learning and Development.* Englewood Cliffs: Prentice Hall; 1984. 256 p.
24. Rogers CR, Freiberg HJ. *Freedom to Learn.* 3rd ed. Upper Saddle River: Pearson; 1994.
25. Ramseier CA, Christen A, McGowan J, et al. Tobacco use prevention and cessation in dental and dental hygiene undergraduate education. *Oral Health Prev Dent.* 2006;4(1):49–60.
26. Davis JM, Stockdale MS, Cropper M. The need for tobacco education: Studies of collegiate dental hygiene patients and faculty. *J Dent Educ.* 2005;69(12):1340–1352.

Maryland Dental Hygienists' Knowledge, Opinions and Practices Regarding Dental Caries Prevention and Early Detection

Joanne B. Clovis, RDH, PhD; Alice M. Horowitz, RDH, PhD; Dushanka V. Kleinman, DDS; Min Qi Wang, PhD; Meredith Massey, MED

Introduction

Reduction in the prevalence of dental caries has been a target of concentrated U.S. public health efforts since the mid 20th century, and dental caries has declined dramatically in the last 50 years. The resulting public perception that dental caries is no longer a significant health concern obscures this important public health problem.¹ However, current evidence suggests that prevention efforts must be enhanced for both individuals and the public.^{2,3} Dental hygienists, the oral health professionals focused on prevention, should play a pivotal role in this effort.

Data from 2 National Health and Nutrition Examination Surveys (NHANES III, 1988 to 2004 and NHANES 1999 to 2004) show that while oral health among Americans improved over time, dental caries continues to be a concern for all age groups.^{1,4,5} Data specifically for the period from 1999 to 2004 show caries prevalence increased among preschool children compared with data from NHANES III. In addition, untreated caries were present for over 25% of adults, aged 20 to 64 years, and more than 20% of adults over age 65 years.^{1,4,5} In Maryland, 33% of kindergarten children and 30% of third graders (age 8) had untreated dental caries in 2005 to 2006, and third graders showed almost no change in caries experience and untreated decay since 2000 to 2001.⁶

Abstract

Purpose: The purpose of this study was to assess Maryland dental hygienists' knowledge, practices and opinions regarding dental caries prevention and early detection.

Methods: A 30 item survey was mailed to 1,258 Maryland dental hygienists. Two follow-up mailings and email reminders were sent.

Results: The response rate was 43% (n=540). Nearly all respondents were female (98%), and 58% practiced in solo settings. Knowledge and certainty of knowledge were moderate: sealants are needed regardless of topical fluoride use (55% certain, 40% less certain), newly erupted permanent molars are the best candidates for sealants (54%, 36%) and professionally applied fluorides are desirable in areas without fluoridated water (55%, 36%). Fewer were certain that incipient lesions can be remineralized before cavitation (23%, 69%), and dilute, frequently administered fluorides are more effective in caries prevention than concentrated, less frequently administered fluorides (6%, 24%). Opinions regarding effectiveness of protocols for 2 age groups from 6 months to 6 years, the challenges of early childhood caries (ECC), prevention practices regarding sealant and topical fluoride applications varied widely. Eighty-nine percent reported routinely assessing dental caries risk factors of child patients and 90% were interested in continuing education courses. There were no significant differences between different types of practice settings, year of graduation, race/ethnicity or gender.

Conclusion: Knowledge of recommended guidelines for fluoride and sealant application support clinical decision-making and self-care counseling. Misinformation and lack of understanding of current research and recommendations identify a need for educational interventions in undergraduate dental hygiene programs and through continuing education for practicing hygienists.

Keywords: Dental caries, dental hygienists, oral health, practice guidelines, clinical practice variations

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Assess the use of evidence-based treatment recommendations in dental hygiene practice.

The Institute of Medicine (IOM) released a report delineating key recommendations for the Health and Human Services Oral Health Initiative, referred to as the U.S. New Oral Health Initiative.

tiative (NOHI).³ The IOM Report provides several recommendations for setting goals and concludes that the Healthy People 2020 goals and objectives should be used as the continuing mission (Table I).⁷ The report recommends promoting and monitoring the use of evidence-based preventive services in oral health (both clinical and community based) and counseling across the life span. The domains and significance of prevention are strikingly underscored in this recommendation and they are especially applicable to the primary role of dental hygienists as preventive specialists.⁸

Though the clinical role of dental hygienists varies throughout the U.S. and the world, their primary role has always focused on prevention.⁸ Dental hygienists can have a significant impact on prevention of dental caries through preventing the onset of disease, early recognition of disease and patient education that encourages individuals to take an active role in maintaining their oral health.^{9,10} The knowledge and understanding of evidence-based preventive regimens and communication approaches that dental hygienists use with their patients is fundamental to their patients adopting recommended oral health practices and procedures.

Dental hygiene advocates agree that dental hygienists must utilize current methods that have

Table I: Healthy People 2020 Oral Health Objectives Related to Dental Caries*

Oral Health of Children and Adolescents
OH-1 Dental caries experience
<ul style="list-style-type: none"> OH-1: Reduce the proportion of children and adolescents who have dental caries experience in their primary or permanent teeth. OH-1.1 Reduce the proportion of young children aged 3 to 5 years with dental caries experience in their primary teeth. OH-1.2 Reduce the proportion of children aged 6 to 9 years with dental caries experience in their primary and permanent teeth. OH-1.3 Reduce the proportion of adolescents aged 13 to 15 years with dental caries experience in their permanent teeth.
OH-2 Untreated dental decay in children and adolescents
<ul style="list-style-type: none"> OH-2: Reduce the proportion of children and adolescents with untreated dental decay. OH-2.1 Reduce the proportion of young children aged 3 to 5 years with untreated dental decay in their primary teeth. OH-2.2 Reduce the proportion of children aged 6 to 9 years with untreated dental decay in their primary and permanent teeth. OH-2.3 Reduce the proportion of adolescents aged 13 to 15 years with untreated dental decay in their permanent teeth. OH-2.3 Reduce the proportion of adolescents aged 13 to 15 years with untreated dental decay in their permanent teeth.
Access to Preventive Services
OH-8 Dental services for low-income children and adolescents
<ul style="list-style-type: none"> OH-8: Increase the proportion of low-income children and adolescents who received any preventive dental service during the past year.
OH-9 School-based centers with an oral health component
<ul style="list-style-type: none"> OH-9.1 Increase the proportion of school-based health centers with an oral health component that includes dental sealants. OH-9.2 Increase the proportion of school-based health centers with an oral health component that includes dental care. OH-9.3 Increase the proportion of school-based health centers with an oral health component that includes topical fluoride.
Oral Health Interventions
OH-12 Dental sealants
<ul style="list-style-type: none"> OH-12: Increase the proportion of children and adolescents who have received dental sealants on their molar teeth. OH-12.1 Increase the proportion of children aged 3 to 5 years who have received dental sealants on one or more of their primary molar teeth. OH-12.2 Increase the proportion of children aged 6 to 9 years who have received dental sealants on one or more of their permanent first molar teeth. OH-12.3 Increase the proportion of adolescents aged 13 to 15 years who have received dental sealants on one or more of their permanent molar teeth.
OH-13 Community water fluoridation
<ul style="list-style-type: none"> OH-13: Increase the proportion of the U.S. population served by community water systems with optimally fluoridated water.

*U.S. Department of Health and Human Services. Oral Health Objectives. Washington, DC: U.S. Department of Health and Human Services,; 2011 [cited 2011 April 29, 2011]; Available from: <http://healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=32>

been verified through clinical trials and recommended as best practices.^{8,11} A specific recommendation, for example, is the practice of caries management by the CAMBRA risk assessment method that focuses on appropriate prevention and treatment measures for each stage of the dental caries disease process and tailors disease

management to individual risk profiles.¹² While the importance of dental hygienists in education and prevention is generally accepted, there are relatively few studies that investigate hygienists' knowledge, opinions and practice in these areas.

In some studies, a significant proportion of hygienists did not have adequate knowledge of current evidence based recommendations in areas such as fluoride and sealant use and application protocols.¹³⁻¹⁵ A study by Forrest et al showed that younger and more recent dental hygienist graduates were more knowledgeable in some topic areas than those who had been practicing longer.¹⁴ However, in a more recent study, Manski et al showed that the more experienced dental hygienists and those who work with Medicaid patients were more likely to understand an appropriate preventive regimen.¹⁵ In these latter 2 studies, those who were members of the American Dental Hygienists Association (ADHA) were more likely to be aware of prevention and treatment recommendations. Even when dental hygienists are aware of current evidence based recommendations, they do not necessarily employ these recommendations consistently.¹⁶

Current knowledge and understanding of evidence-based interventions are needed to practice effective dental caries prevention and to communicate these messages to patients accurately and effectively. The purpose of this study in Maryland was to explore and determine dental hygienists' knowledge, practices and opinions regarding dental caries prevention and early detection.

Methods and Materials

A cross-sectional survey design was used in this descriptive study of Maryland dental hygienists knowledge, opinions and practices related to dental caries prevention and their use of recommended communication techniques. The findings in this report are limited to the former. The institutional review board at the University of Maryland approved the study.

In May, June and July of 2010, a survey was mailed to 1,258 dental hygienists on a membership list provided by the Maryland Dental Hygienists' Association (MDHA), and data were collected. The 30 item questionnaire was developed from previous surveys^{14,17-19} and was designed to elicit what the respondent understands and practices with regard to dental caries prevention and their use of recommended communication techniques. The questions about dental caries were largely drawn from previous surveys,^{14,17} while the questions on communications techniques were largely

drawn from studies conducted by the American Dental Association and the American Medical Association.^{18,19} In addition to the authors of the manuscript, the instrument was reviewed by 2 pediatric dentists, 2 public health dentists and 1 cardiologist for content validity.

For this study, the instrument was then pilot-tested among 6 practicing dental hygienists, revised and printed in a format that could be returned without an envelope. Participation in the study was voluntary and consent to participate was given by completing and returning the survey. The first mailing consisted of the full survey instrument with a cover letter signed by the current president of the MDHA. Approximately 3 weeks after the first mailing, a second complete mailing was sent with a modified cover letter from the president. Approximately 3 weeks after the second mailing, a postal card, also signed by the MDHA president, was mailed as a reminder for the dental hygienist that the survey was not yet received. The MDHA also sent an email reminder to all dental hygienists urging them to respond to the survey as soon as possible.

Statistical analyses included descriptive statistics (frequencies and percentages), cross tabulation and chi-square statistic. For the chi-square test, the associations were examined between all demographic variables and the knowledge and practice variables. All statistical analyses were conducted using SPSS version v18.

Results

A total of 579 surveys were returned for a response rate of 46%. The usable responses were 540 for an effective response rate of 43%. The majority of respondents were female (98%) with 83% Caucasian (Table II). More than half (58%) practiced in a solo practice setting, and 35% were in group practices. Approximately one-fourth of respondents graduated from their dental hygiene education program in each of the previous 3 decades, and 27% graduated before 1980. Eleven percent of dental hygienists treated patients whose oral health care was reimbursed by Medicaid or SCHIP. The majority of respondents' patients (70%) had private insurance.

Knowledge

The findings regarding dental hygienists' knowledge are shown in Table III. For each of the 18 statements regarding the etiology and prevention of dental caries, respondents used a Likert-type scale to indicate their agreement or disagreement

with the statement. Asterisks indicate the correct answers based on current scientific evidence and are identified as strongly agree or strongly disagree. Respondents' preferences regarding caries etiology show correct and incorrect knowledge. One-quarter (25%) correctly strongly agreed that dental caries is a chronic, infectious disease process, but 55% indicated they did not know whether lactobacilli play a more significant role in the initiation of smooth surface carious lesions than do mutans streptococci. Most respondents (62%) correctly identified as strongly agreed that a decreased salivary flow increases the risk for developing caries, 23% indicated that incipient carious lesions before cavitation can be remineralized, 22% responded that levels of salivary micro-organisms may indicate levels of caries risk or activity and 6% indicated that the removal of plaque is more valuable for maintaining gingival health than for preventing caries. Regarding the role of sugars in caries etiology, 44% correctly identified that the quantity of sugar consumed is less important than frequency of consumption, and 29% indicated that fructose, glucose and sucrose are cariogenic.

Responses related to fluoride knowledge reflect variation in the understanding of fluoride's mechanism of action and in the professional application of fluoride. Thirteen percent correctly strongly agreed that the most important mechanism of fluoride action is remineralization of incipient lesions. Although 54% correctly strongly agreed that it is desirable to use professionally applied fluorides for all children in areas without fluoridated water, 6% indicated that dilute, frequently administered fluorides are more effective in caries prevention than more concentrated, less frequently administered fluorides. Regarding whether increased use of bottled water increases tooth decay, 10% correctly identified that they did not know.

Most dental hygienists correctly answered the sealant items recognizing that sealants are needed even if patients receive topical fluorides (55%), newly erupted permanent molars are the most important candidates for sealants (54%) and use of sealants is substantiated by scientific research (45%). Fewer identified that loss of sealants is generally attributed to inappropriate application technique (14%) and sealants are not risky because decay may be sealed in the tooth (11%).

Opinions

Dental hygienists' opinions about the effectiveness of procedures for preventing dental caries are shown in Tables IV and V for ages 6 months to

Table II: Dental hygienists' characteristics

Characteristic	n	Percentage
Year of Graduation		
1958–1979	144	27.4
1980–1989	131	24.9
1990–1999	116	22.1
2000–2009	135	25.7
Practice Setting		
Solo Practice	306	57.8
Group Practice	189	35.3
All other	34	6.4
Race/Ethnicity		
White	451	83.4
Black	34	6.3
All other	56	10.4
Gender		
Female	521	97.9
Male	11	2.1
Type of dental insurance of child patients		
Medicaid/SCHIP	464	11.0*
Private Insurance	488	70.0*
Out of Pocket	483	21.0*
Ever taken a communication course		
Yes	350	65.8
No	182	34.2

*Average percentage

2 years and 3 to 6 years, respectively. Although there were some variations in respondents' beliefs by age group, for both groups the majority of dental hygienists believed that community water fluoridation is very effective for ages 3 to 6 years of age (73%) and for ages 6 months to 2 years (69%). About half the respondents believed that dietary fluoride drops/tablets are very effective for the younger age group. Fluoride dentifrices were believed by the majority of respondents to be very effective for the older age group, but for ages 6 months to 2 years, beliefs were divided between somewhat and very effective. Fluoride varnishes were believed to be very effective by the majority but less so for ages 6 months to 2 years. About half believed that professionally applied topical fluorides are very effective for both age groups. For ages 3 to 6 years, the greatest proportion of respondents believed that fluoride rinses at home and school, brush-on fluoride gels, fluoride gels in mouth trays and fluoride foam are effective. For both age groups, the greatest proportions of respondents believed that tooth brushing without

Table III: Percentages of dental hygienists' knowledge of etiology and prevention of dental caries

Please indicate the extent to which you personally agree or disagree with each of the following statements	SA & A OR (SD & D)	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
Sealants are not needed if patients receive topical fluorides	(94.6)	1.5	2.6	39.6	55.04*	1.3
Use of sealants is not substantiated by scientific research	(86.7)	1.3	2.4	41.2	45.49*	9.6
Newly erupted permanent molars are the most important candidates for sealants	90.4	54.41*	36.0	3.8	4.9	0.9
Loss of sealants is generally attributed to inappropriate application technique	59.9	14.45*	45.4	31.1	2.6	6.4
Sealants are somewhat risky because decay may be sealed in the tooth	(64.2)	2.3	29.1	52.9	11.26*	4.5
It is desirable to use professionally applied fluorides for all children in areas without fluoridated water	90.3	54.49*	35.8	4.1	4.9	0.8
The most important mechanism of action of fluoride is that it is incorporated into developing teeth to make them more resistant to acid demineralization	(8.5)	45.0	44.8	5.5	3.01*	1.7
The most important mechanism of action of fluoride is the remineralization of incipient decay	67.3	12.55*	54.8	24.9	1.7	6.1
Dilute, frequently administered fluorides are more effective in caries prevention than more concentrated, less frequently administered fluorides	29.1	5.51*	23.6	33.3	7.8	29.9
Incipient carious lesions (before cavitation) can be remineralized (healed)	91.7	23.12*	68.6	3.8	0.6	4.0
The increased use of bottled water increases tooth decay among young children		17.8	48.4	21.1	3.2	9.53*
Dental caries is a chronic, infectious disease process	73.6	25.1*	48.5	21.3	1.9	3.3
Levels of salivary micro-organisms may indicate levels of caries risk or activity	88.7	21.85*	66.9	2.5	0.4	8.5
Lactobacilli play a more significant role in the initiation of smooth surface carious lesions than do mutans streptococci	(17.3)	4.0	23.8	14.2	3.07*	54.9
Fructose, glucose and sucrose are cariogenic	88.4	28.84*	59.6	5.7	2.3	3.6
Quantity of sugar consumed is more important in causing caries than frequency of sugar consumption	(92.7)	2.8	3.0	48.6	44.09*	1.5
Decreased salivary flow increases the risk for developing caries	97.4	61.84*	35.5	0.8	1.9	0.0
Removal of plaque is more valuable for maintaining gingival health than for preventing caries	31.3	6.07*	25.2	52.6	13.7	2.5

*Correct Answers

a fluoride dentifrice is either somewhat or very effective.

Pit and fissure sealants were believed to be very effective for ages 3 to 6 by 64% of respondents. Beliefs regarding flossing as very effective for preventing tooth decay increased with age group: 35% for age 6 months to 2 years and 44% for ages 3 to 6. A large proportion of respondents believed that professional prophylaxis is very effective for both age groups. Nutritional counseling and infrequent sugar consumption were believed to be very effective for both age groups by about two-thirds and three-quarters of respondents, respectively. The use of xylitol was believed to be mostly effective or very effective but large proportions did not know, for 6 months to 2 years,

and for 3 to 6 years. For both age groups, routine dental care was believed to be very effective, for ages 6 months to 2 years (63%) and for 3 to 6 years (73%).

Respondents identified a broad range of difficulties with children who have early childhood caries (ECC). Most challenges related to the parent/caregiver (Table VI). Nearly half of all respondents (49%) believed that their greatest challenge with a child patient who has ECC is that the parent/caregiver does not follow their instructions. In addition, the parent/caregiver does not bring the child back for follow-up (45%), continues to give the child sweet drinks (44%), does not seem to care about the child's oral health (26%) and would not accept the recommended fluoride regi-

men (21%). Challenges specific to the child include difficult behavioral issues (37%) and their pain symptoms at the time of the visit (34%). Fewer than half (40%) were somewhat sure they could do what is necessary to prevent ECC, and others (29%) said they didn't know (data not shown).

Practices

Dental hygienists reported their practices regarding risk assessment for dental caries, use of fluorides and sealants, and the topics of education that they provide to children and their parents/caregivers (Table VII). Nearly all (94%) reported that they ask the source of the child patient's drinking water, 79% routinely assessed visible plaque, 77% assessed presence of enamel demineralization and 76% assessed the presence of caries. Frequency of brushing the child's teeth was assessed by 73% and 72% assessed the child's frequency of exposure to fluoride. Less than one-third (30%) reported assessing socioeconomic status of the child's parents as a risk factor.

Nearly all respondents (94%) said they provide/recommend fluoride products for the home use of child patients. Most respondents reported providing topical fluoride

Table IV: Percentages of dental hygienists' beliefs of the effectiveness of the procedures for preventing dental caries in children 6 months to 2 years of age

Effectiveness for Children Ages 6 months to 2 years	Not Effective	Somewhat Effective	Effective	Very Effective	Don't Know
Community water fluoridation	2.6	7.3	20.6	68.6	0.9
Dietary fluoride drops/tablets	3.2	10.7	27.9	51.9	6.4
Fluoride dentifrices	8.8	21.8	32.9	31.2	5.4
Fluoride varnish	7.6	7.6	24.6	51.5	8.7
Cleaning infant's mouth	2.1	8.7	25.6	61.1	2.6
Toothbrushing without a fluoride dentifrice	11.2	30.9	34.7	20.3	3.0
Routine dental care	2.1	9.5	22.5	63.0	3.0
Professional prophylaxis	6.8	16.7	28.0	44.9	3.6
Flossing	11.6	21.1	26.6	34.7	6.1
Nutritional counseling	0.9	8.1	23.0	65.1	2.8
Infrequent sugar consumption	0.6	4.7	21.8	71.7	1.3
Use of xylitol	6.5	19.7	25.6	17.8	30.4
Of the above procedures, which two do you consider most effective in preventing caries in children ages 6 months to 2 years?					
<ul style="list-style-type: none"> • 1st Priority: Community water fluoridation 30.98% • 2nd Priority: Nutritional counseling 19.16% 					

Table V: Percentages of dental hygienists' beliefs of the effectiveness of the procedures for preventing dental caries in children 3 to 6 years of age

Effectiveness for Children Ages 3 to 6 years	Not Effective	Somewhat Effective	Effective	Very Effective	Don't Know
Community water fluoridation	0.9	3.9	21.6	73.2	0.4
Dietary fluoride drops/tablets	1.3	10.1	27.7	56.2	4.7
Fluoride dentifrices	0.6	8.9	37.1	52.7	0.8
Fluoride varnish	0.2	5.5	26.5	65.6	2.3
Pit and fissure sealants	2.1	7.9	24.6	64.2	1.3
Topical fluorides—professional	0.9	12.8	34.9	50.2	1.1
Fluoride rinse—at home	2.1	18.6	40.3	37.1	1.9
Fluoride rinse—at school	5.1	23.7	33.2	24.1	13.9
Brush—on fluoride gels	2.7	20.1	42.8	29.6	4.9
Fluoride gel in mouth tray	4.9	25.4	40.1	25.8	3.8
Fluoride foam	5.7	36.6	35.4	20.0	2.3
Toothbrushing without a fluoride dentifrice	17.2	43.7	27.2	10.2	1.7
Flossing	2.1	17.0	36.9	43.7	0.4
Professional prophylaxis	0.6	9.9	33.8	55.5	0.2
Routine dental care	0.0	2.6	23.8	73.4	0.2
Nutritional counseling	0.0	6.4	25.9	66.2	1.5
Infrequent sugar consumption	0.2	3.5	21.1	75.0	0.2
Use of xylitol	1.7	17.2	32.0	26.1	22.7
Of the above procedures, which two do you consider most effective in preventing caries in children ages 3 to 6 years?					
<ul style="list-style-type: none"> • 1st Priority: Community water fluoridation 34.06% • 2nd Priority: Routine dental care 16.73% 					

Table VI: Percentages of dental hygienists' beliefs of the greatest challenges with a child patient who has ECC

Item	n	Percentage
Parent/caregiver does not follow my instructions	267	48.8
Child does not return for follow-up care	246	45.1
Parent/caregiver continues to give sweet drinks in child's bottle or tippy cup	247	43.8
Child has difficult behavioral issues	204	36.8
Child is in pain at visit	182	33.6
Child's teeth always needs cleaning	180	33.3
Child (parent) is frequently a no-show	170	31.4
Parent/caregiver does not seem to care about child's oral health	143	26.1
Parent/caregiver will not accept the recommended fluoride regimen	115	21.3
I don't encounter problems	0	0.0
Other: Includes responses from the following categories	-	n/a
<ul style="list-style-type: none"> • Access to dental healthcare • Education of importance for prevention & treatment • Cost of prevention & treatment • Heredity as a risk factor • Not applicable 	<ul style="list-style-type: none"> 2 11 8 1 8 	n/a

treatments twice a year for children aged 3 to 6 years (82%) and for those 7 to 20 years (87%, Table VIII). Although 30% said they provide professionally applied fluoride treatments twice per year for children aged 6 months to 2 years, 56% said they do not provide any fluoride treatments. The preferred in-office fluoride treatment was fluoride varnish for 30 seconds (33%) or 1 minute (36%), followed by fluoride prophylaxis paste for 2 minutes (28%). Both APF gel and APF foam were reported by about 25% respondents for a 1 minute application.

Nearly all respondents reported applying sealants (93%) and 46% reported providing sealants for more than 75% of their patients (Table IX). Most respondents reported the reasons that child patients did not receive sealants were financial concerns, including parents being unwilling to pay entirely or to co-pay (62%) and insurance not including sealants as a benefit (46%).

Bivariate analysis did not reveal significant relationships between demographic characteristics and knowledge or practices. There were no sig-

Table VII: Dental hygienists' risk assessment for dental caries

Question & Item	n	Percentage
Do you routinely assess dental caries risk factors for your child/youth patients?		
<ul style="list-style-type: none"> • Yes • No 	<ul style="list-style-type: none"> 463 59 	<ul style="list-style-type: none"> 88.7 11.3
If Yes, which of the following caries risk factors do you use for these patients?*		
<ul style="list-style-type: none"> • Source of drinking water • Visible plaque • Presence of enamel demineralization • Child has decay • Times per day child's teeth are brushed • Child's exposure to fluoride • New lesions since last visit • Frequency of dental visits • Daily between-meal exposures to cavity producing food • Child has special health care needs • Socioeconomic status of child's parents • Other 	<ul style="list-style-type: none"> 494 429 417 412 396 389 382 365 351 312 164 20 	<ul style="list-style-type: none"> 93.6 79.3 77.1 76.2 73.2 71.9 70.6 67.5 64.9 57.7 30.3 5.0

*Respondents were asked to "Check ALL that apply"

nificant differences regarding knowledge or practices between different types of practice settings, year of graduation, race/ethnicity or gender.

Discussion

The recommendation of the IOM's Advancing Oral Health in America report to promote and monitor the use of evidence-based preventive services in oral health is particularly relevant to dental hygiene in the state of Maryland.³ Evidence-based dental hygiene practice in all practice settings can address and help to meet the current Healthy People 2020 objectives related to the prevention and control of dental caries (Table I). In Maryland there is now even greater potential to be effective in caries prevention in multiple settings as a result of recent regulatory change permitting dental hygienists to treat patients in public health facilities without the direct supervision of a dentist. Further, there is new attention to the need for primary prevention of dental caries in Maryland after the death in 2007 of 12-year-old Deamonte Driver.

Grounding dental hygiene practice in current evi-

Table VIII: Professional application of fluorides by dental hygienists

What is the frequency you or someone in your office provide topical fluoride treatments to your child patients?	Responses as percentages					n
	Once a year	2x per year	More than 2x per year	Only if they have caries	Do not provide	
Children (6 mos. to 2 years)	6.4	29.7	1.3	6.4	56.1	519
Children (3 to 6 years)	7.7	82.3	1.7	2.6	5.6	531
Youth (7 to 20 years)	7.2	87.0	1.9	0.6	3.4	531
Please indicate the type of fluoride and the application time you most often use for in-office treatments.	30 secs.	1 min.	2 mins.	4 mins.	Do not use	n
APF gel	0.2	22.9	3.5	11.9	61.4	428
APF foam	0.9	26.9	6.3	7.4	58.6	432
NaF gel	0.5	13.6	3.2	5.7	76.9	403
NaF rinse	1.9	15.7	4.8	1.2	76.3	413
SnF2	1.5	5.9	1.8	2.0	88.8	393
Fluoride varnish	33.0	36.3	12.9	8.9	8.9	482
Fluoride prophylaxis paste	9.0	27.3	28.2	23.1	12.5	433
Other, please specify	36.4	9.1	0	0	0	11

dence has been clearly recognized as an imperative, strongly recommended over several decades^{8,11} and is explicit in a number of core competencies defined by the American Dental Education Association.²⁰ This study suggests that enhancing Maryland dental hygienists' knowledge and practices would help to enable them to make a greater contribution towards achieving the Healthy People 2020 objectives, particularly for the youngest age groups.

Opinions about Practice

Dental hygienists' opinions influence how they practice dental caries prevention and control.²¹ To use current best evidence, self-regulatory skills, including self-assessment and self-efficacy, are needed to implement practice change based on evidence.²¹ Uncertainty about correct treatment procedures for various ages, such as managing ECC as reported in this study, can lead to selection of ineffective treatments and reduced caries prevention effect. ECC is a form of dental caries that is distinctive in its characteristics. It begins on smooth surfaces, usually in the primary maxillary incisors, then progresses rapidly, and is highly prevalent among very young children of low income families.^{22,23} Fluoride interventions, especially fluoride varnishes, are effective in the prevention of ECC.²⁴

Respondent opinions regarding the effectiveness of fluorides varied, and likely accounted for their variations in practice, particularly with regard to the time required for the fluoride application protocol

(Table VIII). Although most respondents reported that xylitol is beneficial for all age groups, there are no evidence-based clinical guidelines regarding use of xylitol. There is promising evidence for the use of xylitol chewing gum as part of a caries prevention regimen,²⁵ and an oral xylitol syrup for ages 9 to 15 months to prevent ECC.²⁶ Nutritional counseling and infrequent sugar consumption were believed by large proportions of respondents to be effective in preventing dental caries for each age group, and this belief is consistent with guidelines for children, adolescents and adults (Table V).^{27,28}

Many respondents believed that flossing is very effective for preventing dental caries, but studies have not supported this belief.²⁹⁻³¹ Large proportions of respondents incorrectly held that professional prophylaxis is very effective for caries prevention for all age groups. The public does not understand the difference between strategies for the prevention of dental caries and the prevention of periodontal diseases.³² Dental hygienists can clarify the difference for individual patients and the public if they are certain about the evidence regarding the effectiveness of different strategies for the prevention of oral diseases. Routine dental care was believed to be very effective in preventing oral disease by at least 60% of respondents, however, this opinion is not supported by evidence. Although routine dental visits are associated with better oral health,³³ and childhood socioeconomic status affects future dental visit patterns,³⁴ evidence does not support a standardized time interval for dental attendance. It is rec-

ommended that individual patient considerations guide the time intervals for appropriate dental and dental hygiene care and recall schedules.³⁵ Even in a standardized program for preventive dental care in a population of low risk children, the recall intervals were individualized according to dental health and dental health behavior.³⁶

Knowledge-based Practice

Respondents in this study demonstrated moderate knowledge and use of the methods and strategies designed to prevent and control dental caries. A need for continuing education to update knowledge that can be applied in practice was also demonstrated. Those who correctly strongly agreed or strongly disagreed with knowledge items demonstrated certainty regarding

their knowledge. Those who responded agreed or disagreed indicated some uncertainty regarding their knowledge. These are reported in parentheses in the following discussion with certain knowledge first, less certain knowledge second. The higher level of knowledge regarding sealants was reflected in respondents' reported practice, with nearly all applying sealants on child patients and over half reporting use for over 75% of their patients. The sealant knowledge was largely consistent with sealant research,^{37,38} specifically that sealants are needed regardless of whether patients receive topical fluorides (55%, 40%), newly erupted permanent molars are the best candidates for sealants (54%, 36%) and sealant use is well documented in scientific research (46%, 41%). However, only one-fourth were certain

Table IX: Use of sealants by dental hygienists

Question & Item	n	Percentage
Do you use sealants for your child/youth patients?		
Yes	484	93.1
No	36	6.9
If Yes, to what percentage of your patients under age 20 do you apply sealants?		
None	14	2.9
10% or less	22	4.5
11–25%	29	6.0
26–50%	67	13.8
51–75%	130	26.7
Over 75%	225	46.3
If your child patients do not receive sealants, which of the following reasons apply?*		
Patients are unwilling to pay for them	333	61.6
Insurance does not pay for it	252	46.0
Decay can develop under a sealant	50	9.1
Parents are unfamiliar with the procedure	48	8.9
Possible to seal in decay	35	6.3
Office policy does not support use of sealant	31	5.4
Sealants do not last very long	18	3.3
Use of sealants are unsubstantiated by research	8	1.5
I have had poor experience with sealants	9	1.5
It is more economical to place amalgam or composite fillings as needed	8	1.3
Technique is too difficult	8	1.3
Too time consuming to apply	12	0.7
Other: Includes responses from the following categories	–	n/a
<ul style="list-style-type: none"> • Tooth anatomy is smooth, low risk • Child cannot tolerate procedure (gags) • Concern about plastic safety • Dentist applies sealant • Office does not offer service 	35 3 2 5 4	n/a

*Respondents were asked to "Check ALL that apply."

(23%, 69%) that incipient lesions can be remineralized before cavitation, and fewer (11%, 53%) were certain that sealants are not risky because decay may be sealed in the tooth, indicating a need for review of the evidence that sealing non-cavitated caries in permanent teeth is effective in reducing caries progression.³⁹ The range of responses regarding loss of sealants being attributed to application technique also showed uncertainty regarding the evidence. Clarification is needed for those who are not certain about the reasons for sealant loss (15%, 45%) and for those (10%) who responded they do not know if sealants are supported by research.

The lower level of knowledge of fluorides was remarkable given that the benefits of fluoride in pre-

venting dental caries have been known for more than 75 years, and evidence regarding use of fluorides has received considerable systematic review. Knowing the predominant mechanism of action of fluorides for caries prevention is a prerequisite for the reinforcement of appropriate and routine use in both self and professional care. Over half (55%, 36%) knew that professionally applied fluorides are desirable in areas without fluoridated water,⁴⁰ but most (13%, 55%) were not certain that the most important mechanism for fluoride action is by remineralization of incipient lesions.^{40,41} Fewer (6%, 24%) understood that dilute, frequently administered fluorides are more effective in caries prevention than more concentrated, less frequently administered fluorides. Knowing the chief mechanism of fluoride action would provide a foundation for dental hygienists to understand the attributes of the various types of topical fluorides and their evidence-based modes of application and effectiveness.^{40,42-47} Using current information on fluorides and sealants is especially important because a recent study of Maryland adults showed that they have a low level of understanding about how to prevent dental caries.⁴⁸ With regard to the increased use of bottled water increasing dental caries among young children, only 10% correctly answered that they did not know. Evidence regarding bottled water usage is not clear. If bottled water is the main source of water intake, there is likely to be decreased use of community water that is fluoridated. Most bottled water contains fluoride in amounts less than 0.3 ppm.^{49,50} Since consumption of bottled drinking water is very high in the U.S.,^{51,52} it is generally believed that the decreased fluoride availability will lead to an increase in dental caries prevalence. This might be the reason that two-thirds of respondents (18%, 48%) agreed that increased use of bottled water increases dental caries.

A sound knowledge of dental caries etiology is the foundation needed to understand fluoride mechanisms and how various forms of fluoride function as preventive agents. In the dental caries process, the biofilm on teeth is known to be dominated by acidogenic bacteria, primarily mutans streptococci and lactobacilli. Lactobacilli are not involved in initiation but rather potentially contribute to the demineralization of the teeth once the lesions are established.⁵³ Knowledge of the critical role of fermentable carbohydrates in the caries process was also low. Although most respondents (45%, 49%) knew that the quantity of fermentable carbohydrates consumed is less important in causing caries than frequency of sugar consumption,⁵⁴ less than one-third were certain that fructose, glucose and sucrose are all cariogenic (29%, 60%).^{55,56} Most respondents did not know that removal of the biofilm or plaque is not recommended as a caries preventive strategy, but is

a focus for maintaining gingival health.⁵⁴ Compared with respondents in the national study of 2,000, respondents in this survey demonstrated very similar results on knowledge with minor gains in understanding that caries is a chronic, infectious disease and incipient lesions can be remineralized.¹⁴

Dental caries risk assessment is strongly recommended for every patient in dental hygiene practice. Clinical guidelines and caries assessment tools are readily available and can be very helpful in daily practice.^{28,57} It is noteworthy that most hygienists in this survey reported routine assessment for dental caries risk factors in children and youth, with the exception of the identification of the socioeconomic status of a child's parents. Given U.S. data that show poverty in children and adolescents is still an important risk factor, inclusion of socioeconomic status in risk assessment is advised.^{1,5} Current data demonstrating increases in dental caries among non-poor, especially boys ages 6 to 8 years, suggest that assessment of sweetened beverage consumption (juice drinks and sodas) is a vital part of dental caries risk assessment for prevention and control.¹

The application of fluorides as in-office treatments showed practices inconsistent with evidence. Two-thirds reported using varnishes, although over half reported not applying any topical fluorides for children ages 6 months to 2 years. For this youngest age group, fluoride varnishes have been shown to be very effective when combined with caregiver counseling,⁵⁸ and should be applied more often for high risk children.⁵⁹ When used, other forms of topical fluoride in this study were applied for 1 minute, even though clinical studies have used only 4 minute protocols. The use of fluoride prophylaxis paste is not recommended as a substitute for fluoride varnish or a 4 minute application of a gel.

Similar to findings by Manski et al, the dental hygienists in this study who provided care for patients with Medicaid were more likely to understand appropriate treatments.¹⁵ The percentage of dental hygienists who treated Medicaid or SCHIP patients was only 11%.

Implications and Recommendations for Practice, Education and Research

As the only oral health professional dedicated to prevention, dental hygienists have an important role to play in meeting the majority of the Healthy People 2020 objectives that are related to the prevention and control of dental caries in all age groups.⁷ Knowledge of recommended guidelines for fluoride and sealant application support clinical decision-making and self-care practice counseling. Educational inter-

ventions are needed to advance the knowledge base of dental hygienists. Overall, it appears that a sound grounding in dental caries etiology would be most helpful in laying the foundation for dental hygienists' knowledge of dental caries prevention mechanisms and application strategies. Dental hygiene practice includes an array of preventive therapies designed for dental caries and periodontal disease. Therapeutic strategies for the prevention of dental caries should be separated from those for periodontal diseases to ensure that the etiology, mechanisms of action and application techniques are clearly distinguished and understood. Dental hygiene curricula should be reviewed regularly to ensure consistency with current scientific evidence. Dental hygiene education and post-graduate continuing education courses can be designed to include current evidence, and presented in multiple formats to meet the diverse learning needs of students and graduates.

Self-assessment is the essential component of professional practice that can direct the dental hygienist to review and revise current practices regarding dental caries prevention.⁶⁰ Understanding the disease process and the diagnostic and preventive regimens available is essential to oral health promotion and as the foundation for self-assessment of evidence-based dental caries prevention practices. Dental hygiene educators and professional and regulatory agencies can facilitate the development of practice standards and guidelines to support the process of self-assessment and continuing competence in dental hygiene practice.

Intervention education research on dental hygienist practices could help to identify the most effective and efficient strategies for updating and using current evidence regarding the prevention and control of dental caries.

Study Limitations

The generalizability of findings from this study may be limited by several factors. Although the response rate is similar to other studies with health

care providers, it is possible that the responses of the survey participants may not reflect the views of nonresponders.⁶¹ Further, because we used the membership list of the MDHA, we did not survey non-member dental hygienists who might be practicing in the state.

Conclusion

Evidence-based knowledge and understanding is essential for both clinical practice with individual patients and for community-based programs. Maryland hygienists were moderately informed about dental caries etiology and prevention. There also was evidence of misinformation and lack of understanding of current research and recommendations. Most dental hygienists (90%) reportedly were interested in continuing education courses in caries prevention. This stated interest is especially positive and will be used to foster implementation of educational interventions. These findings will inform a statewide oral health program to be initiated in 2012.

Joanne C. Clovis, RDH, PhD, is a professor at the School of Dental Hygiene, Faculty of Dentistry, Dalhousie University, Halifax, Nova Scotia, Canada. Alice M. Horowitz, PhD, is a research associate professor at the Center for Health Literacy, School of Public Health, University of Maryland, Dushanka V. Kleinman, DDS, MScD, is a professor and associate dean for research at the School of Public Health, University of Maryland. Min Qi Wang, PhD, is a professor at the Department of Behavior and Community Health, School of Public Health, University of Maryland. Meredith Massey is an associate professor at the Department of Language Studies, Prince Georges Community College.

Acknowledgments

The authors thank QuynhTu Tran for her assistance in developing the tables. This study was supported by a grant from the DentaQuest Foundation.

References

1. Dye BA, Thornton-Evans G. Trends in oral health by poverty status as measured by Healthy People 2010 objectives. *Public Health Rep.* 2010;125(6):817-830.
2. Shenkin JD. An increase in caries rate or an increase in access to care: data show mixed results. *J Public Health Dent.* 2011;71(1):1-5.
3. IOM (Institute of Medicine). *Advancing Oral Health in America.* Institute of Medicine of the National Academies. 2011.
4. Beltran-Aguilar ED, Laurie KB, Canto MT, et al. Surveillance for Dental Caries, Dental Sealants, Tooth Retention, Edentulism, and Enamel Fluorosis --- United States, 1988--1994 and 1999--2002. *MMWR Surveill Summ.* 2005;54(3):1-43.
5. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat 11.* 2007;(248):1-92.
6. Altema-Johnson D. The Burden of Oral Diseases in Maryland. Maryland Department of Health and Mental Hygiene, Office of Oral Health [Internet]. 2010. Available from: http://fha.dhmh.maryland.gov/oralhealth/docs1/Burden_Oral_DiseasesinMaryland_May2010.pdf
7. U.S. Department of Health and Human Services. Oral Health Objectives. 2020 Topics and Objectives. U.S. Department of Health and Human Services. 2011.
8. Horowitz AM. Health education & promotion to prevent dental caries. The opportunity and responsibility of dental hygienists. *Dent Hyg (Chic).* 1983;57(5):8, 10-5.
9. Ohrn K. The role of dental hygienists in oral health prevention. *Oral Health Prev Dent.* 2004;2(Suppl 1):277-281.
10. McConaughy FL, Toevs SE, Lukken KM. Adult clients' recall of oral health education services received in private practice. *J Dent Hyg.* 1995;69(5):202-211.
11. Cobban SJ, Edgington EM, Clovis JB. Moving research knowledge into dental hygiene practice. *J Dent Hyg.* 2008;82(2):21.
12. Young DA, Lyon L, Azevedo S. The role of dental hygiene in caries management: a new paradigm. *J Dent Hyg.* 2010;84(3):121-129.
13. Faine MP, Oberg D. Survey of dental nutrition knowledge of WIC nutritionists and public health dental hygienists. *J Am Diet Assoc.* 1995;95(2):190-194.
14. Forrest JL, Horowitz AM, Shmueli Y. Caries preventive knowledge and practices among dental hygienists. *J Dent Hyg.* 2000;74(3):183-195.
15. Manski MC, Parker ME. Early childhood caries: knowledge, attitudes, and practice behaviors of Maryland dental hygienists. *J Dent Hyg.* 2010;84(4):190-195.
16. Warren DP. A survey of in-office use of fluorides in the Houston area. *J Dent Hyg.* 1996;70(4):166-171.
17. Loupe MJ, Frazier PJ, Horowitz AM, Kleinman DV, Caranicas PC, Caranicas DA. Impact of an NIDR educational program on the teaching of caries prevention in dental hygiene. *J Dent Educ.* 1988;52(3):149-155.
18. Rozier RG, Horowitz AM, Podschun G. Dentist-patient communication techniques used in the United States: The results of a national survey. *J Am Dent Assoc.* 2011;142(5):518-530.
19. Schwartzberg JG, Cowett A, VanGeest J, Wolf MS. Communication techniques for patients with low health literacy: a survey of physicians, nurses, and pharmacists. *Am J Health Behav.* 2007;31(Suppl 1):S96-S104.
20. American Dental Education Association (ADEA). ADEA Competencies for entry into the allied dental professions. *J Dent Educ.* 2010;74(7):769-775.
21. Bandura A. Health promotion by social cognitive means. *Health Educ Behav.* 2004;31(2):143-164.
22. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat 11.* 2007;(248):1-92.

23. Wyne AH. Early childhood caries: nomenclature and case definition. *Community Dent Oral Epidemiol.* 1999;27(5):313–315.
24. Weintraub JA, Ramos–Gomez F, Jue B, et al. Fluoride varnish efficacy in preventing early childhood caries. *J Dent Res.* 2006;85(2):172–176.
25. Twetman S. Consistent evidence to support the use of xylitol– and sorbitol–containing chewing gum to prevent dental caries. *Evid Based Dent.* 2009;10(1):10–11.
26. Milgrom P, Ly KA, Tut OK, et al. Xylitol pediatric topical oral syrup to prevent dental caries: a double–blind randomized clinical trial of efficacy. *Arch Pediatr Adolesc Med.* 2009;163(7):601–607.
27. Feldens CA, Giugliani ER, Duncan BB, Drachler Mde L, Vitolo MR. Long–term effectiveness of a nutritional program in reducing early childhood caries: a randomized trial. *Community Dent Oral Epidemiol.* 2010;38(4):324–332.
28. Marshall TA. Chairside diet assessment of caries risk. *J Am Dent Assoc.* 2009;140(6):670–674.
29. Horowitz AM, Suomi JD, Peterson JK, Lyman BA. Effects of supervised daily dental plaque removal by children: II. 24 months’ results. *J Public Health Dent.* 1977;37(3):180–188.
30. Suomi JD, Peterson JK, Matthews BL, Vogglesong RH, Lyman BA. Effects of supervised daily dental plaque removal by children after 3 years. *Community Dent Oral Epidemiol.* 1980;8(4):171–176.
31. Hujoel PP, Cunha–Cruz J, Banting DW, Loeche WJ. Dental flossing and interproximal caries: a systematic review. *J Dent Res.* 2006;85(4):298–305.
32. Corbin SB. Oral disease prevention technologies for community use. *Int J Technol Assess Health Care.* 1991;7(3):327–344.
33. Thomson WM, Williams SM, Broadbent JM, Poulton R, Locker D. Long term dental visiting patterns and adult oral health. *J Dent Res.* 2010;89(3):301–311.
34. Crocombe LA, Broadbent JM, Thomson WM, Brennan DS, Slade GD, Poulton R. Dental visiting trajectory patterns and their antecedents. *J Public Health Dent.* 2011;71(1):23–31.
35. Clarkson JE, Amaechi BT, Ngo H, Bonetti D. Recall, reassessment and monitoring. *Monogr Oral Sci.* 2009;21:188–198.
36. Wang NJ, Aspelund GO. Preventive care and recall intervals. Targeting of services in child dental care in Norway. *Comm Dent Health.* 2010;27(1):5–11.
37. Ahovuo–Saloranta A, Hiiri A, Nordblad A, Mäkelä M, Worthington HV. Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents. *Cochrane Database Syst Rev.* 2008;(4):CD001830.
38. Beauchamp J, Caufield PW, Crall JJ, et al. Evidence–based clinical recommendations for the use of pit–and–fissure sealants: a report of the American Dental Association Council on Scientific Affairs. *Dent Clin North Am.* 2009;53(1):131–147.
39. Griffin SO, Oong E, Kohn W, et al. The effectiveness of sealants in managing caries lesions. *J Dent Res.* 2008;87(2):169–174.
40. Recommendations for using fluoride to prevent and control dental caries in the United States. Centers for Disease Control and Prevention. *MMWR Recomm Rep.* 2001;50(RR–14):1–42.
41. Griffin SO, Regnier E, Griffin PM, Huntley V. Effectiveness of fluoride in preventing caries in adults. *J Dent Res.* 2007;86(5):410–415.
42. Marinho VC, Higgins JP, Logan S, Sheiham A. Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev.* 2003;(4):CD002782.
43. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride mouthrinses for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev.* 2003;(3):CD002284.
44. Marinho VC, Higgins JP, Sheiham A, Logan S. Fluoride toothpastes for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev.* 2003;(1):CD002278.

45. Marinho VC, Higgins JP, Sheiham A, Logan S. Combinations of topical fluoride (toothpastes, mouthrinses, gels, varnishes) versus single topical fluoride for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev*. 2004;(1):CD002781.
46. Marinho VC, Higgins JP, Sheiham A, Logan S. One topical fluoride (toothpastes, or mouthrinses, or gels, or varnishes) versus another for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev*. 2004;(1):CD002780.
47. American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: evidence-based clinical recommendations. *J Dent Educ*. 2007;71(3):393-402.
48. Horowitz AM, Wang MQ, Kleinman DV. What Maryland adults know and do about preventing dental caries. In press.
49. Newbrun E. What we know and do not know about fluoride. *J Public Health Dent*. 2010;70(3):227-233.
50. American Dental Association. For the dental patient. The facts about bottled water. *J Am Dent Assoc*. 2003;134(9):1287.
51. Gleick PH. War On Tap: America's Obsession With Bottled Water. NPR [Internet]. 2010 May 17. Available from: <http://www.npr.org/templates/story/story.php?storyId=126833795>
52. Gleick PH. Bottled and Sold: The Story Behind Our Obsession with Bottled Water. Washington DC: Island Press; 2000. 211 p.
53. Tanzer JM, Livingston J, Thompson AM. The microbiology of primary dental caries in humans. *J Dent Educ*. 2001;65(10):1028-1037.
54. Marshall TA, Broffitt B, Eichenberger-Gilmore J, Warren JJ, Cunningham MA, Levy SM. The roles of meal, snack, and daily total food and beverage exposures on caries experience in young children. *J Public Health Dent*. 2005;65(3):166-173.
55. Marsh PD. Dental plaque as a biofilm and a microbial community - implications for health and disease. *BMC Oral Health*. 2006;6(Suppl 1):S14.
56. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. *Public Health Nutr*. 2004;7(1A):201-226.
57. Young DA, Lyon L, Azevedo S. The role of dental hygiene in caries management: a new paradigm. *J Dent Hyg*. 2010;84(3):121-129.
58. Weintraub JA, Ramos-Gomez F, Jue B, et al. Fluoride varnish efficacy in preventing early childhood caries. *J Dent Res*. 2006;85(2):172-176.
59. Azarpazhooh A, Main PA. Fluoride varnish in the prevention of dental caries in children and adolescents: a systematic review. *J Can Dent Assoc*. 2008;74(1):73-79.
60. Eva KW, Regehr G. Self-assessment in the health professions: a reformulation and research agenda. *Acad Med*. 2005;80(10 Suppl):S46-S54.
61. VanGeest JB, Johnson TP, Welch VL. Methodologies for improving response rates in surveys of physicians: a systematic review. *Eval Health Prof*. 2007;30(4):303-321.

Identifying Barriers to Receiving Preventive Dental Services: Expanding Access to Preventive Dental Hygiene Services Through Affiliated Practice

Michelle L. Gross-Panico, RDH, MA, DHSc; Wilbur K. Freeman III, BSE, MBA

Introduction

Achieving good oral health is dependent on understanding the importance of oral hygiene and following through with preventive oral health maintenance. However, geographic, economic and political factors also contribute to oral health status. Lack of access to oral health care affects many U.S. populations. More than half of American preschool children ages 2 through 5 have never been to a dentist.¹ In 2000, the Surgeon General's Report on Oral Health in America called for action to specifically address oral health care needs and disparities within the U.S.² Improving the oral health status of the U.S. population is a significant challenge to policymakers, health officials, dental educators and providers. One way to expand preventive dental services to underserved populations is by allowing registered dental hygienists to provide services in underserved communities without requiring the direct supervision of a licensed dentist.

In the spring of 2004, Arizona Governor Janet Napolitano signed HB 2194 into law, which created a new opportunity for children to access preventive dental services. This law allows dentists and dental hygienists to work in collaboration to increase access to preventive dental services through a non-traditional model called an affiliated practice relationship (APR). Later, in 2009, the age restriction for patients was lifted to allow all qualifying patients of any age (children, adults and seniors) to access preventive dental services from an affiliated practice dental hygienist.

A traditional dental service delivery model con-

Abstract

Purpose: Minority children and children from lower income families are more likely to experience the burden of oral disease. Since oral disease reduces quality of life, it is a priority to utilize preventive dental services. The research questions ask if affiliated practice increases utilization of preventive dental services by underserved children from birth to 18 years of age, and what the barriers to receiving preventive dental services are and their level of importance.

Methods: A survey was administered to parents/guardians of patients from birth to 18 years of age who received preventive dental services from Catholic Healthcare West East Valley Children's Dental Clinic, an affiliated practice dental clinic in Chandler, Arizona. Thirty-four surveys were completed: 21 completed in English and 13 completed in Spanish. The data was analyzed to provide descriptive statistics and non-parametrically analyzed using the Friedman's, Kendall's W and Wilcoxon Signed Ranks Tests.

Results: The cost of preventive dental services is more important to this population than both convenience of appointment time and distance traveled. As the cost increases for preventive dental services, this population will utilize preventive dental services less frequently.

Conclusion: The study indicated that the increase of self-reported utilization of preventive dental services by underserved children, ranging in age from birth to 18 years old, in Arizona affiliated practice dental clinics, was primarily impacted by perceived reduced costs of receiving care. Funding efforts, reimbursement mechanisms and legislative policies should support this dental care delivery model to provide care to underserved children, adults and seniors throughout the U.S.

Keywords: Dental health services, health care disparities, oral hygiene, delivery of health care, health service accessibility, health care facilities, manpower, services, preventive dentistry

This study supports the NDHRA priority area, **Health Services Research:** Investigate how alternative models of dental hygiene care delivery can reduce health care inequities.

sists of a dentist providing direct or general supervision of a dental hygienist and requires that a dentist examine patients before treatment is provided by a dental hygienist. The uniqueness of APR is that registered dental hygienists can provide care

in community-based settings without an exam by a dentist beforehand.³ The Arizona Department of Health Services reports that APR allows greater access to preventive care for underserved patients at convenient locations and early referral for restorative services.³ Preventive dental services that can be delivered in an APR include examination of the oral cavity, referrals, radiographs, fluoride treatments, prophylaxis, scaling, periodontal examination, dental sealants and oral health education. The Arizona Legislature and Arizona Board of Dental Examiners explain that persons who qualify to receive these preventive dental services from an affiliated practice dental hygienist must be one of the following:

- Enrolled in a federal, state, county or local health care program
- Participating in the national school meal program
- From a family with a household income that is less than 200% of the federal poverty guidelines⁴

A licensed dentist must see the patients within 12 months of initial treatment by the affiliated practice dental hygienist, before the dental hygienist can provide further treatment beyond the 1 year timeframe. As of April 19, 2011 there were only 42 affiliated practice dental hygienists in Arizona, therefore, few studies have been completed on affiliated practice dental hygiene as data is being gathered in other APR settings.

The research questions addressed in this study are:

- "What are the participant's perceptions of the utilization of preventive dental services by underserved children from birth to 18 years of age in affiliated practice given hypothetical costs?"
- "What are the barriers and the level of importance of these barriers that impede underserved populations from receiving preventive dental services?"

Burden of Dental Disease

Good oral health is important because untreated oral disease can cause pain, "which can interfere with diet, nutrition, sleep, learning and other daily functions."² In 2000, the U.S. Surgeon General reported there was a large disparity in the oral health of U.S. citizens and that oral disease reduces quality of life by restricting activities at school, work and home.⁵ Dental caries is one of the most common diseases among youth in the U.S. "Among 5 to 17-year-olds, dental caries are 5 times as common

as asthma, and 7 times as common as hay fever."² Findings from national surveys indicate that three-quarters of 17-year-olds have at least 1 cavity or filling and about one-fifth of adolescents have at least 1 untreated caries lesion or active tooth infection.⁶

The burden of dental disease is not equally distributed. Adolescents who live in families with an income near or below the federal poverty level are 3 times more likely to have untreated caries than adolescents who live in families with an income at least twice the federal poverty level.⁷ Additionally, the burden of dental disease is mostly borne by children from lower income families and also by African American and Mexican adolescents.⁸

Barriers to Dental Services

The inability to pay for dental services is a significant barrier to receiving oral health care.⁹ Children who are enrolled in Medicaid also face several other barriers to receiving dental services, including limited English proficiency of parents, low reimbursement rates for providers, bureaucracy and lack of transportation.¹⁰ Other barriers to utilization of preventive dental services include low education level of parents, individual cultural and environmental factors, parental and peer influences, individual attitudes and beliefs about dental care and parents' inability to take time off from work for their child's dental appointments.⁶ An uneven distribution of practicing dentists and inconsistent and restrictive practice situations of registered dental hygienists are also major barriers to receiving dental services. Modifying practice restrictions and developing new practice models that allow registered dental hygienists to provide preventive services without direct supervision of a dentist begins to address improved distribution of dental manpower in previously underserved communities.

Trends in Dentistry

In 2007, it was reported that as the population is increasing, the number of dentists entering the workforce is decreasing.¹¹ Although the number of dentists continues to decline, the number of dental hygienists is increasing. The number of dental hygiene educational programs has increased with an additional 131 programs since 1990 and a 25% increase in first year enrollment from 1998 to 2008.¹² As of December 2009, there was a record 309 entry-level dental hygiene educational programs.¹² Expanding the use of dental hygienists and other mid-level oral health care providers could possibly and most likely offset part of the workforce shortage of dentists and address some of the dental dis-

parities in the U.S.

Based on the extensive classroom and clinic instruction, continuing education and licensing requirements that dental hygienists are required to complete, one could advocate that, similar to registered nurses, registered dental hygienists are able to be self-regulated and provide preventive dental services in alternative settings with varied levels of supervision or no supervision. Since dental hygienists' education prepares them with the requisite knowledge and skills to be preventive oral health care professionals, it could be argued that it is appropriate to utilize the increasing dental hygiene workforce to offset dental disparities in the U.S.

Model Effectiveness

Within the U.S. there are several successful models of less restrictive dental hygiene practices that increase access to dental services by increasing the points of entry into the oral health care system. Permitting dental hygienists to provide services with less restrictive supervision requirements is cost-effective and can increase access to care by reducing barriers. Compelling evidence suggests that services delivered by dental hygienists is cost-effective.^{14,15} APR in Arizona is designed to reduce many of the main barriers to oral health care that cause disparities: cost, transportation and uneven distribution of dental care providers. Making care accessible and affordable is necessary if improvements in the dental care system are to be made.

Catholic Healthcare West (CHW) East Valley Children's Dental Clinic, an affiliated practice dental clinic, has demonstrated being more cost-effective and able to offer services at lower costs compared to traditional dental care models. This is due to lower overhead costs, community partnerships and resource sharing. An affiliated practice dental hygienist's salary is less costly compared to that of a dentist's, and dental services are limited to prevention so a smaller staff is needed, fewer instruments and equipment are required and malpractice insurance fees are lower. Additionally, grant funding, Medicaid reimbursement and partnerships with non-profit and community organizations that contribute resources allow affiliated practice dental clinics to be cost effective.

From August 2008 to May 2009, the CHW East Valley Children's Dental Clinic collected data regarding cost efficacy. It was determined, with the clinic open 2 to 3 days per week and treating 60 patients per month, the clinic expenses were \$8,466 per month considering costs of equipment depreciation, disposable supplies, salaries and rent. Table

Table I: Potential Affiliated Practice Dental Clinic Partners

Type of Organization	Example
State or County Government	<ul style="list-style-type: none"> • Women, Infant, Children (W.I.C.) • Elementary Schools • Head Start • Correctional Facilities
Nonprofit Organizations	<ul style="list-style-type: none"> • Boys & Girls Club • Hospitals • Y.M.C.A. • Homeless Shelters • Child Crisis Centers • Orphanages
Profit Organizations	<ul style="list-style-type: none"> • Senior Residence Community • Assisted Living • Nursing Homes • Child Day Care Facilities
Private Practice Offices	<ul style="list-style-type: none"> • Dentists • Pediatricians • Family Physicians
Clinics	<ul style="list-style-type: none"> • Community Health Centers • Federally Qualified Health Center • Indian Health Services Clinics

I depicts several different potential partnering community organizations that could collaborate with an affiliated practice dental hygienist to offer preventive services in areas of the greatest need and maintain cost-effectiveness. Improving the cost-effectiveness of services offered to underserved communities, increasing access to care, containing fees and referring more patients to dentists for earlier restorative treatment are goals for less restrictive practice situations and position dental hygienists to contribute to the solutions that address oral health care needs in the U.S.^{14,15}

Methods and Materials

To answer the research questions for this study, a survey was created that measured the perceived utilization of affiliated practice dental clinics by underserved populations and the barriers and the level of importance of these barriers that impede underserved populations from receiving dental services. This survey was created by the authors and was not based on an existing survey instrument. There were no measures taken to ensure the survey was reliable. A pilot test was completed to ensure the survey was valid. The pilot test consisted of administering the survey to parents/guardians at the Maricopa County Head Start oral health-screening event before their children received oral screenings. Fifty-four surveys were completed: 17 were completed in English and 23 in Spanish. After the pilot test, the survey ques-

tions were reviewed and revised to be more concise and suitable for the population's literacy level.

The survey items were designed to assess the impact of fees on the utilization of affiliated practice dental clinics. Items 2, 3 and 4 of the survey assess whether a preventive dental service was available for children and how likely the parent/guardian would be to utilize this service if it cost \$0, \$20 or \$150. The fee level of \$0 was based on feedback from the population explaining that any charge for oral health care could not be afforded. The fee level of \$20 was based on the approximate supply cost for the affiliated practice dental clinic to treat a patient. The fee level of \$150 was based on the usual and customary fee for preventive services at local dental offices. The available responses to these survey items were presented in a 4-point Likert scale, where 1=not likely, 2=somewhat likely, 3=likely and 4=very likely. Items 2a, 3a and 4a of the survey asked how frequently (0 to 6 months, 7 to 12 months, 1 to 5 years or more than 5 years) the parent/guardian would have their child utilize preventive dental services at each cost level, \$0, \$20 and \$150. Survey items 5a, 5b and 5c assess the importance of barriers to receiving dental services, such as cost, distance and appointment time. These survey items were designed with available responses presented in a 10-point numerical Likert scale, where 10 represents being most important and 1 represents being the least important. Additional survey items were included in the survey to aid in the internal process evaluation of the affiliated practice dental clinic operations, which falls outside the scope of this study. Data from these survey items did not apply to this research and was not included in the results of this research.

Both the Northern Arizona University (NAU) and CHW Institutional Review Boards (IRB) approved this study. Additionally, both the NAU and CHW IRB did not require the participant's signature for entry into the study because subject identifiers were not collected. Instead, parents/guardians surveyed were given information about the research study in the form of an invitation to participate. The invitation to participate in the survey explained the voluntary nature of the subject's participation, purpose of the project, procedures, confidentiality, lack of compensation and cost, and benefits and risks of participating in the survey. Because this research project involved Spanish-speaking respondents, both institutions, NAU and CHW, required the invitation to participate and survey to be translated into Spanish. The NAU invitation to participate form was translated into Spanish by the NAU IRB. The CHW invitation to participate form was translated into Spanish by a certified translator at CyraCom Transparent Language Services.

Table II: Dollar Value of Services Provided at CHW East Valley Children's Dental Clinic

Service Provided	Dollar Value (\$)
Cancer Screening	25
Caries Risk Assessment	0
Oral Evaluation	82
Periodic Oral Evaluation	41
Oral Evaluation for Children 1 & 2 Years of Age	50
Radiographs:	
4 Bitewing	50
2 Occlusal	64
Full Mouth Series	107
Fluoride Varnish	20
Child Prophylaxis	54
Sealants	39/tooth
Therapeutic Rx Fluoride Toothpaste	10
Chlorhexidine	16
Oral Health Education	8
Nutritional Counseling	0
Referral	0
Goodie Bag with toothbrush, toothpaste and educational materials	5
Asepsis	15

Patients seen at the CHW East Valley Children's Dental Clinic are not charged a fee for the services they receive and Medicaid is not billed for reimbursement. However, the Medicaid fee schedule is used to determine the dollar value of the services provided from the clinic (Table II). From the clinic opening on August 1, 2008 to March 30, 2011, there have been 450 patient visits and \$276,442 worth of services provided at no charge. Depending upon patient age and treatment needs, the dollar value of services provided per child ranges from \$85 to \$496.

In the fall of 2008, the survey was administered to 34 parents/guardians of patients from birth to 18 years of age who received preventive dental services from CHW East Valley Children's Dental Clinic (Figure 1). The survey was offered to parents/guardians who attended the clinic during the month of November in 2008. Two parents/guardians declined to complete the survey due to literacy issues. The survey response rate was 94% as 34 out of 36 parents/guardians that were asked to complete the survey agreed to do so. This location and population were chosen for this study because it is representative of underserved populations in Arizona. The responses from the survey were en-

Table III: Descriptive Statistics of Barriers to Receiving Preventive Dental Care

Survey Item	Responses									
	Least Important					Most Important				
	1	2	3	4	5	6	7	8	9	10
Q5a. Cost of services	0	0	0	1	9	0	4	1	3	16
Percentages	0	0	0	2.9%	26.5%	0	11.8%	2.9%	8.8%	47.1%
Q5b. Convenience of appointment time	1	1	4	2	7	2	2	7	4	4
Percentages	2.9%	2.9%	11.8%	5.9%	20.6%	5.9%	5.9%	20.6%	11.8%	11.8%
Q5c. Distance traveled to receive services	2	0	4	3	5	2	4	5	3	6
Percentages	5.9%	0	11.8%	8.8%	14.7%	5.9%	11.8%	14.7%	8.8%	17.6%

tered into a Microsoft Office Excel 2003 spreadsheet. The data was then analyzed in SPSS 15.0 for Windows statistical software.

Results

Thirty-four surveys were completed: 21 completed in English and 13 completed in Spanish. Both of the research questions were answered through descriptive statistics and statistical analysis of the survey responses (Tables III, IV). With the use of descriptive statistics and non-parametric statistical tests, it was determined that the CHW East Valley Children’s Dental Clinic increased utilization of preventive dental services for underserved children from birth to 18 years of age. It was also determined that cost compared to distance or convenience of appointment time was the most important barrier impeding this underserved population from receiving preventive dental services. Further, the data showed there is a strong likelihood that affiliated practice dental clinics are more utilized due to the reduced cost of preventive dental services.

Regarding barriers to receiving preventive dental services, descriptive statistics of the responses show that approximately 47% of respondents ranked the cost of services as being most important. More than 11% ranked the convenience of appointment time as being the most important. Approximately 17% ranked the distance traveled to receive services as being the most important factor (Table III).

According to the Friedman Test results for survey items pertaining to the barriers of the cost of services, convenience of appointment time and distance traveled for services ($\chi^2(2) = 14.04, p < 0.05$), there were significant differences in the level of importance of the 3 barriers to care. Kendall’s coefficient of concordance ($W(2) = 0.206, p < 0.05$) also indicates relatively strong differences among the 3 barriers to care.

Figure 1: CHW East Valley Children’s Dental Clinic



Results from the Wilcoxon Test reveal that the cost of preventive dental services is more important to this population than both convenience of appointment time ($z = -3.087, p < 0.05$) and distance traveled ($z = -3.011, p < 0.05$). Additionally, this population reports there is no significant difference in importance between convenience of appointment time and distance traveled ($z = 0.000, p > 0.05$).

Table IV outlines the descriptive statistics, which revealed that approximately 91% of respondents said they were likely or very likely to utilize a free preventive dental service for their children. More than 76% said they were likely or very likely to utilize a preventive dental service for their children that cost \$20. Less than 9% said they were likely

Table IV: Descriptive Statistics of the Cost of Preventive Dental Services and Frequency of Utilization

Survey Item	Responses				
	0 to 6 Months	7 to 12 Months	1 to 5 Years	>5 years	Never (1st)
Q1. How long ago was your child's last dental cleaning?	0 to 6 Months	7 to 12 Months	1 to 5 Years	>5 years	Never (1st)
Number of Respondents	18	2	9	2	3
Percentages	52.9%	5.9%	26.5%	5.9%	8.8%
Q2. If a Free preventive dental service (dental cleaning, fluoride, sealants) was available for your children, how likely would you be to utilize this service?	Not Likely	Somewhat Likely	Likely	Very Likely	
Number of Respondents	0	3	8	23	
Percentages	0.0%	8.8%	23.5%	67.6%	
Q2a. How frequently would you bring your child back to receive preventive dental care from this service?	0 to 6 Months	7 to 12 Months	1 to 5 Years	>5 years	
Number of Respondents	28	5	1	0	
Percentages	82.4%	14.7%	2.9%	0.0%	
Q3. If the same preventive service (dental cleaning, fluoride, sealants) was available to your children for a fee of \$20, how likely would you be to utilize this service?	Not Likely	Somewhat Likely	Likely	Very Likely	
Number of Respondents	0	8	15	11	
Percentages	0.0%	23.5%	44.1%	32.3%	
Q3a. How frequently would you bring your child back to receive preventive dental care from this service?	0 to 6 Months	7 to 12 Months	1 to 5 Years	>5 years	
Number of Respondents	24	8	2	0	
Percentages	70.6%	23.5%	5.8%	0.0%	
Q4. If the same preventive service (dental cleaning, fluoride, sealants) was available to your children ONLY THROUGH A DENTIST, for a fee of \$150, how likely would you be to utilize this service?	Not Likely	Somewhat Likely	Likely	Very Likely	
Number of Respondents	13	18	2	1	
Percentages	38.2%	52.9%	5.8%	2.9%	
Q4a. How frequently would you bring your child back to receive preventive dental care from this service?	0 to 6 Months	7 to 12 Months	1 to 5 Years	>5 years	
Number of Respondents	11	9	12	2	
Percentages	32.3%	26.5%	35.3%	5.8%	

or very likely to utilize a preventive dental service for their children that was available only through a dentist and cost \$150. These preliminary data suggest that, as the cost of preventive dental services increases, this population is less likely to utilize preventive dental services.

Descriptive statistics additionally revealed that approximately 82% of the respondents would bring their child back to a free preventive dental service to receive regular preventive dental care every 0 to 6 months. More than 70% would bring their child back to a preventive dental service that cost \$20 to receive regular preventive dental care every 0 to 6 months. Less than 33% would bring their child back

to a preventive dental service that was available only through a dentist and cost \$150 to receive regular preventive dental care every 0 to 6 months.

As the cost increased from \$0 to \$20, the responses remained mostly unchanged and indicated respondents would bring their child back to a preventive dental service to receive regular preventive dental care every 0 to 6 months. However, when the cost increased to \$150, the respondents' replies changed to indicate they would not bring their child back as frequently. These data suggest that as the cost of preventive dental services increases, the frequency of utilization of these dental services decreases.

In order to determine if these answers were statistically significant, the Friedman Test and Kendall's W Test were initially performed, then followed up with a Wilcoxon Test to determine individual differences. The Friedman Test revealed significance (0.000) and the Kendall coefficient of concordance ($W(2) = 0.820, p < 0.05$) indicates fairly strong agreement among the replies of all 34 respondents regarding their likelihood of utilizing preventive dental services for \$0, \$20 and \$150. Follow-up pairwise comparisons conducted using a Wilcoxon Test revealed that, as the cost for preventive dental services increased from \$0 ($z = -3.690, p < 0.05$) to \$20 ($z = -4.815, p < 0.05$) and to \$150 ($z = -4.959, p < 0.05$), responses changed significantly from very likely, to likely and to somewhat likely that they would utilize the preventive dental service.

The Friedman Test was significant ($\chi^2(2) = 28.33, p < 0.05$), and the Kendall coefficient of concordance (0.417) indicates neutral agreement among the replies of all 34 respondents regarding their frequency of return visits to receive preventive services at \$0, \$20 and \$150. Follow-up pairwise comparisons conducted using a Wilcoxon Test showed that as the cost of preventive services increased from \$0 to \$150 ($z = -3.836, p < 0.05$), and \$20 to \$150 ($z = -3.678, p < 0.05$), responses changed significantly from returning for preventive dental services every 0 to 6 months when the cost is \$0 or \$20 to returning for preventive dental services every 7 to 12 months when the cost is \$150. However, as cost increased \$0 to \$20 ($z = -1.890, p > 0.05$), the responses did not change significantly. The reported frequency of return for preventive dental services remained at 0 to 6 months.

Discussion

The respondents of the survey report cost of preventive dental services has much more of an impact on their children receiving preventive dental services than both convenience of appointment time and distance traveled. This study shows that as the cost increases for preventive dental services, people of underserved populations report they are less likely to utilize these dental services. There was a significant difference in respondents' responses about the frequency of their visits based on cost. As cost continues to increase, people of underserved populations report they are also less likely to return frequently to receive follow-up or maintenance preventive dental services.

As the cost for preventive dental services increased from \$0 to \$20 to \$150, there was a significant difference in the responses to utilizing a preventive dental service. At the cost of \$0, the

respondents reported they are very likely to utilize preventive dental services. At the cost of \$20 the respondents reported they are likely to utilize dental services. At the cost of \$150 the respondents reported they are somewhat likely to utilize preventive dental services. As the cost increased from \$0 to \$20 there was no significant difference in response to frequency of return visits. Respondents indicated that whether the cost of receiving preventive dental services was \$0 or \$20 they would return in 0 to 6 months for continued care. However, as the cost increases from \$0 to \$150 and from \$20 to \$150, the responses changed significantly from returning for preventive dental services in 0 to 6 months to 7 to 12 months. Thus, it was found that the parents/guardians of this affiliated practice dental clinic reported they would increase utilization of preventive dental services for their children due to reduced costs of services.

Further research to evaluate the affect of affiliated practice dental clinics on the utilization of preventive dental services is needed. A deeper analysis and completion of a comparative study would be the next step. It is suggested that measuring the frequency at which patients return to an affiliated practice dental clinic to receive preventive dental services be compared to the frequency at which patients receive services from a traditional dental care model before coming to the affiliated practice dental clinic.

Future research should also evaluate other barriers to receiving preventive dental care, besides those of cost, transportation and appointment time. A few barriers to further research could include lack of providing underserved patients with dignity, respect, professionalism and cultural sensitivity. The tone, mood and attitude of personal interactions between dental professionals and underserved patients should be explored to determine if negative interaction might also be a major barrier to receiving preventive dental services.

Also recommended for future research is the number and types of preventive services that were provided prior to and after affiliated practice laws were passed. This research focus would address the National Dental Hygiene Research Agenda of identifying how public policies impact the delivery, utilization and access to care.¹⁶ Future research on how the legislative changes surrounding affiliated practice impact health care access and inequalities would address the National Dental Hygiene Research Agenda of investigating how alternative models can reduce health care inequalities.¹⁶

Upon review of the limitations of this study a

critique of the methods and statistical analysis can be offered. The method for this study was to collect data with the use of a survey that was created by the authors and there is no evidence to support that the survey questions were reliable. A reliability test would need to be completed in order to determine whether the results are consistent multiple times and across time. The same survey would need to be administered to the same sample on 2 different occasions. Additionally, the study's small sample size (n=34) provides a limitation to generalizing the results to a larger population.

Conclusion

This study indicated that affiliated practice dental clinics could increase utilization of preventive dental services by underserved children. The survey respondents reported increased utilization of preventive dental services for underserved children in Arizona primarily due to the reduced cost of receiving care at an affiliated practice dental clinic. This study also indicated that cost, when compared to convenience of appointment time and distance traveled for care, is the most important barrier to receiving preventive dental services for underserved children. As the cost of preventive dental services increases, the respondents reported being less likely to utilize the preventive dental services and less likely to return as frequently for follow-up or maintenance preventive dental services.

Improving the oral health status of the U.S. population is a significant challenge for policymakers, health officials, dental educators and oral health care providers. The legislative approval of less restrictive supervision requirements for dental hygienists, such as the APR, is key to reducing patient costs, eliminating barriers to care and alleviating uneven distribution of dental professionals, thereby increasing patient utilization of preventive dental services. Because providing preventive treatment is less costly than restorative treatment, community based oral health

prevention programs should be encouraged and supported.¹⁷ "Both the public and health care professionals, in looking for ways to solve the inefficiencies and inequalities in health care delivery, have begun to question the overly restrictive laws governing the dental hygiene profession."¹³ Lifting restrictive supervision requirements of dental hygiene practice nationally could expand the entry points for delivery of dental services, and increase referrals to dentists for services that fall outside the scope of a dental hygienist's practice. Now is the time to tackle the issues of access to oral health services and disease disparity. There is evidence supporting the need for a new delivery model and the effectiveness of APR. Policy makers and health care professionals are encouraged to support the national lifting of restrictive supervision requirements from dental hygiene practice in order to increase access to preventive dental services for underserved populations.

Michelle L. Gross-Panico, RDH, MA, DHSc, is the Associate Director of Dentistry in the Community at A.T. Still University Arizona School of Dentistry & Oral Health and an Affiliated Practice Dental Hygienist at Catholic Healthcare West; Wilbur K. Freeman III, B.S.E., M.B.A., is a medical student at A.T. Still University School of Osteopathic Medicine in Arizona.

Acknowledgments

We would like to express our sincerest gratitude to Janet Woldt, M.S., Ph.D., for her efforts in consulting on survey design and manuscript editing.

Disclosure

Michelle L. Gross-Panico is a contracted Affiliated Practice dental hygienist with Catholic Healthcare West, Chandler Regional Hospital. Since the summer of 2005, she has worked to create and develop the third Affiliated Practice dental clinic in Arizona, Catholic Healthcare West East Valley Children's Dental Clinic.

References

1. Vargas CM, Ronzio CR. Relationship between children's dental needs and dental care utilization, United States: 1988–1994. *Am J Pub Health*. 2002;92(11):1–7.
2. U.S. Department of Health and Human Services. Oral health in America: A report of the Surgeon General—executive summary. U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health. 2000.
3. Maternal and child health services title V block grant, State narrative for Arizona: application for 2008, annual report for 2006. Arizona Department of Health Services [Internet]. 2007 June 13 [cited 2011 March 28]. Available from: http://www.azdhs.gov/phs/owch/pdf/mch/az_narr_2007.pdf
4. 32–1289 Employment of a dental hygienist by a public agency, institution or school: definitions. Arizona State Legislature [Internet]. 2011 [cited 2011 March 28]. Available from: <http://www.azleg.gov/FormatDocument.asp?inDoc=/ars/32/01289.htm&Title=32&DocType=ARS>
5. Krause D, Mosca N, Livingston M. Maximizing the dental workforce: implications for a rural state. *J Dent Hyg*. 2003;77(4):253–261.
6. Hatcher JL, Scarpa J. Background for community-level work on physical health and safety in adolescence: Reviewing the literature on contributing factors. *Child Trends* [Internet]. 2001. Available from: http://www.childtrends.org/what_works/youth_development/doc/KHealth.pdf.
7. MacKay AP, Fingerhut LA, Duran CR. Adolescent health chartbook. Health, United States, 2000. National Center for Health Statistics [Internet]. 2000. Available from: [http://www.cdc.gov/nchs/data/00cht.pdf](http://www.cdc.gov/nchs/data/hus/00cht.pdf)
8. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988–1994. *J Am Dent Assoc*. 1998;129(9):1229–1238.
9. Access to care position paper, 2001. American Dental Hygienists' Association [Internet]. 2001 [cited 2011 March 20]. Available from: http://www.adha.org/profissues/access_to_care.htm
10. Payne JW. Dental-care challenge: Open wider—Local tragedy spotlights need for more affordable care and public education. *Washington Post* [Internet]. 2007 March 27 [cited 2011 March 20]. Available from: <http://www.washingtonpost.com/wp-dyn/content/article/2007/03/23/AR2007032301560.html>
11. McKinnon M, Luke G, Bresch J, Moss M, Valachovic RW. Emerging allied dental workforce model: considerations for academic dental institutions. *J Dent Educ*. 2007;71(11):1476–1491.
12. Valachovic R. Charting progress December 2009. American Dental Education Association [Internet]. 2009 [cited 2011 August 12]. Available from: http://www.adea.org/about_adea/Documents/Charting%20Progress/ADEAs_Charting_Progress_December_2009.htm
13. Ring T. Trends in dental hygiene supervision. *Access*. 2004;18:20–27.
14. Monajem S. Integration of oral health into primary health care: the role of dental hygienists and the WHO stewardship. *Int J Dent Hyg*. 2006;4(1):47–51.
15. Kushman JE, Perry DA, Freed JR. Practice characteristics of dental hygienists operating independently of dentist supervision. *J Dent Hyg*. 1996;70(5):194–205.
16. National Dental Hygiene Research Agenda. American Dental Hygienists' Association [Internet]. 2007 [cited 2011 August 17]. Available from: <http://www.adha.org/research/nra.htm>
17. Future of health care/universal coverage 2007–2008 task force: Universal healthcare reform. American Dental Association [Internet]. 2008 June [cited 2011 March 28]. Available from: <http://www.ada.org/1391.aspx>

Dental Hygienist Attitudes toward Providing Care for the Underserved Population

Lynn A. Marsh RDH, EdD

Introduction

The Surgeon General's Report on Oral Health identified barriers to care as restraining people from care that is needed, and the inability to access venues where care is delivered.¹ Geographic location or physical restrictions that patients endure can be resolved by dental hygienists who are willing to work to overcome these barriers. Numerous reports and studies have been published documenting the increased concern regarding the oral health status of low-income children and the aging population.¹

Millions of Americans are not receiving oral health care because of "persistent and systemic" barriers that disproportionately affect children, older adults and the underserved populations. More than half of the population does not visit a dentist each year. Children and older adults are considerably less likely to have access to oral health care than are their peers.

Americans living in rural areas have poorer oral health status and more unmet dental needs than their urban counterparts. Older adults, especially those living in long-term care facilities, have a high prevalence of oral health problems and difficulty accessing care by individuals trained in their special needs.²

According to Haley et al, 48% of low-income older adults have no dental coverage, 38% have no insurance coverage at all and 21% have insurance coverage that does not include dental care. Low-income older adults are more likely than higher-income older adults to have gone without routine dental care and are one and a half times as likely to have unmet dental needs. Low-income

older adults without dental coverage experience difficulty in accessing dental care.³

More states with volunteer programs that offer sovereign immunity are essential to helping the un-

Abstract

Purpose: The purpose of this study was to investigate registered dental hygienists' attitude toward community service, sensitivity to patient needs, job satisfaction and their frequency to volunteer care for the underserved population.

Methods: A 60 question survey instrument was developed and distributed to 306 participants. The survey instrument addressed the following variables: community service, sensitivity to patient needs, job satisfaction, social responsibility, spirituality and willingness to volunteer care. A total of 109 surveys were returned yielding a 33.9% response rate. SPSS version 19.0 was utilized for data analysis. Based on the factor analysis, the 6 original variables were reduced to 3 variables, which included attitude toward community service, job satisfaction and sensitivity to patient needs.

Results: For registered dental hygienists their level of education, membership in their professional association, attitude toward community service and sensitivity to patients were associated with their frequency of volunteering care for the underserved population. Additionally, a discriminant analysis indicated a strong prediction among registered dental hygienists attitude toward community service and job satisfaction to their frequency of volunteering care for the underserved population.

Conclusion: This research study of the factors that influence registered dental hygienists' frequency of volunteering care indicates how important oral health care preparatory norms and dispositions are to the underserved population. Understanding what persuades registered dental hygienists to volunteer care provides valuable information to registered dental hygienists, as well as dental hygiene programs regarding volunteering care for the underserved population and the importance of attitudes toward community service, sensitivity to patient needs and job satisfaction.

Keywords: Underserved population, access to care, community service, sensitivity to patient needs, job satisfaction

This study supports the NDHRA priority area, **Health Services Research:** Assess the impact of increasing access to dental hygiene services on the oral health outcomes of underserved populations.

derserved population within communities.⁴ Health care providers in sovereign immunity states might be more willing to volunteer knowing they would not be held liable for damages. Sovereign immunity would also be appealing to those health care providers that did not hold personal malpractice insurance. Sovereign immunity legislation would allow health care providers to volunteer services in dire need without the concern of malpractice liability. Although volunteer programs alone cannot solve the problem of access to care for the uninsured and underserved populations, they are viable and significant part of a comprehensive approach as future health reform unfolds.⁴

The lack of access to dental care directly affects children, and the majority of high-risk children will develop active carious lesions by the age of 3 or 4. This access to care has a considerable impact in terms of the lost opportunity for disease prevention. As a result of this lost opportunity, most decayed teeth go untreated regardless of the significant health consequences. As the 2000 Surgeon General's Oral Health Report indicated, some public, policymakers and providers considered oral health and the need for care to be less important than other health needs, pointing to the need to raise awareness and improve oral health literacy. When oral health was recognized as important to overall health, increased consideration was given to the importance of dental health and the problems caused by lack of dental care.¹ Table I lists definitions for variables used in this research study.

Methods and Materials

A 60 question survey instrument was developed for distribution to participants of this research study. Respectively, 10 questions addressed social responsibility, spirituality, community service, sensitivity to patient needs, job satisfaction and volunteerism. Completion and return of the survey indicated consent from the subject to participate in this research study. Both the electronic and mailing methods of the survey instrument remained anonymous and confidential throughout the study. The institute review board concerning the rights of human subjects approved this research study.

Participants responded to items previously defined and related to job satisfaction based on Williams,⁶ social responsibility based on Faulkner and McCurdy,¹¹ spirituality based on Harrington, Preziosi et al,¹² community service based on McClain et al,⁵ sensitivity to patient needs based on Darby et al^{8,9} and volunteerism based on Azad.⁷ The participants responded to statements on the survey instrument using a 5-point Likert (strongly agree

Table I: Table of definitions, for the purposes of this study

Community Service
The definition of community service/programs is defined as providing communities with highly accessible, affordable and responsive health promotion, education and disease prevention programs. ⁵
Sensitivity to Patient Needs
The definition of sensitivity to patient needs is a paradigm that provides a comprehensive and patient-centered approach to the dental hygiene care in which need fulfillment dominates human activity and behavior is organized in relation to unsatisfied needs. ^{8,9}
Job Satisfaction
The definition of job satisfaction is defined as the extent to which people like (satisfaction) or dislike (dissatisfaction) their jobs and is a general or global affective reaction that individuals hold about their job. ⁶
Social Responsibility
The definition of social responsibility is defined as the state of being fit to be trusted, worthy of confidence, and dependable for the improvement of the health of society and its members through spirituality, community service, job satisfaction and volunteerism. ¹¹
Spirituality
Spirituality is defined as "expression of inner life needs by seeking meaningful work that energizes and provides enthusiasm to pursue one's life's work alongside others." ¹²
Willingness to Volunteer Care
The definition of willingness to volunteer care is through their involvement, professionals demonstrate good citizenship, experience personal satisfaction and growth and advertise their abilities. ⁷
Underserved Population
The definition of underserved population is defined as children from the ages of 1 to 18 and adults 65 and older that do not have adequate financial resources to avail themselves of appropriate dental care. ¹⁰

– strongly disagree) scale and reported their own sense of social responsibility, spirituality, community service, sensitivity to patient needs, job satisfaction and their willingness to volunteer to care. The participants responded to statements based on their experience since becoming a dental hygienist. The data gathered from this research study was analyzed using the Statistical Package for the Social Sciences Program (SPSS).

A random sample of 306 participants of the sample size of 1,497 registered dental hygienists on Long Island, New York was used for this study. There were 306 survey instruments distributed to registered dental hygienists for completion electronically, as well as through the U.S. Post Office. Of the 306 surveys, 104 surveys were completed through the web based option of Survey Monkey,

and 5 surveys were returned through the U.S. Post Office. A total of 109 respondents submitted surveys, yielding a 33.9% response rate.

For the purpose of this study, all items on the survey instrument were subjected to the factor analysis in SPSS version 19.0 utilizing 109 surveys to acquire distinct variables. Based on the factor analysis, the 6 original variables were reduced to 3 variables, which included job satisfaction, attitude toward community service and sensitivity to patient needs. All results reported are based on the 3 variables, which was the outcome from a reduction of data process utilizing a Principle Component method and a Varimax with Kaiser Normalization rotation procedure. As a result of the factor analysis, items 29, 35, 42r and 46 on the survey instrument did not fit conceptually in the three newly rotated variables and were removed from the survey instrument as well as further statistical analysis.

After the factor analysis, the original factor of volunteering combined with community service to create a new factor, "attitude toward community service." This factor is comprised of both attitudes and actions regarding community service. Additionally, the factor "sensitivity to patient needs" was created on the theoretical framework of Darby et al.⁹ Several of the items from the proposed factor of spirituality combined with job satisfaction which remained the job satisfaction variable.

A Cronbach analysis of internal consistency was conducted for the reliability of each subscale by using participant responses. An independent t-test and ANOVA were used to analyze the part time and full time registered dental hygienists who hold and do not hold professional membership status and who have different levels of education and years of experience.

A correlation analysis was conducted to examine if a relationship existed between registered dental hygienists' level of education and years of experience, attitude toward community service, sensitivity to patient needs and job satisfaction, and their frequency of providing care for the underserved population.

A discriminant analysis was conducted to determine whether the dental hygienists' part time or full time employment status, professional membership status, level of education, years of experience, attitude toward community service, job satisfaction and sensitivity to patient needs discriminate their frequency of providing care for the underserved population.

Results

A one-way ANOVA between groups was performed to examine the differences between the participant responses regarding years of experience and job satisfaction. There was no significant difference ($F(4)=0.73$, $p=0.58$). No difference was indicated between the registered dental hygienists years of experience and job satisfaction (Table II).

A one-way ANOVA between groups was performed to examine the differences between the participant responses regarding years of experience and community service. There was no significant difference ($F(4)=1.27$, $p=0.29$). In addition, there was no significant difference between the registered dental hygienists' years of experience and community service (Table III).

A one-way ANOVA between groups was performed to examine the differences between the participant responses regarding years of experience and sensitivity to patient needs. There was no significant difference ($F(4)=0.61$, $p=0.66$). No difference was indicated between the registered dental hygienists years of experience and sensitivity to patient needs (Table IV).

A one-way ANOVA between groups was performed to examine the differences between the participant responses regarding level of education and job satisfaction. There was no significant difference ($F(2)=0.61$, $p=0.55$). No difference was indicated between the registered dental hygienists level of education and job satisfaction (Table V).¹³

A one-way ANOVA between groups was performed to examine the differences between the participant responses regarding level of education and their attitude toward community service. There was a significant difference ($F(2)=11.32$, $p=0.00$) between the registered dental hygienists level of education and their attitude toward community service (Table VI).¹³

There was a significant difference in the means between the registered dental hygienists level of education and attitude toward community service between the bachelor degree ($p=0.01$) and the master's degree plus doctoral degree ($p=0.00$) and the associate degree. The participants with a master's degree plus doctoral degree reported more positive attitudes toward community service than the associate degree and bachelor degree participants. In addition, the bachelor degree participants expressed more positive attitudes toward community service than the associate degree participants.¹³

A correlation statistical analysis procedure utiliz-

ing the Pearson Product Moment Correlation Test was conducted to examine the existence of a relationship among registered dental hygienists' level of education and years of experience, community service, sensitivity to patient needs, job satisfaction and their frequency of volunteering care. Using the Pearson Correlation approach, a p value of <0.05 was required for significance.¹³

There was a significant correlation regarding the registered dental hygienists' frequency of volunteering and all the variables: positive attitude toward community service ($r=0.59$, $p=0.00$), sensitivity to patient needs ($r=0.30$, $p=0.00$), level of education ($r=0.34$, $p=0.00$) and job satisfaction ($r=0.25$, $p=0.02$). Attitudes toward community service shared a variance of $r^2=34.81\%$, sensitivity to patient needs shared a variance of $r^2=9\%$, level of education shared a variance of $r^2=12\%$ and job satisfaction shared a variance of $r^2=6.25\%$. There was also a significant relationship between the registered dental hygienists level of education and attitude toward community service ($r=0.44$, $p=0.00$), with a shared variance of $r^2=19.36\%$. In addition, there was no significant relationship among the registered dental hygienists' years of experience and job satisfaction, attitude

Table II: Descriptive statistics: Years of experience and job satisfaction

	n	M	SD		
Less than 1 year	13	59.92	7.71		
1 to 5 years	19	58.42	10.37		
5 to 10 years	13	55.69	8.84		
10 to 20 years	21	57.00	9.57		
More than 20 years	27	60.22	9.47		
Total	93	58.45	9.33		
One-Way Between Groups Analysis of Variance (ANOVA): Job Satisfaction					
	Sum of Squares	df	Mean Square	F	p
Between Groups	256.04	4	64.01	0.73	0.58
Total	325,746	93			

Table III: Descriptive statistics and ANOVA: Years of experience and attitude toward community service

	n	M	SD		
Less than 1 year	14	63.71	7.00		
1 to 5 years	18	56.39	12.12		
5 to 10 years	12	54.50	15.44		
10 to 20 years	19	59.95	9.02		
More than 20 years	26	60.23	13.92		
Total	89	59.17	12.06		
One-Way Between Groups Analysis of Variance (ANOVA): Community Service					
	Sum of Squares	df	Mean Square	F	p
Between Groups	730.77	4	182.69	1.27	0.29
Total	324,374	89			

Table IV: Descriptive statistics and ANOVA: Years of experience and sensitivity to patient needs

	n	M	SD		
Less than 1 year	14	66.93	5.14		
1 to 5 years	19	64.05	8.74		
5 to 10 years	12	66.33	6.88		
10 to 20 years	22	65.95	6.80		
More than 20 years	26	67.19	6.88		
Total	93	66.11	7.01		
One-Way Between Groups Analysis of Variance (ANOVA): Sensitivity to Patient Needs					
	Sum of Squares	df	Mean Square	F	p
Between Groups	121.39	4	30.35	.61	.66
Total	410,944	93			

toward community service and sensitivity to patient needs. A strong relationship was evident among sensitivity to patient needs and community service ($r=0.50$, $p=0.00$) and shared 25% of the variance. Also, a relationship was evident among job satisfaction and community service ($r=0.37$, $p=0.00$) and shared 13.7% of the variance. Lastly, there was no significant relationship among the registered dental hygienists level of education and job satisfaction and sensitivity to patient needs. However, a significant difference is evident regarding the registered dental hygienists' level of education and attitude toward community service.¹³

A discriminant analysis was performed to determine whether the registered dental hygienist's part-time or full-time status, membership status, level of education and years of experience, community service, sensitivity to patient needs and job satisfaction could classify within the 3 levels of frequency of volunteering: never, twice a year and once a year.

The overall Wilk's Lambda was significant ($\Lambda=0.61$, $\chi^2(12, N=73)=33.53$, $p<0.01$), indicating that the overall predictors were distinguished among the groups. Additionally, the residual Wilk's Lambda was not significant ($\Lambda=0.99$, $\chi^2=(5, N=73)=0.78$, $p<0.01$). The discriminant analysis test indicated that the predictors of attitude toward community service and job satisfaction distinguish significantly among the registered dental hygienists who volunteered twice a year, and those who never volunteered or who volunteered once a year. Both discriminant functions were analyzed and reported as a result of their significance (Table VII).¹³

Table V: Descriptive statistics and ANOVA: Level of education and job satisfaction

	n	M	SD		
Associate Degree	57	57.82	8.82		
Bachelor Degree	18	58.28	9.80		
Master Degree or Doctoral Degree	18	60.61	10.59		
Total	93	58.45	9.33		
One-Way Between Groups Analysis of Variance (ANOVA): Job Satisfaction					
	Sum of Squares	df	Mean Square	F	p
Between Groups	106.90	2	53.45	0.61	0.55
Total	325,746	93			

Table VI: Descriptive statistics and ANOVA: Level of education and attitude toward community service

	n	M	SD		
Associate Degree	52	55.60	11.19		
Bachelor Degree	18	58.67	10.45		
Master Degree or Doctoral Degree	19	69.42	10.24		
Total	89	59.17	12.06		
One-Way Between Groups Analysis of Variance (ANOVA): Attitude toward Community Service					
	Sum of Squares	df	Mean Square	F	p
Between Groups	2665.32	2	1332.66	11.32	.00
Total	324,374	89			

Table VII: Wilk's Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	p
1 through 2	0.61	33.53	12.00	0.00
2	0.99	0.78	5.00	0.98

The first discriminant function indicates that attitude toward community service has a relatively large positive coefficient as level of education has a weaker coefficient, and a negative relationship exists among sensitivity to patient needs, membership status and full-time/part-time employment status. The second discriminant function indicates that the largest positive coefficient is job satisfaction, while a negative relationship is evident for community service, sensitivity to patient needs and membership status. On the strength of these standardized functions and structure coefficients, the first and second discriminant functions are identified as 1=Attitude toward Community Service and 2=Job Satisfaction. Attitude toward community service and level of education accounts for 38.44% of the variance in frequency to volunteer, while job satisfaction, sen-

sitivity to patient needs and membership accounts for 1.21% of the variance in frequency to volunteer care. The values labeled group centroids are the mean values on the discriminant functions for the registered dental hygienist frequency to volunteer care (Tables VIII, IX).¹³

Table VIII: Standardized canonical discriminant function coefficients

	1	2
Job Satisfaction	0.07	0.98
Attitude toward Community Service	0.88	-0.06
Sensitivity to Patient Needs	-0.01	-0.56
Membership	-0.14	-0.41
Full-time/Part-time	-0.03	0.18
Level of Education	0.33	0.08

The means of discriminant function are consistent with the analysis of the functions of group centroids. Dental hygienists that volunteer most frequently had the highest discriminant function mean (M=0.99) regarding attitude toward community service (discriminant function 1). Dental hygienists that volunteer once a year had a lower discriminant function mean score (M=0.32), while dental hygienists that never volunteer had a negative discriminant function mean score (M=-0.90). Additionally, dental hygienists that volunteer most frequently had the highest discriminant function mean (M=0.13) regarding job satisfaction (discriminant factor 2). Dental hygienists that never volunteer had a lower discriminant function mean score (M=0.04) while dental hygienists that volunteer once a year had a negative discriminant function mean score (M=-0.14).¹³

Discussion

The findings suggest that registered dental hygienists, who are members of the American Dental Hygienists' Association, are more active participants in community service activities than registered dental hygienists that are not members. In addition, registered dental hygienists who held a bachelors, master's or doctoral degree had more positive attitudes toward community service activities, a greater sense of sensitivity to patient needs and were more likely to volunteer care for the underserved population than those who held an associate degree.

The research results suggest that registered dental hygienists' attitude toward community service, sensitivity to patient needs and job satisfaction relate to the frequency in which dental hygienists volunteer care for the underserved population. A positive attitude toward community service has a significant relationship to frequency of volunteering to serve underserved populations. The recognition of the significant findings related to the frequency of volunteering and community service are consistent with findings as reported by McBride et al, that citizenship came with responsibilities that included being involved in one's community and taking care of the underserved

Table IX: Functions at Group Centroids

Frequency of Volunteering	Function	
	1	2
Never	-0.90	0.04
Once a year	0.32	-0.14
Twice a year	0.99	0.13
Unstandardized canonical discriminant functions evaluated at group means		

population.¹⁴ Volunteerism aids in developing open-mindedness and understanding of the underserved populations. It is imperative to understand the potential challenges regarding the underserved population and successful volunteerism by registered dental hygienists. An increasing number of health professionals argue that volunteerism, encouragement and guidance represent core professional responsibilities with essential implications for responsibly serving underserved populations.¹⁵

The discriminant analysis predicted that registered dental hygienists' attitudes toward community service activities have an impact on the frequency of their volunteering care for the underserved population. While 11% of the variance was accounted for in job satisfaction, the discriminant analysis clearly demonstrated that registered dental hygienists who hold positive attitudes toward community service programs and activities will more frequently volunteer care for the underserved population. The assumption can be made that the better disposed a dental hygienist is toward community service, the more frequently one will volunteer care for the underserved population.¹³ These findings relate to service and frequency to volunteer care were consistent with findings in the literature. Although volunteer programs alone cannot solve the problem of access to care for the uninsured and underserved populations, they are a viable and significant part of a comprehensive approach as future health reform unfolds.⁴

The results of this study are limited to registered dental hygienists on Long Island, New York. All par-

ticipants in this study graduated from an accredited dental hygiene school and held a license to practice dental hygiene in New York State. Dental hygienists practicing on Long Island participated in this study and results may generalize to dental hygienists' in similar regions of the U.S. composed of small towns and hamlets in a suburban setting.

The following recommendations are made: Incorporate more volunteering and community service activities within the dental hygiene curriculum, and facilitate agreements with other health care disciplines to foster a volunteer and community service program within the curricula.¹³

Registered dental hygienists who held positive attitudes toward community service represented 33% of participants on the dimension of attitude toward community service. Furthermore, participants that provided community outreach to the uninsured or underinsured also held positive dispositions toward community service and represented 31% of the respondents. Lastly, respondents who participated in outreach oral hygiene projects for various communities indicated they held positive dispositions toward community service, and represent 15.9% of the participants on the dimension of attitude toward community service.¹³

The results of this research study illustrate the attitudes of registered dental hygienists regarding frequency of volunteering care for the underserved population. Of the 306 surveys, there were 109 participants. This research study is limited to the research population and is too small to generalize to all registered dental hygienists. Therefore, the following recommendations are made to support future research based on the findings and conclusions of this study:

1. Replicate this study by distribution of a survey instrument to a wider respondent and more diverse population
2. Conduct studies regarding volunteerism among dental hygienists and volunteerism to serve the uninsured, elderly and underserved population
3. Design the study in order to reach an equal population of members and non-members of the American Dental Hygienists' Association
4. Conduct an ethnographic study to better understand the motive of registered dental hygienists for volunteering care for the underserved population

Conclusion

This investigation of the factors that influence registered dental hygienists' frequency of volunteering care indicates how important oral health care preparatory norms and dispositions are to oral care for underserved populations. Understanding what motivates registered dental hygienists to volunteer care provides valuable information to the profession as well as dental hygiene program leaders related to the importance of fostering attitudes toward community service, sensitivity to patient needs and job satisfaction variables. It is evident that the attitudes of registered dental hygienists toward community service are not universal. Community service and volunteer directives could influence the awareness of dental hygienists as well as dental hygiene students. Consequently, the findings of this research study could increase understanding regarding preventive oral health care for the underserved population through the incorporation of community service and volunteering programs.

Lynn Marsh RDH, EdD, is a full-time professor at Farmingdale State College Department of Dental Hygiene.

References

1. U.S. Department of Health and Human Services. Oral Health in America: A report of the Surgeon General. U.S. Department of Health and Human Services, National Institute of Dental and Cranial Research, National Institute of Health. 2000.
2. Improving Access to Oral Health Care for Vulnerable and Underserved Populations. Institute of Medicine of the National Academies [Internet]. 2011. Available from: <http://www.iom.edu/Reports/2011/Improving-Access-to-Oral-Health-Care-for-Vulnerable-and-Underserved-Populations.aspx>
3. Haley J, Kenney G, Pelletier J. Access to Affordable Dental Care: Gaps for Low-Income Adults. The Kaiser Family Foundation [Internet]. 2008 July [cited 2009 March 15]. Available from: <http://www.kff.org/medicaid/upload/7798.pdf>
4. Geletko KW, Beitsch LM, Lundberg M, Brooks RG. Reducing the impact of the health care access crisis through volunteerism: A means, not an end. *Am J Public Health*. 2009;99(7):1166-1170.
5. McClain WJ, Stratton BF. Planning and partnering for healthier communities. *J Health Care Mark*. 1994;14(4):10-12.
6. Williams J. Job satisfaction and organizational commitment. The Sloan Work and Family Research Network [Internet]. 2004 [cited 2010 January 4]. Available from: <http://workfamily.sas.upenn.edu/wfrn-repo/object/se8k0qt7xp835q0x>
7. Azad A. Public service. *Internal Auditor*. 1994;51(3):56-60.
8. Darby ML, Walsh MM. Application of sensitivity to patient needs conceptual model to dental hygiene practice. *J Dent Hyg*. 2000;74(3):230-237.
9. Darby ML, Walsh MM. Dental Hygiene Theory and Practice. St. Louis: Saunders Elsevier; 2010.
10. Guay AH. Access to dental care: Solving the problem for the underserved populations. *J Am Dent Assoc*. 2004;135(11):1599-1605.
11. Faulkner LR, McCurdy RL. Teaching medical students social responsibility: The right thing to do. *Acad Med*. 2000;75(4):346-350.
12. Harrington WJ, Preziosi RC, Gooden DJ. Perceptions of workplace spirituality among professionals and executives. *Employee Respons Rights J*. 2001;13(3):155-163.
13. Marsh LA. Dental hygienist attitudes toward willingness to volunteer care for the underserved population. Udini [Internet]. 2011. Available from: <http://udini.proquest.com/view/dental-hygienist-attitudes-toward-pqid:2325102931/>
14. McBride A, Sherraden M, Pritzker S. Civic engagement among low-income and low-wealth families: In their words. *Fam Relations*. 2006;55(2):152-163.
15. Mohan CP, Mohan A. A student approach to building skills needed to serve poor communities. *J Health Care Poor Underserved*. 2007;18(3):523-531.

Effects of Dental Magnification Lenses on Indirect Vision: A Pilot Study

Sarah B. Hoerler, RDH, MS; Bonnie G. Branson, RDH, PhD; Anne M. High, RDH, MS; Tanya Villalpando Mitchell, RDH, MS

Introduction

Dental hygienists are required to perform very fine precise movements within the small parameters of the oral cavity. The use of direct vision throughout the entire oral cavity combined with a balanced posture is not always feasible. Published studies have found a relationship between the use of indirect vision and a balanced clinical posture.¹⁻⁴ The head position is considered balanced when it is tilted no more than 20 degrees forward.⁵ Ninety percent of the time, a typical clinician's head is tilted forward to angles ranging from 17 degrees to 39 degrees and at angles greater than 40 degrees during 10% of the time.⁴ These extreme positions are not reflective of a balanced, comfortable clinical posture. A clinician is at risk for musculoskeletal trauma when a posture remains outside the balanced parameters for long periods of time.

Clarity of vision plays an important role in the ease at which a clinician can maintain a balanced posture. Posture, clarity of vision and musculoskeletal discomfort are all related in a viscous cycle. The discomfort of musculoskeletal disorders may impact the efficiency and accuracy of the clinician. Likewise, diminished clarity of vision can impact musculoskeletal discomfort. Research demonstrates a correlation between visual acuity and maintaining a balanced posture.¹⁻⁴ A survey of 868 practicing dental hygienists revealed 91.5% of the dental hygienists agree an advantage of using magnification lenses is better posture.³ Magnification lenses, which produce a clear, larger image, combined with indirect vision, allows the clinician to maintain this balanced clinical posture.

Abstract

Purpose: The purpose of this pilot study was to evaluate the effect of magnification lenses on the indirect vision skills of dental hygiene students.

Methods: This pilot study examined the accuracy and efficiency of dental hygiene students' indirect vision skills while using traditional safety lenses and magnification lenses. The sample was comprised of 14 students in their final semester of a dental hygiene program. A crossover study approach was utilized, with each participant randomly assigned to a specific order of eyewear. The study included evaluation of each participant taking part in 2 separate clinical sessions. During the first session, each participant completed a clinical exercise on a dental manikin marked with 15 dots throughout the oral cavity while wearing the randomly assigned eyewear, and then completed a similar exercise on a differently marked dental manikin while wearing the randomly assigned eyewear. This procedure was repeated at a second clinical session, however, the dental manikin and eyewear pairings were reversed. Accuracy was measured on the number of correctly identified dots and efficiency was measured by the time it took to identify the dots. Perceptions of the participants' use of magnification lenses and the participants' opinion of the use of magnification lenses in a dental hygiene curriculum were evaluated using a questionnaire.

Results: Comparing the mean of the efficiency scores, students are more efficient at identifying indirect vision points with the use of magnification lenses (3 minutes, 36 seconds) than with traditional safety lenses (3 minutes, 56 seconds). Comparing the measurement of accuracy, students are more accurate at identifying indirect vision points with traditional safety lenses (84%) as compared to magnification lenses (79%). Overall, the students reported an increased quality of dental hygiene treatment provided in the clinical setting and an improved clinical posture while treating patients with the use of magnification lenses.

Conclusion: This study did not produce statistically significant data to support the use of magnification lenses to enhance indirect vision skills among dental hygiene students, however, students perceived that their indirect vision skills were enhanced by the use of magnification lenses.

Keywords: Magnification lenses, indirect vision, dental hygiene students, clinician posture

This study supports the NDHRA priority area, **Occupational Health and Safety:** Investigate methods to decrease errors, risks and or hazards in health care and their harmful impact on patients.

Properly utilizing indirect vision and maintaining a balanced clinical posture while viewing the oral cavity minimizes a clinician's musculoskeletal discomfort. Dental professionals who regularly utilize their dental mouth mirror to view areas of the mouth indirectly have shown to have fewer headaches and reduced neck/shoulder discomfort.⁶ Although most studies of training and utilizing indirect vision with the use of a dental mouth mirror were conducted in the 1980s, the skills and techniques remain common practice.^{6,7} Boyd et al observed that, "When students are taught psychomotor skills in the mandibular arch and transfer to the maxillary arch, there is a continued desire to depend upon direct vision, which results in early acquisition of poor postural habits."⁸ Results from a student questionnaire following the study indicate the students who began with direct vision skill exercises on the mandibular arch perceived they were not progressing as fast, now working on the maxillary arch due to loss of visualization. In contrast, the students who began with indirect vision skill exercises on the maxillary arch felt they were progressing faster, visualizing better, maintaining correct posture and producing better dentistry.⁸ This study found no statistical significance between the performance of students who began with indirect vision skill exercises compared to direct vision skill exercises. Skills learned from indirect vision build confidence in the clinicians as well as promote a balanced clinical posture.

Dental hygienists are required to perform the meticulous tasks of scaling and root planing, assessing the periodontal health with the aid of a millimeter marked periodontal probe and a screening of the oral cavity for oral cancer. Magnification lenses allow the clinician to see greater detail than that of traditional safety lenses. Literature suggests the use of magnification lenses will improve the precision in instrumentation and facilitate optimal visualization of the oral cavity, however, minimal clinical studies have been conducted in dental hygiene.^{6,9} To better understand the effect magnification has on human movement and control in operating a tool via indirect vision, medical researchers performed clinical experiments with 10 study participants. Each participant manipulated a computer mouse to direct a pointer from Target A to Target B, viewed indirectly on a magnified display. It was found that greater magnification resulted in more precision in movement.⁹ Bohan et al summarizes, "The role of magnification can thus be understood as amplifying the particular skill level afforded by the effecting limb."⁹

While several authors suggest magnification lenses improve posture, the empirical evidence is very limited. Two comparable dental hygiene clinical studies were conducted assessing dental hygiene student posture while performing 2 different clinical procedures – an

intra-oral full mouth probing and hand scaling. Both of these procedures required detailed manipulation of dental instruments within the oral cavity and utilized the Branson's Posture Assessment Instrument (BPAI) to examine the students' posture.^{1,2,10} Branson et al assessed the effect of magnification lenses on dental hygiene students' posture while performing an intra-oral procedure of full mouth probing with and without the use of magnification lenses.¹¹ Results showed the posture of the students was more balanced while wearing magnification lenses as compared to wearing traditional safety lenses.¹ It was also noted that all of the participants felt their posture improved while utilizing magnification lenses, and 90% felt magnification lenses would improve their effectiveness in private practice after graduation.¹

Maillet et al reported significant improvement in posture while using magnification lenses in the task of hand scaling.² Results were more pronounced in students who used magnification lenses when entering the dental hygiene program as compared to the students who delayed starting the use of magnification lenses. This study sought to incorporate magnification lenses into the dental hygiene curriculum as early as possible.

Branson et al conducted a clinical case study documenting the experience of a dental hygiene student during a 4 week adjustment period to magnification lenses.⁴ The BPAI was also utilized in this study for postural measurements.^{4,10} Overall, the case study indicated the use of magnification lenses created postural improvement according to the BPAI and the dental hygiene student perceived postural improvements in 12 out of 15 reflective journal entries. In many of the journal entries, clarity of the oral cavity and better overall perception of quality of work were documented. This case study supports the idea that the use of magnification lenses can create a more balanced posture and provide greater clarity of the oral cavity. The above studies all involved dental hygiene students and all resulted in a perceived or documented measurement of improved posture.

Clinical studies have been conducted exploring the relationship of magnification lenses to posture while performing clinical procedures.¹⁻³ The reported study operates on the premise that increased skill with indirect vision will result in an improved clinical posture. The purpose of this pilot study was to evaluate the effect of magnification lenses on the indirect vision skills of dental hygiene students. This impact will be measured against 4 parameters: the accuracy of the student clinicians, the efficiency of the student clinicians, the perceptions of the student clinicians and the recommendations of the student clinicians.

Methods and Materials

Participants

A convenience sample of 14 dental hygiene students from the 2011 dental hygiene program at Rochester Community and Technical College were invited to participate in the study. These participants had 3 prior semesters of dental hygiene education and were in the final semester of the curriculum. Participation was optional and written informed consent was obtained from each participant.

Data Collection

Prior to data collection, the study was approved by the University of Missouri–Kansas City Social Sciences Institutional Review Board. All dental hygiene student participants were fitted by a representative from Designs for Vision (Ronkonkoma, NY) for through-the-lens magnification lenses. None of the participants had prior experience with magnification lenses and were allowed a 1 month adjustment period prior to beginning the study. The company was chosen out of convenience in that the representative was available to measure and fit all students in the time frame necessary to complete the study and was willing to allow the students to utilize the magnification lenses at no cost throughout the duration of the study. At the completion of the study, the students had to either return the magnification lenses or had the option to purchase them at a discounted price.

Each participant was evaluated by 2 investigators while completing indirect vision exercises during 2 separate clinical sessions. The clinical sessions were conducted with the clinician wearing the same personal protective barriers that would be used during patient treatment. These included: gloves, mask, gown and either magnification lenses or traditional safety lenses. The clinical exercises were conducted with the manikin fitted into a dental chair, serving as a reasonable representation of human positioning (Figure 1). The manikin was marked with 15 red dots made with permanent marker and randomly placed throughout the oral cavity (Figure 2). The majority of the dots (10) were on tooth structures. However, 4 dots were placed on gingival tissue. Red dots were differently positioned on Manikin A as compared to Manikin B.

The study utilized a crossover design in which each participant served as their own control. All participants utilized both magnification lenses and traditional safety lenses on both Manikin A and Manikin B. The order of utilizing magnification lenses versus traditional safety lenses was determined by the flip of a coin. Therefore, some participants utilized magnification lenses first on Manikin A during the first clinical session, followed by traditional safety lenses 1 month later on Mani-

Figure 1: Photo of dental manikin used for clinical exercises



Figure 2: Photo showing a representation of the red dots placed indirectly throughout the oral cavity



kin A. Others utilized traditional safety lenses first on Manikin A during the first clinical session, followed by magnification lenses 1 month later on Manikin A. The same method of randomization was utilized to determine the eyewear pairings for Manikin B.

Prior to each clinical exercise, verbal directions were given to each participant by the same examiner. The participants were given a maximum of 5 minutes to complete each exercise. If the participant had located all 15 intra-oral dots prior to the 5 minute time frame, the participant was instructed to stop. If the participant felt they had located as many of the 15 intra-oral dots as possible, they stated they were done. Participants could only verbalize tooth numbers or intra-oral locations during the clinical exercises.

Performance was measured for accuracy as based on the number of correctly identified red dots within the oral cavity and efficiency was measured by the time it took to identify the intra-oral dots. Perceptions of the participants' regarding the use of magnification lenses and recommendations of the introduction of magnification lenses into the dental hygiene curriculum were measured using a questionnaire distributed by an online survey engine, www.zoomerang.com. The survey instrument was developed by the investigators, mimicking the perception based surveys administered by Branson et al¹ and Maillet et al.² It was pilot tested via paper to a group of dental hygiene students at the University of Missouri-Kansas City at a similar level of education as the study participants. Based on the feedback from the students, the survey was revised to capture the desired information. The revised survey was then converted into an internet survey form.

Analysis

To determine if participants were more efficient at locating indirect vision points in the oral cavity with magnification lenses, a 2-tailed paired t-test with an alpha level of 0.05 was utilized. This test analyzed the difference in means between the times it took to identify the indirect vision points with magnification lenses versus the times it took to identify the indirect vision points with traditional safety lenses.

The Wilcoxon Rank Signed Test was applied to determine if the participants were more accurate at locating indirect vision points in the oral cavity with magnification lenses. This test merged the number

Table I: Summary of dental hygiene students' perceptions of dental magnification lenses (n=14)

Impact on Clinical Skills	
Increased quality of treatment provided	<ul style="list-style-type: none"> • Yes – 79% • No – 14% • Undecided – 7%
Enhanced indirect vision skills	<ul style="list-style-type: none"> • Yes – 72% • No – 21% • Undecided – 7%
Increased efficiency	<ul style="list-style-type: none"> • Yes – 42% • No – 29% • Undecided – 29%
Increased accuracy	<ul style="list-style-type: none"> • Yes – 42% • No – 29% • Undecided – 29%
Impact on Clinical Posture	
Improved posture	<ul style="list-style-type: none"> • Yes – 86% • No – 14%
Comfort and Adjustment	
Time for adjustment	<ul style="list-style-type: none"> • 1 day or less – 14% • 2-4 clinic days – 50% • 5 or more clinic days – 36%
Symptoms	<ul style="list-style-type: none"> • Vertigo – 14% • Headaches – 50% • None – 36%
Weight of the lenses	<ul style="list-style-type: none"> • Heavy – 0% • Moderate – 14% • Light – 86%
Recommendations	
Magnification lenses should be a requirement for dental hygiene students?	<ul style="list-style-type: none"> • Yes – 21% • No – 79%
When would you recommend novice clinicians begin using magnification lenses?	<ul style="list-style-type: none"> • 1st yr dental hygiene – 29% • 2nd yr dental hygiene – 71% • Start of private practice – 0% • After a few year of private practice – 0% • Not at all – 0%

of correctly identified dots displayed with the use of magnification lenses and traditional safety lenses and ranked them from highest to lowest. The test determined if accuracy is the same between the eye wear pairings or different.

A follow up survey was conducted of the participants' perception of their experience with magnification lenses when viewing objects indirectly within the oral cavity. Furthermore, the survey sought to identify the students' recommendations regarding the use of magnification lenses as part of the dental hygiene curriculum. Results of this survey are reported as descriptive findings using percentages (Table I).

Results

Mean and standard deviation scores, with and without the use of magnification lenses, are shown in Table II and III. Study findings indicate a difference in efficiency with the use of magnification lenses as compared to traditional safety lenses. When comparing the combined data from Manikin A and Manikin B (n=28), 54% of participants were more efficient with magnification lenses, and 25% were more efficient with traditional safety lenses. There was no difference in time between the use of magnification lenses and traditional safety lenses 21% of the time. The average time to complete the clinical exercise with magnification lenses was 3 minutes and 36 seconds, which increased to 3 minutes and 56 seconds with traditional safety lenses. A 2-tailed t-test resulted in a p value of 0.07. This difference was not of statistical significance at the established level of $p \leq 0.05$ (Figure 4).

Study findings also indicate a difference in accuracy with the use of magnification lenses as compared to traditional safety lenses. When comparing the combined data from Manikin A and Manikin B (n=28), 57% of participants were more accurate with traditional safety lenses, and 25% were more accurate with magnification lenses. There was no difference in accuracy 18% of the time. Accuracy scores were an average of 79% with the use of magnification lenses and 84% with the use of traditional safety lenses. This difference was not of statistical significance when analyzing accuracy with a Wilcoxon Signed Rank Test ($p \leq 0.05$) (Figure 5).

Figure 3 displays the complete online survey used to identify how the participants perceive their experience with magnification lenses. All 14 participants completed the questionnaire for a 100% response rate. Examining the demographics of the survey responses indicated all of the participants were female, with an age range from 21 to 31 years. Twelve respondents were Caucasian, 1 respondent was African American and 1 respondent was Somali. Table I displays summative data on the dental hygiene students' perceptions of magnification lenses. Overall, students reported an improved clinical posture, increased quality of dental hygiene treatment provision and enhanced indirect vision skills. All participants recommended use of magnification lenses within the dental hygiene curriculum, with 71% recommending that magnification lenses be used during the second year of the dental hygiene curriculum, and 29% recommending that they be used during the first year of dental hygiene curriculum. The majority (79%) do not feel magnifi-

Table II: Summary statistics for efficiency (time) of indirect vision exercises – includes combined data from Manikin A and Manikin B

Variable	Observations	Mean (seconds)	Standard Deviation
Magnification Lenses	28	216.53	56.85
Traditional Safety Lenses	28	236.25	54.63

Table III: Summary statistics for accuracy (percent correct) of indirect vision exercises – includes combined data from Clinical Session I and II

Variable	Observations	Mean	Standard Deviation
Magnification Lenses	28	79%	0.15
Traditional Safety Lenses	28	84%	0.14

cation lenses should be a requirement for dental hygiene students.

Half of the students felt it only took 2 to 4 clinic days to adjust to the use of magnification lenses. During this time period, half of the students experienced headaches and 14% of the students experienced vertigo. In contrast, 36% did not experience any vertigo, headaches, eye soreness or any other symptoms. When asked about the weight of the magnification lenses, the majority of the students (86%) felt the lenses were light weight, whereas the remaining 14% felt they were moderate weight.

Discussion

This study was conducted to determine if magnification lenses lead to any improvement in indirect vision skills. While the results of the accuracy and efficiency data analysis indicated no statistical significance, the majority of the dental hygiene students (72%) perceived magnification lenses enhanced their indirect vision skills. This finding supports the literature of perceived improvements with the use of magnification lenses.¹⁻³

The adjustment period to the magnification lenses may have had an influence on the outcomes of this study. Each student was given 1 month to adjust to the lenses, with each student setting their own time frame for this adjustment. Some students invested more time into this process than others. It could be that the students intending to purchase

Figure 4: Line graph displaying efficiency in locating the red dots (time in seconds), n=28 observations

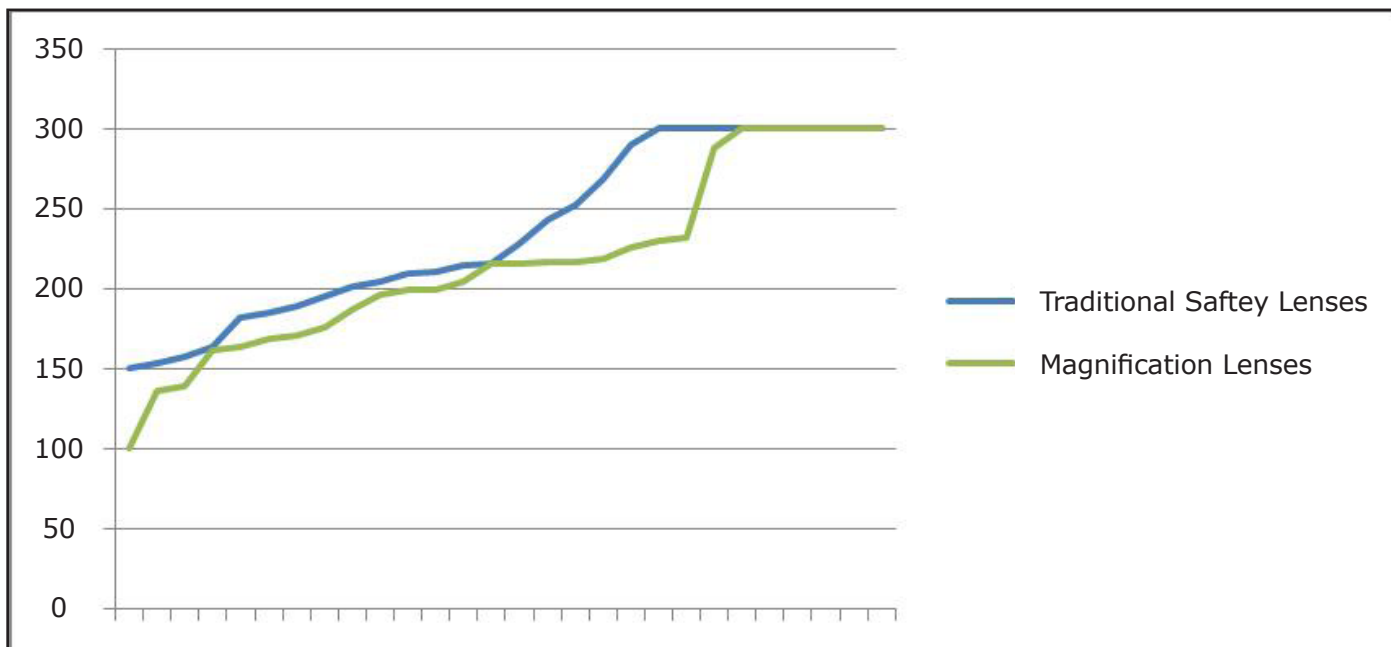
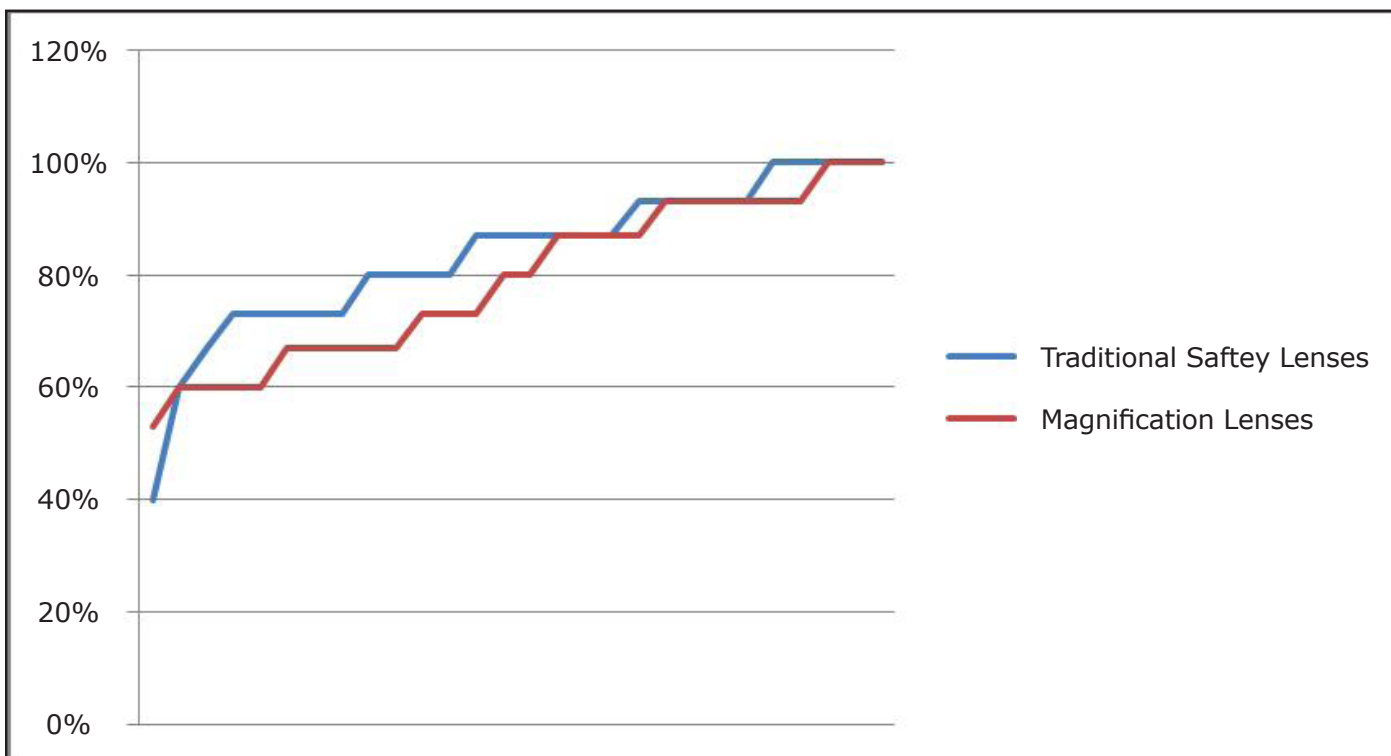


Figure 5: Line graph displaying accuracy in locating the red dots (percent correct), n=28 observations



the magnification lenses at the end of the study invested more time into the adjustment process than those students who intended to return the magnification lenses at the end of the study. Another factor could have been the cost of the magnification lenses. Eight of the dental hygiene students decided to purchase the magnification lenses at the comple-

tion of the study, whereas 6 of the dental hygiene students returned the magnification lenses at the completion of the study.

The outcome of this study may have also been influenced by the students' choice of eyewear to utilize during the 1 month period between Clinical Ses-

sion I and Clinical Session II. If the students went back to traditional safety lenses, this allowed them to perfect their proficiency with this modality. Conversely, if they continued to use magnification lenses, it perfected that modality, skewing their ability to use one modality or the other during the second phase of the study.

The sample size used in this study was small and therefore skewed the results. Fourteen dental hygiene students completed the study. Therefore, the results cannot be generalized. The results may have been significant with a larger sample size. However, the methods of this study may serve as a pilot for future research with larger samples.

The study population, second year dental hygiene students, may have had a technical bias on the study as this population had already had 3 semesters of prior experience with indirect vision using traditional safety lenses. Therefore, it did not allow for an equal assessment of magnification lenses compared to traditional safety lenses. However, since traditional safety lenses are the current form of eyewear protection for all clinicians, this will always be a bias for any study population.

The indirect vision points may have had an influence on the outcomes of the study. Each indirect vision point was represented with a red dot, which was easy to visualize on the tooth structure with the unaided eye. Future studies should be designed to locate indirect vision points that appear more neutral in color to represent calculus formation or composite restorations. More students missed locating the red dots on the gingival tissue due to the camouflaging of the red dots against the tissue as compared to the red dots against the white tooth structure.

Finally, the experience level of the dental hygiene students may have had an influence on the

outcomes of this study. Even though the students were in their final semester of their curriculum, they have not mastered their clinical skills. There were several incidences where the student verbalized the wrong tooth number to the examiner. Future studies should address the experienced graduate dental hygiene clinician who does not currently utilize any form of magnification lenses.

Conclusion

This study did not produce statistically significant data to support the use of magnification lenses to enhance indirect vision skills among dental hygiene students. However, the students perceived the use of magnification lenses enhanced their indirect vision skills, improved their clinical posture and increased the quality of dental hygiene treatment provided. It is suggested that future studies utilize this research design as a model and incorporate a larger sample size and utilize a more realistic intra-oral color for indirect vision points.

Sarah Hoerler, RDH, MS is a dental hygienist at the Mayo Clinic in the Department of Dental Specialties. She is also adjunct dental hygiene faculty at the Rochester Community and Technical College. Tanya Villalpando Mitchell, RDH, MS is an Associate Professor and the Director of Graduate Studies at the University of Missouri – Kansas City School of Dentistry, Division of Dental Hygiene. Anne M. High, RDH, MS, is an Instructor at Rochester Community and Technical College, Rochester, MN. Bonnie G. Branson, RDH, PhD is a Professor at the University of Missouri–Kansas City School of Dentistry

Acknowledgments

Dental magnification lenses were provided by Designs for Vision. The authors gratefully acknowledge Brian Nass, MSME, MSIE at Mayo Clinic for his time and statistical counsel.

References

1. Branson BG, Bray KK, Gadbury–Amyot C, et al. Effect of magnification lenses on student operator posture. *J Dent Educ.* 2004;68(3):384–389.
2. Maillet JP, Millar AM, Burke JM, Maillet MA, Maillet WA, Neish NR. Effect of magnification loupes on dental hygiene student posture. *J Dent Educ.* 2008;72(1):33–44.
3. Jennifer R, Thomas FD. Dental hygienists' opinion about loupes in education. *J Dent Hyg.* 2007;81(4):1–12.
4. Chang BJ. Ergonomic benefits of surgical telescope systems: Selection guidelines. *J Calif Dent Assoc.* 2002;30(2):161–169.
5. Branson BG, Black MA, Simmer–Beck M. Changes in posture: A case study of a dental hygienist's use of magnification loupes. *Work.* 2010;35(4):467–476.
6. Díaz MJ, Sánchez E, Hidalgo JJ, Vega JM, Yanguas M. Assessment of a preclinical training system with indirect vision for dental education. *Eur J Dent Educ.* 2001;5(3):120–126.
7. Lundergan WP, Soderstrom EJ, Chambers DW. Tweezer dexterity aptitude of dental students. *J Dent Educ.* 2007;71(8):1090–1097.
8. Boyd MA, Rucker LM. Effects of immediate introduction of indirect vision on performance and posture. *J Dent Educ.* 1987;51(2):98–101.
9. Bohan M, McConnell DS, Chaparro A, Thompson SG. The effects of visual magnification and physical movement scale on the manipulation of a tool with indirect vision. *J Exp Psychol Appl.* 2010;16(1):33–44.
10. Valachi B. Dentistry shouldn't be a pain in the neck: Ergonomics and wellness strategies to prevent pain and extend your career. Ineedce [Internet]. Available from: http://www.ineedce.com/courses/1742/PDF/DentistryShouldntbe_ergo.pdf
11. Branson BG, Williams KB, Bray KK, McInay SL, Dickey D. Validity and reliability of a dental operator posture assessment instrument (PAI). *J Dent Hyg.* 2002;76(4):255–261.

The Adequacy of Oral Care Performed for Critically-Ill Patients in Intensive and Critical Care Unites.

*Michelle Strange, RDH, BHS

Oral care becomes a lower priority when a patient is critically ill and other important nursing duties need to be performed (Berry & Davidson, 2006). Oral care is a necessary procedure to maintain the patients' oral health and to prevent infections. In addition to maintaining the patient's oral health and decreasing the chance of nosocomial infections, oral care may improve the patient's mood and overall feeling of wellness (Holmes & Mountain, 1993). When patients cannot eat properly, do not feel clean or are concerned about the social aspect of a neglected and unclean mouth, they can become discouraged during their recovery, resulting in a longer hospitalization (Holmes & Mountain, 1993).

By healthcare professionals controlling oral bacteria, the patient may exhibit fewer nosocomial infections, which can develop from aggressive types of bacteria that can be found in the mouth. For instance, patients with upper respiratory infections have an increased chance of developing candidiasis from ventilators and inhalers due to a lack of routine and proper oral care (Adachi, Ishihara, Abe, & Okuda, 2007).

It is the intention of this study to determine if adequate oral care is performed by healthcare professionals and to what extent is oral health education being taught in nursing education programs, based on the standard of care stated by the American Association of Critical-Care Nurses. This study also may identify the need for positions for dental hygienists who are interested in branching out of private clinical practice and entering hospitals, nursing homes and assisted living facilities.

Short-Term Effects of Non-Surgical Periodontal Therapy on Clinical Measures of Impaired Glucose Tolerance in People with Prediabetes and Chronic Periodontitis.

*Lori J. Giblin, RDH, BA

Problem: Diabetes and Periodontal Disease are conditions considered to be biologically linked. Prediabetes is a condition in which individuals have blood glucose levels, impaired fasting glucose and/or impaired glucose or A1C levels higher than normal but not high enough to be classified as diabetes. Few

studies address the relationship between periodontitis and prediabetes and none clarified an association between periodontitis and prediabetes. This pilot study examined impact of non-surgical periodontal therapy (NSPT) on clinical measures of glycemic control in prediabetes.

Hypotheses: 1) Non-surgical periodontal therapy (NSPT) will improve clinical measures of IFG, IGT, and A1C in participants with prediabetes and slight to moderate chronic periodontitis; 2) Improvement in measures of periodontal status, (PD, CAL, PI, and GI), result in statistically significant improvement in IFG, IGT or A1C in participants with prediabetes.

Methods: Prediabetes measures of IFG, IGT, A1C, and periodontal measures of PD, CAL, PI, GI, were taken at baseline and 3 months in 5 subjects with prediabetes and treated chronic slight to moderate periodontitis. Blood samples were taken from each subject following an 8 hour fast. Controlled for changes in BMI, physical activity and diet.

Results: Comparison of mean prediabetes and periodontal measures from baseline and post treatment at 3 months demonstrates an improvement in both clinical measures of prediabetes and periodontal disease.

Conclusion: This pilot study demonstrated slight improvement in prediabetes and periodontal measures after 3 months. Limitations are the small sample size and lack of a control group which may impact the robustness of measures.

The Prevalence of E-Cheating Among Second Year Dental Hygiene Students in Mississippi, North Carolina and Texas.

*Jessica Huffman, RDH, MDH

Recent reports examining the increased incidence of academic dishonesty in higher education have fueled a renewed interest in the subject of academic integrity and methods to reduce cheating. As high-tech resources such as electronics and electronic devices become more readily available to students, the popularity of e-cheating continues to increase. Upon reviewing academic dishonesty in dental hygiene programs, little research has been published addressing the prevalence of academic dishonesty and no research has been published concentrating on the prevalence of academic dishonesty with electronic de-

vices. The purpose of this study was to investigate the prevalence of e-cheating among second year dental hygiene students and to evaluate the effect of honor codes on academic dishonesty. An explanatory email and survey link was sent to the thirty-nine dental hygiene directors in Mississippi, North Carolina, and Texas. Each director was asked to forward the survey link to all second year dental hygiene students enrolled in the program. A total of 103 usable surveys were completed.

The results from the study revealed that 21 percent of second year dental hygiene students in Mississippi, North Carolina, and Texas have participated in at least one form of e-cheating. Students identified sharing homework answers via IM, text messaging, or email as the most frequent form of e-cheating. Students acknowledged not knowing the material and striving to obtain a better grade as the most common reasons for cheating.

The results from this study may enable dental hygiene faculty to recognize the occurrence of e-cheating and the need for academic integrity or honor codes policies.

Ultrasonic Instrumentation Instruction in Dental Hygiene Programs in the United States.

*Sharon Stemple Hinchman, RDH, MSDH

The purpose of this study is to determine the existence and extent of ultrasonic scaling instrumentation instruction in dental hygiene programs nationally. Currently, there is no research available defining a consensus of instruction for ultrasonic instrumentation in dental hygiene programs. An email survey was sent to all directors of dental hygiene programs in the United States (n=323). The response rate was 45%.

No significant differences in methods or extent of instruction were found between associate and baccalaureate degree granting programs. Eighty-nine percent of programs introduce hand scaling prior to ultrasonic scaling instrumentation instruction. Students in 96% of the programs are required to administer a pre-procedural mouth rinse reducing the amount of bacteria that would potentially be released in the aerosol produced.

A variety of resources and strategies are employed for teaching ultrasonic instrumentation and competency is measured in several ways. The availability of magnetostrictive ultrasonic scalers is much great-

er than that of piezoelectric ultrasonic scalers in the student clinics. Programs use a variety of inserts and tips and some programs require students to purchase magnetostrictive ultrasonic units.

The results of this study show that ultrasonic instrumentation is an integral component of the clinical curriculum and the majority of the dental hygiene programs prescribe to similar teaching methods, use the same textbooks, teach the same adaption techniques and strokes and use typodonts, student partners and onsite patients.

A Pilot Study: Examining Objective Structured Clinical Examination (m-OSCE) as an Effective Way to Measure Dental Hygiene Students' Critical Thinking.

*Martha McComas, LDH, BGS, MSDH

The purpose of this study was to examine objective structured clinical examination (OSCE) as a feasible method of evaluating critical thinking in dental hygiene education.

The goal of this study was to answer the central questions developed, and evaluate the methods and procedures of the exam for later comparison hopefully on a larger scale. Central questions of the study were: 1) Does a case-based OSCE that utilizes higher order multiple-choice questions effectively evaluate dental hygiene students' critical thinking? 2) Is this type of student evaluation a feasible form of assessment in dental hygiene education? 3) Is a written treatment plan an effective method of evaluating students' application of basic clinical and biomedical sciences? 4) When formulating a written treatment plan, do students utilize the dental hygiene process of care model?

A convenience sample of 50 volunteer senior dental hygiene students participated. The exam was designed as an OSCE consisting of 24 multiple-choice questions, one fill in the blank, and a written treatment plan section.

Statistical analysis determined the OSCE did not reliably measure dental hygiene students' critical thinking. From the item analysis it was evident gaps in students' knowledge existed. Understanding these 'gaps' in knowledge provides valuable information to educators who often assess their teaching in conjunction with student learning. With modifications to the questions, grading rubric, and patient case it is suggested that further investigation of this topic is warranted.

Determining Caregiver and Infant Caries Risk.

*Judy Danielson, BSDH

Bacterial testing can identify and quantify mutans streptococci and lactobacilli, two bacteria considered to be highly responsible for the dental caries infection. CAMBRA protocol recommends that patients assessed at high caries risk in terms of Disease Indicators be given a bacteria culture test to determine MS and LB counts. However, conventional methods used for culturing these bacteria are inconvenient and time consuming. Traditionally, bacterial cultures must be incubated for forty-eight to seventy-two hours before specific bacteria are identified.

The objective of this study is to determine if a real-time caries assessment tool using Adenosine-Triphosphate Driven Bioluminescence (CariScreen ATP testing by Oral Biotech) can reliably predict the amount of bacteria associated with dental caries. Can ATP-B testing be useful in developing a caries management plan for high risk caregivers and infants? Can ATP-B infant readings predict ATP-B readings of the caregiver? The Caries Risk Test (CRT by Ivoclar-Vivadent) will be used as the gold standard in identification of mutans streptococci and lactobacilli.

Caries Management by Risk Assessment (CAMBRA) will be used as an oral assessment tool in identification of caries risk in both primary caregivers and infants.

Correlation of Perceived and Objective Stress in Temporomandibular Disorder: A Case Control Study.

*Cynthia Ann Lambert, CDA, BS, MS

Perceived stress is associated with temporomandibular disorder (TMD). Whether levels of cortisol are also elevated in individuals with TMD is unknown.

We hypothesized that cortisol concentration, a biomarker of hypothalamic-pituitary-adrenal (HPA) axis reactivity, was elevated in TMD cases relative to controls, and that perceived stress was positively correlated with cortisol concentration.

This study used a case control design in which TMD case status was determined by examiner using the TMD Research Diagnostic Criteria. Participants (n=116) aged 18-59 years were recruited from within a 50 mile radius of the University of North Carolina at Chapel Hill. Following examination, cases (n=45) and controls (n=71) completed the 14-item Perceived Stress Scale using a reference interval of the past three months.

Approximately 100 strands of hair were cut from the posterior vertex segment of their scalp. The three centimeters of hair most proximal to the scalp was analyzed with a commercially available salivary cortisol enzyme immunoassay adapted for hair cortisol. This length of hair corresponds to the last three months of growth and thereby captures systemic HPA axis activity over time.

TMD cases perceived higher levels of stress than controls over three months preceding this study (P=0.001). However, systemic cortisol production was lower in TMD cases than in controls (P<0.001) over the corresponding three month period. The correlation coefficient revealed a negative relationship (r= -0.12) between perceived stress and cortisol concentration (P=0.044). In analysis stratified by case status, the relationship of perceived stress and cortisol concentration was non significant for cases (P=0.169) and controls (P=0.498).

Despite perceiving more stress, TMD cases had lower cortisol levels than controls. Cortisol concentration was negatively associated with perceived stress.

Point-of-Care HbA1c Screening Predicts Diabetic Status of Dental Patients.

*Susan Franck, RDH, MSDH

Problem: A diabetes incidence predictive model calculates the prevalence of diabetes in 2050 as high as 33% of the population (Boyle, Thompson, Gregg, Barker, & Williamson, 2010). Currently, there is a lack of opportunistic diabetes screenings (Ealovega, Tabaei, Brandle, Burke, & Herman, 2004) which may prevent or delay the onset of diabetes and likewise decrease or eliminate diabetic complications (Zhou, et al., 2010) including periodontal disease.

Null Hypothesis: A Point-of-Care (POC) HbA1c screening will not reliably identify dental clients who have self-proclaimed diabetes risk factors, as diabetic or pre-diabetic when compared to laboratory tests methods.

Methods: This was a prospective cohort descriptive study in which subjects were chosen by convenience sampling and a diabetes risk questionnaire. A POC fingerstick HbA1c screening identified subjects for laboratory HbA1c testing.

Results: The diabetes risk questionnaire identified 75 subjects for inclusion in the POC screening. Thirty four of these subjects (71% female and 29% male) had glycolated hemoglobin levels at or above the American Diabetes Association's recommended 5.7% cut-point. Three subjects were less than age 44, ten were 44 to 57, and 21 were over 57. Laboratory results categorized

six of these subjects as normoglycemic and 28 with HbA1c greater than or equal to 5.7%. Four nonparametric tests revealed statistical significance: Kendall's tau analysis ($p=.004$), Pearson's chi-square ($p=.000$), Likelihood ratio ($p=.004$), and Cramer's V ($p=.000$). The nonparametric Lambda test ($p=.145$) did not show statistical significance.

Conclusion: This study showed that a safe and minimally invasive dental chairside point-of-care HbA1c screening unveiled statistically significant previously unidentified diabetic and pre-diabetic patients.

The Effectiveness of Locally Delivered Minocycline Hydrochloride in the Treatment of Periodontal Disease in an HIV-Positive Population.

*Oksana Mishler, RDH, BS

Periodontal diseases are infections of the teeth's supporting and surrounding structures. If left untreated, they can result in tooth loss. Periodontal diseases are not evenly distributed among United States adults. They are more prevalent in immune-compromised individuals such as those with Human Immunodeficiency Virus (HIV) infection. Various strategies are utilized routinely for treating periodontal diseases. Scaling and root planing (SRP) followed by the application of locally administered antimicrobials (e.g., minocycline hydrochloride) has shown a greater reduction in periodontal pocket depths than SRP alone. While SRP followed by the administration of minocycline hydrochloride has been effective in arresting periodontal diseases in non-HIV adults, little is known about suggested treatment regimens and their effectiveness in the HIV positive population.

The purpose of this study is to assess whether the effectiveness of a locally delivered antimicrobial (i.e., minocycline hydrochloride) used in conjunction with SRP in the reduction of periodontal pocket depths in periodontally involved HIV positive adults is comparable to the results achieved in a healthy population. One tooth in each subject with a periodontal pocket depth equal to or greater than five millimeters will be used to assess the effectiveness of minocycline hydrochloride used in conjunction with SRP.

The study sample will consist of twenty HIV-positive adults from whom a treatment tooth will be selected. Only individuals with minimally compromised immune system (e.g., CD4 cell count of 200 or greater and WBC count ranging from 4 to 11) will be permitted to participate in the study. Subjects with allergy to tetracyclines and a history of or predisposition to oral candidiasis will be subsequently excluded from the study. Each study tooth will undergo SRP followed by the administration of minocycline hydrochloride and re-probed for possible

periodontal probing depth reduction in one month. A one-tail t-test will be used to analyze the study results.

To interpret the results, the t-obtained will be compared to t-critical. The value of t-obtained will be calculated using the study results and the formula. The value of t-critical will be obtained from the one-tailed test table with a critical error equal to 0.05.

The Role of the Dental Hygienist on the Cleft Palate Team.

*Sara L. Beres, BA, RDH, MSDH

Individuals with cleft lip and/or palate (CLP) need anticipatory guidance and preventive care for oral health. Complexity of CLP requires a multidisciplinary team for comprehensive care.

This study examined roles of dental hygienists on CLP teams based on opinions of U.S. CLP team representatives. Data were collected via a Web-based questionnaire and analyzed using descriptive statistics, frequencies, and percentages. Responses were coded for roles defined by the American Dental Hygienists' Association (ADHA). Respondents scored roles of the dental hygienist based on importance to the CLP team as identified by the American Cleft Palate-Craniofacial Association during the Neonatal Period and Infancy (Birth to 1 year), Childhood to Young Adulthood (1 year to 20 years), and Throughout Lifespan of the Case.

Professional roles of dental hygienists identified by the ADHA were educator, researcher, administrator/manager, advocate, clinician, and public health. Findings provide information about dental hygienists potential as a member of CLP teams.

Evaluation of an Audit and Feedback Approach to Promote Sustainability of a Pediatric Fluoride Varnish Program in a Primary Care Setting.

*Nicolette Moultrie, RDHAP, BSDH, MSDH

Problem: Early childhood caries (ECC) is the most common chronic disease of childhood. Rates are highest among children from low-income, minority families. Although fluoride varnish (FV) is a low cost caries prevention agent, these children have little access to early preventive dental care. Because they frequently visit medical providers for their well child exam, it is recommended that primary care providers apply FV to the teeth of at risk 1-5 year olds at their well-child visit.

Purpose: To evaluate the effect of an audit and feedback intervention on the rate of FV applications during

well child visits at 12 months compared to baseline values in a county safety-net system as measured by electronic billing data.

Methods: After assessing the rate of FV applications among 1–5 year olds at baseline time periods in 8 primary care clinics, we implemented an audit and feedback intervention in 3 clinics identified as low, moderate and high FV application performers. The intervention consisted of presenting individual clinic performance data for all 8 clinics during site manager interviews and in provider focus groups during which barriers and facilitators for program sustainability were identified. Findings were disseminated to all 8 county health center site managers who transmitted them in all staff/ provider meetings.

Results: Preliminary 4 month follow-up data indicate that FV applications increased from 17% of the 1–5 year olds in a baseline cohort studied to an overall 79% among 1–5 year olds in all 8 clinics. Barriers, facilitators, and 12 month outcomes will be presented.

Conclusion: Audit and feedback appeared to facilitate pediatric FV program sustainability.

Cost Analysis of the Miles of Smiles Program, A School-Based Preventive Oral Health Program.

*Kylie Siruta, RDH, MSDH, ECP II

The purpose of this study was to provide a cost analysis of the Miles of Smiles Program, a collaboration between the University of Missouri–Kansas City (UMKC) School of Dentistry and the Olathe School District.

This preventive program was implemented to address the access to oral health care issues that affect low income children within the school district. The analysis of the program utilized an inventory list and an existing de-identified database to determine the costs associated with operating the program throughout the 2008–2009 school term. Costs related to equipment, supplies, and personnel were included.

The results of the analysis revealed that the cost of operating the program during 2008–2009 was \$107,515.74. The program received Medicaid reimbursement for approximately 1.5% of the total cost of operating the program and approximately 6.3% of the amount produced through billable services; however, challenges with submitting and billing Medicaid claims for the first time contributed to this low percentage of reimbursement.

It was determined that for the program to be sus-

tainable, continuous external sources of funding or a change in the program design would be necessary.

Effects of Low Temperature Atmospheric Pressure Plasma on Tooth Whitening.

*Denise M. Claiborne RDH, BSDH, MS(c)

Low temperature atmospheric pressure plasma (LTAPP) is a novel science being studied as an alternative light source to enhance tooth whitening.

The safety and effectiveness of LTAPP has not been established therefore; the purpose of this study was to determine if LTAPP along with H₂O₂ gel would safely and effectively accelerate the tooth whitening process, in terms of lightness and temperature.

The hypotheses were the following: HO1: There is no difference in the lightness of teeth exposed to LTAPP plus 36% H₂O₂ gel compared to those with 36% H₂O₂ gel alone. HO2: There is no difference in temperature of teeth exposed to LTAPP plus 36% H₂O₂ gel compared to 36% H₂O₂ gel alone. Thirty extracted human teeth were randomized to three groups: (I) LTAPP plus 36% H₂O₂ gel; (II) 36% H₂O₂ gel only; and (III) control. Group I received LTAPP plus H₂O₂ gel at 10, 15, and 20 minutes; Group II received H₂O₂ gel only at the same time intervals; and Group III served as a control and received no treatment. Tooth surface temperature was measured periodically throughout the experiment with a non-contact thermometer. Pre and post photographs were taken to compare color using the CIE L* a* b* system. Only L* (lightness) values were measured.

Data were analyzed using descriptive statistics and t-test at the .05 level. There was a statistically significant difference in mean CIE L* values after exposing teeth to LTAPP plus H₂O₂ gel versus H₂O₂ gel only, in the 10 minute group (p-value of .0003) and 20 minute group (p-value of .0103). There was no statistically significant difference in mean CIE L* values among the 15 minute group (p-value of .3815). The temperature in both groups remained under 80 throughout the study, which is below the thermal threat for vital tooth bleaching.

Results indicate that LTAPP + H₂O₂ mean CIE L* values in the 10 and 20 minute groups were significantly greater than the H₂O₂ only groups. However, the mean CIE L* values for 15 minute group were not significant.

The research revealed the potential for plasma usage in the tooth whitening process is promising, and may prove to be a new technology to enhance tooth whitening.

CLL Poster Session

Integrating Oral Health Literacy into the Dental Hygiene Curriculum—A Model.

*Tomira Luchynskyi, RDH, MHS(c); Susan Callahan Barnard, RDH, DHS(c); Lisa M. Duddy, RDH, DHS(c)

Bergen Community College

Oral Health Literacy (OHL) is measured as a functional literacy – a human’s ability to apply reading skills to daily tasks. Overall, all developed instruments (REALD–99, REALD–30, TOFHLID, and OHLI) measure functional literacy but do not seize the full range of skills required for health literacy. Current OHL assessments cannot distinguish among: reading ability, lack of health–related background knowledge, lack of understanding of health–related language and materials, and cultural differences in approaches to health.

The National Assessment of Adult Literacy survey revealed that 53% of the adult population in the U.S. has intermediate health literacy scores the same survey found that health literacy varies by ethnicity, race, poverty level, and level of education. Studies show that patients forget up to 80% of what their doctor tells them as soon as they leave the office and nearly 50% of what they do remember is recalled incorrectly. Lastly, low HL is costly. Recent reports estimate that the cost to the American society is now between \$106 billion and \$238 billion each year.

The assessment of oral health literacy is important to dental hygiene care outcomes. This model focuses on oral health communication and education related to age–targeted prevention, cultural competence, and access to care. Community oral health outreach initiatives and partnerships can further educate patients to enhance positive treatment outcomes. These topics are covered in the second semester clinical course and the third semester Community Oral Health course. The intent of this model is to incorporate oral health literacy into clinical and community interactions providing baseline information to assist in education and treatment strategies.

This model includes student peer collaboration to assess communication and develop effective oral health education strategies based on age, educational and cultural backgrounds in the Oral Hygiene II course. Students further apply the oral health literacy model to community oral health initiatives and a collaborative mock grant writing assignment in the Community Oral Health course. The evaluation mechanism for success for these projects is competence based measuring out-

comes related to student knowledge, performance. Patient outcomes are measured related to knowledge and treatment outcomes. Limitations include cultural belief related to health practices, language barriers and access to care.

This pilot project demonstrated that opportunities to incorporate oral health literacy into the dental hygiene curriculum with interdisciplinary activities are also increasing and should continue to be explored to expand overall health literacy for both patients and health professionals.

Survey of Dental Hygiene Journal Peer Reviewers.

*Ann Eshenaur Spolarich, RDH, PhD

Arizona School of Dentistry and Oral Health, A.T. Still University

Rebecca S. Wilder, RDH, MS

University of North Carolina–Chapel Hill School of Dentistry

Objectives: Peer reviewers are essential contributors to quality of publications in scientific journals, yet little is known about challenges and benefits of being a peer reviewer for a dental hygiene journal. The purpose of this survey research was to examine peer review behaviors, ethical and professional concerns, and challenges encountered during the peer review process.

Methods: A nursing survey with established reliability and validity was modified to reflect the Dental Hygiene profession. IRB approval was obtained and the survey was pilot–tested for face validity. A sample of all reviewers (n=90) for a refereed dental hygiene journal were invited to participate in an electronic survey (Survey-Monkey®). Eighty three response items measured 6 constructs: level of involvement in reviewing; relationships with editorial staff; preparation for the role of reviewer; experiences and challenges; ethical conflicts; and general reviewer experiences. Responses were collected electronically and reported in aggregate. Descriptive statistics were utilized.

Results: Seventy percent responded (n=63). The majority (92%) have a masters or doctoral degree. Most (67%) are currently involved in research. One to three reviews are completed by 78% annually. Reasons for turning down invitations to review include timing of deadline (63.8%), competing work priorities (46.6%)

and lack of content expertise (44.8%). Most (68.6%) desire access to comments by other reviewers and 76% want feedback about their review. The majority (84.8%) are satisfied/very satisfied with communications with the editor/editorial staff. Most have encountered ethical conflicts with submitted papers, including insufficient protection of animal/human subjects, duplicate publication, plagiarism and legitimacy or honesty in representation of data. All report a high value of this professional opportunity.

Conclusion: Reviewers for dental hygiene journals encounter challenges, but value serving in this role and desire to improve.

Student Learning Outcomes of Oral Health Content Integration into Physician Assistant and Nursing Curricula by Dental Hygiene Faculty.

*Dianne S. Chadbourne, RDH, MDH and Linda D. Boyd, RDH, RD, EdD, MCPHS

Forsyth School of Dental Hygiene

The literature indicates many health profession students are not well prepared for oral health promotion and assessment in their educational programs. This is related to a lack of oral health related competencies in many allied health curricula. The purpose of this study was to determine the effectiveness of DH faculty delivering oral health content developed by, Nursing, PAS (Physician Assistant Studies) and dental hygiene faculty, at a not-for-profit private educational institution, based on the discipline-specific accreditation standards and course objectives for Nursing and PAS students.

A pre/post-test was developed by the investigators based on the literature and planned oral health content, and approved by the IRB. The test items consisted of the following: oral health knowledge, perceived level of confidence in assessing patients' oral health, and effectiveness of the content when delivered by dental hygiene faculty. Both nursing and PAS students (n=207) completed the pre- and post-tests with sixty-four percent (n=136) of the participants being PAS students and 36% (n=71) nursing students.

The mean score for the PA and nursing students on the oral health knowledge questions was 77% on the pre-test, and 88% on the post-test. Questions related to the students' perceived level of competence in oral health assessment on the pre-test indicated that 33% (n=68) of the PAS and nursing students felt competent in their oral health assessment skills, while on the post-test 86% (n=177) felt competent in their assessment skills. In regard to the post-test questions, measuring the effectiveness of the dental hygiene faculty in pre-

senting oral health content, 96% (n=198) of the PAS students and nursing students felt the involvement of the dental hygiene faculty enhanced their learning.

Comparison of the outcomes of the pre- and post-tests demonstrated a marked improvement in students' understanding of oral health and disease and in their confidence in identifying and assessing oral health issues. In addition, student responses indicated dental hygiene faculty were successful in delivering oral health content and in enhancing the students' ability to use this knowledge. The success of this interdisciplinary experience serves as a building block in the development of a model for integrating oral health content in other health professions.

Building Online Learning Communities in a Graduate Dental Hygiene Program.

*Ellen J. Rogo, RDH, PhD; Karen Portillo, RDH, MS

Idaho State University

The literature abounds with research related to building online communities in a single course; however, limited evidence is available on this phenomenon from a program perspective. The intent of this qualitative case study inquiry was to explore student experiences in a graduate dental hygiene program contributing or impeding the development and sustainability of online learning communities. Approval from the IRB was received (HSC #3618).

Participants were recruited from a stratification of students and graduates. Informed consent procedures were followed and 17 participants completed semi-structured interviews; the interaction was audio recorded, transcribed and verified to ensure verbatim transcription. Data analysis was completed through two rounds; one for coding responses and the second to develop common themes.

The participants' collective definition of an online learning community was a complex synergistic network of interconnected people who create positive energy. The findings indicated the development of this network began at the hybrid program orientation. This experience was beneficial for building a foundation for the community and was important for understanding how to contribute to online learning and getting connected.

Factors promoting the learning community were based on the commonality of being dental hygienists and graduate students, yet different experiences provided opportunities for learning. Students felt socially connected through the development of personal relationships, mutual appreciation and communication that

was respectful and encouraging. A supportive network was experienced as being a contributor, receiving positive feedback, and mentoring each other. Course design was another important factor; communicating in Coffee Shops and weekly discussions, and participating in group and peer review activities. Instructors were viewed as active participants in the community, offering helpful feedback and being a facilitator in discussions, attentive to adult learning principles and available for consultation.

The findings indicated that factors impeding the development of online learning communities related to the performance of peers and instructors. Student factors included low quality postings by peers or nonparticipation in discussions, feeling isolated and vulnerable with technology, and spending a significant amount of time completing coursework. In addition, instructor factors included the lack of course organization, online teaching experience and technology skills; unrealistic expectations for assignments and weekly activities; and lack of support for students.

Specific factors supporting and impeding the development of online learning communities related to the program itself, course design, students and faculty. These factors are important to consider to maximize student learning potential in this environment.

Self-Selecting When to Take the National Board Dental Hygiene Exam.

*Judy A. Kwapis-Jaeger, RDH, MA; Margaret E. Coleman, RDH, BS; Kathi R. Shepherd, RDH, MS; Jackson B. Linger, DMD, MS

University of Detroit Mercy School of Dentistry

In 2010, the National Board Dental Hygiene Exam (NBDHE) switched from a written exam to a computer based exam. This allowed candidates who had applied to take the NBDHE and were approved by their Program Director, the ability to self-select the date they take the exam. Prior to this, the NBDHE was administered three times a year on a designated day in the Spring, Summer or Fall. The change of the format of this exam has presented the student with the dilemma of self selecting when they perceive themselves to be most prepared to take and pass the exam.

The purpose of this study was to determine if a student's personality type (MBTI) and the student's self-selection of the date an exam is administered increases the candidate's ability to prepare, take and pass the exam. The Myers-Briggs Type Indicator (MBTI) was administered over a two year period (2008 and 2009) to students (n=46) during the first semester of the program. In this study, "Early" is defined as students (n=25) who

took the exam in either late March through April and who were still attending classes. "Late" is defined as students (N=21) who took the exam in the months of May through July and had completed classes. Exit interviews of student's perception of their preparedness to take the NBDHE were conducted at the end of the program. The MBTI data was analyzed using frequency distribution and chi square analysis. Personality types were identified and strength of individual preferences reported. On the Extrovert (E) / Introvert (I) scale 61% of the E's and 44% of the I's took the exam early. On the Sensing (S) / Intuitive (N) scale 53% of the S's and 66% of the N's took the exam early. On the Thinking (T) / Feeling (F) scale 46% of the T's and 58% of the F's took the exam early. On the Judging (J) / Perceiving (P) scale 61% of the J's and 30% of the P's took the exam early. The distribution of individual personality types in the early and late groups were relatively equal except on the individual P scale (total n=10) where there was a greater number of students in the late group (n=7) or 70%. This is consistent with previous MBTI data and P type behavior.

NBDHE scores were analyzed. Twenty-one of the forty-six students, or almost 50% of this group took the exam in the "Late" period. Six of these twenty-one students were strongly recommended or released by the Program Director to take this exam in the "Late" period; the remaining 15 self-selected to wait.

The students who took the exam in the "Early" group all received higher scores on average compared to the "Late" group with the exception that the Perceiving (P) students in the "Late" group scored better.

Mentoring, strong counseling and advising to optimally select and make wise choices as to when to take the exam may need to be implemented to increase students' success. Even though the students who took it later didn't score as well as the earlier group, all of the "at risk" and the remaining 15 students that self-selected to wait reported that they felt better prepared and more confident than they would have, if they had taken it earlier.

Precision Grip Strength in Dental Hygiene Students.

*Lisa J. Moravec, RDH, MS; Kathleen O. Hodges, RDH, MS; Ellen J. Rogo, RDH, PhD; Deanna C. Dye, PT, MA, PhD

University of Nebraska Medical Center

Background: Precision grip is utilized in hand-activated instrumentation and is accepted as an objective index for the functional integrity of the upper extremity. Normative data are given as a range that is typical for a

population group. This information is helpful in interpreting evaluation data and assessing a person's workability. Establishing baseline data for pinch grip strength in dental hygiene students could lead to future findings that help identify instrumentation risk factors for musculoskeletal disorders.

Problem: Upper extremity musculoskeletal disorders are prevalent among dental hygienists; however, no normative data exist for precision grip strength.

Purpose: The purpose of the study was to establish normative data for precision grip strength in first year students. Upon receiving IRB approval, the study compared grip strength at the beginning and end of the fall semester of a preclinical course. Also, precision grip strength was compared to normative data for the general population.

Null hypotheses: There is no statistically significant difference in maximum precision grip strength: 1) at the beginning and end of the first semester for first year dental hygiene students, and 2) between dental hygiene students and the normative values.

Methods: A pretest/posttest design was used to compare the precision grip strength at the beginning and end of the first semester ($n=23$). Three maximum palmar pinch grip readings with a B & L pinch gauge were taken for each subject's dominant hand and an average reading was determined.

Results: The assumption of Normality was computed using a Shapiro-Wilk test for the pretest and posttest scores and no violation of assumption was found (pretest $p=.996$, posttest $p=.956$); therefore, a parametric analysis followed. A paired t -test was used to test for a difference in average pretest and posttest scores. No statistically significant difference was found ($t=-0.257$, $df=22$, $p=.800$) and the first null hypothesis was accepted ($p\leq.05$). Subsequently, a z -score was computed for each participant using the average measurement and score recorded by Mathiowetz et al. to adjust for age, gender, and dominant hand. Pretest and posttest z -scores were compared using a paired t -test and no statistically significant difference was revealed ($t=-0.107$, $df=22$, $p=.916$). This analysis confirmed the t -test results. The second null hypothesis also was accepted ($p\leq.05$).

Discussion: A trend was noticed, although not statistically significant, that many students increased precision grip strength. Future research is needed to establish whether this strength increases as instrumentation skills develop providing clinical care in the curriculum and practice.

Engaging Students in the Provision of Dental Care to Patients Residing in Long Term Care Facilities.

Marge Buehner, RDH, RDA, BS, MHSA

University of Detroit Mercy School of Dentistry

The purpose of this long term care outreach program is to prepare students to function as integral members of the health care team managing and providing dental patient care in long term care facilities for institutionalized and/or geriatric populations. Commission on Dental and Dental Hygiene Accreditation standards state, "Graduates must be competent in assessing the treatment needs of patients with special needs." A University of Detroit Mercy School of Dentistry long term care facility outreach program was implemented to provide dental ($N=85$) and dental hygiene students ($N=25$) experiences addressing these standards and to engage students in service learning increasing access to care for special populations.

Program objectives are to provide students an opportunity to: 1) assess the dental needs of residents in institutionalized and/or geriatric settings in order to plan and implement appropriate dental care; 2) function as an integral member of the health care team; 3) use mobile dental equipment and modify dental skills to meet specific patient needs; and 4) correlate and apply dental and biomedical scientific knowledge with medical conditions observed. Clinical rotation sessions include teams of both second year dental hygiene and fourth year dental students supervised by both a dental and dental hygiene faculty member. Experiences are designed to reinforce concepts presented in the classroom.

Students review and analyze patient records including medical status, initial admission reports, DNR directives, and physician orders. Extra/intraoral examinations are performed, care is then delivered and oral hygiene instructions are provided for patients and/or care givers. Students also learn medical acronyms and protocols in writing medical consults associated with the patient's oral care. The treatment is often performed in a difficult environment warranting modification of traditional management techniques.

Initial dental hygiene long term care rotation survey results revealed that while some students find the rotation to be uncomfortable, there was a 71.8 % agreement rate for objectives 1 and 2, 74.1 % for objective 3, and 72.9 % for objective 4. Students also noted that they feel good about the care they are able to provide for this vulnerable population. By engaging the students in this model of community outreach, their didactic learning is enhanced by way of real life hands on experience. They also experience the concept of increasing access to care which will hopefully inspire them to provide care in this setting in their professional careers.

Evaluation of the Addition of a Water Flosser to Sonic Toothbrushing: Effect on Plaque, Bleeding and Gingivitis.

*Deborah M. Lyle, RDH, MS

Water Pik, Inc.

C. Ram Goyal, BDs; Jimmy G. Qaqish BS(c)

BioSci Research Canada, Ltd.

Reinhard Schuller, MS(c)

Reinhard Schuller Consulting

Finding an effective oral care regimen that is easy, fast, and effective can be challenging. This study evaluates the oral care regimen of a water flosser and sonic toothbrush on bleeding, gingivitis and plaque.

The primary objective of this study was to compare the effectiveness of a water flosser plus sonic toothbrush to a sonic toothbrush alone on the reduction of bleeding, gingivitis, and plaque. The secondary objective was to compare the effectiveness of different sonic toothbrushes on bleeding, gingivitis, and plaque.

One hundred and thirty-nine subjects completed this randomized, four-week, single-masked, parallel clinical study. Subjects were randomly assigned to one of four groups: Group 1 used a water flosser plus sonic toothbrush (WFS), Group 2 used a sonic toothbrush (SPP), Group 3 used a sonic toothbrush (SF), and Group 4 used a manual toothbrush (MT). Subjects were provided written and verbal instructions for all power products. MT users continued with their normal brushing method. Data were evaluated for whole mouth, facial, and lingual surfaces for bleeding on probing (BOP) and gingivitis (MGI). Plaque data were evaluated for whole mouth, lingual, facial, approximal, and marginal areas of the tooth using the Rustogi modification of the Navy Plaque Index (RMNPI).

All groups showed significant reduction from baseline in BOP, MGI, and RMNPI scores for all areas measured at four-weeks ($p < 0.001$). The reduction of whole mouth BOP scores was significantly higher for the WFS group; 34% more effective than the SPP group ($p = 0.008$), 70% more effective than the SF group ($p < 0.001$) and 1.59 times more effective than the MT group ($p < 0.001$) at four-weeks. The whole mouth reduction of MGI was significantly higher for the WFS group; 23% more effective than SPP, 48% more effective than SF, and 1.35 times more effective than MT at four-weeks ($p < 0.001$). The WFS group showed significantly better reductions for whole mouth RMNPI scores; 18% more effective than the SPP group ($p = 0.003$), 52% more effective than SF ($p < 0.001$), and 1.34 times more effective than

the MT group ($p < 0.001$). The SPP sonic toothbrush was significantly higher than the SF sonic toothbrush for whole mouth BOP scores (26%), MGI scores (20%) and RMNPI scores (29%) ($p < 0.001$).

The water flosser plus sonic toothbrush is an effective regimen for improving oral health indices and significantly more effective than sonic brushing alone. The SPP toothbrush is significantly more effective at improving oral health indices than the SF toothbrush.

Superior Plaque and Gingivitis Efficacy of an Essential Oil-Containing Mouthrinse Compared to a 0.07% Cetylpyridinium Chloride Mouthrinse.

*Sylvia L. Santos, RDH, MS; James A. McGuire; Mei-Miau Wu

Johnson & Johnson

C.R. Goyal, BDS; Naresh C. Sharma, DDS

BioSci Research Canada, Ltd.

The antiplaque and antigingivitis benefit of adding an antimicrobial rinse to toothbrushing has been clinically proven in numerous long term studies. There is substantial evidence that a marketed mouthrinse containing a fixed combination of essential oils significantly reduces and inhibits supragingival plaque and gingivitis. The objective of this six month clinical study was to compare the effectiveness of rinsing with Cool Mint LISTERINE® Antiseptic and Crest® PRO-HEALTH™ mouthrinse, in reducing dental plaque and gingivitis in a six-month period. A 5% hydroalcohol control rinse served as a negative control.

This was a randomized, controlled, observer-blind, parallel group, IRB approved, 6-month clinical trial. At baseline, subjects presented to the clinical site having refrained from oral hygiene for at least 8 hours. Qualified subjects were randomized to one of three treatment groups: Cool Mint LISTERINE® Antiseptic (CML), Crest® Pro-Health™ (CPH) rinse or 5% hydroalcohol control rinse. Subjects brushed their teeth twice daily with Crest Vivid White toothpaste and rinsed with their assigned rinse for 30 seconds. At the three- and six-month visits, the Modified Gingival Index (MGI), Turesky Modification of the Quigley-Hein Plaque Index (PI) and the Bleeding Index (BI) were scored and oral tissue examinations performed.

The primary efficacy variables were mean MGI and mean PI at 6 months. Statistical comparisons were based on a one-way analysis of covariance model with treatment as factor and corresponding baseline value as a covariate. A total of 356 subjects completed the study. Both CML and CPH, were significantly better than the

negative control, ($p < 0.001$) and CML was significantly better than CPH for both MGI and PI, with 12.6% and 32.3% reductions, respectively, at 6 months ($p < 0.001$). At six month, mean difference from baseline was 0.84 and 0.67 for CML and CPH, respectively. With respect to plaque, six month PI mean difference from baseline was

1.77 and 1.42 for CML and CPH, respectively.

In this six-month, randomized, controlled clinical study Cool Mint LISTERINE® provided superior anti-plaque and antigingivitis benefits compared to Crest® Pro-Health™ rinse.